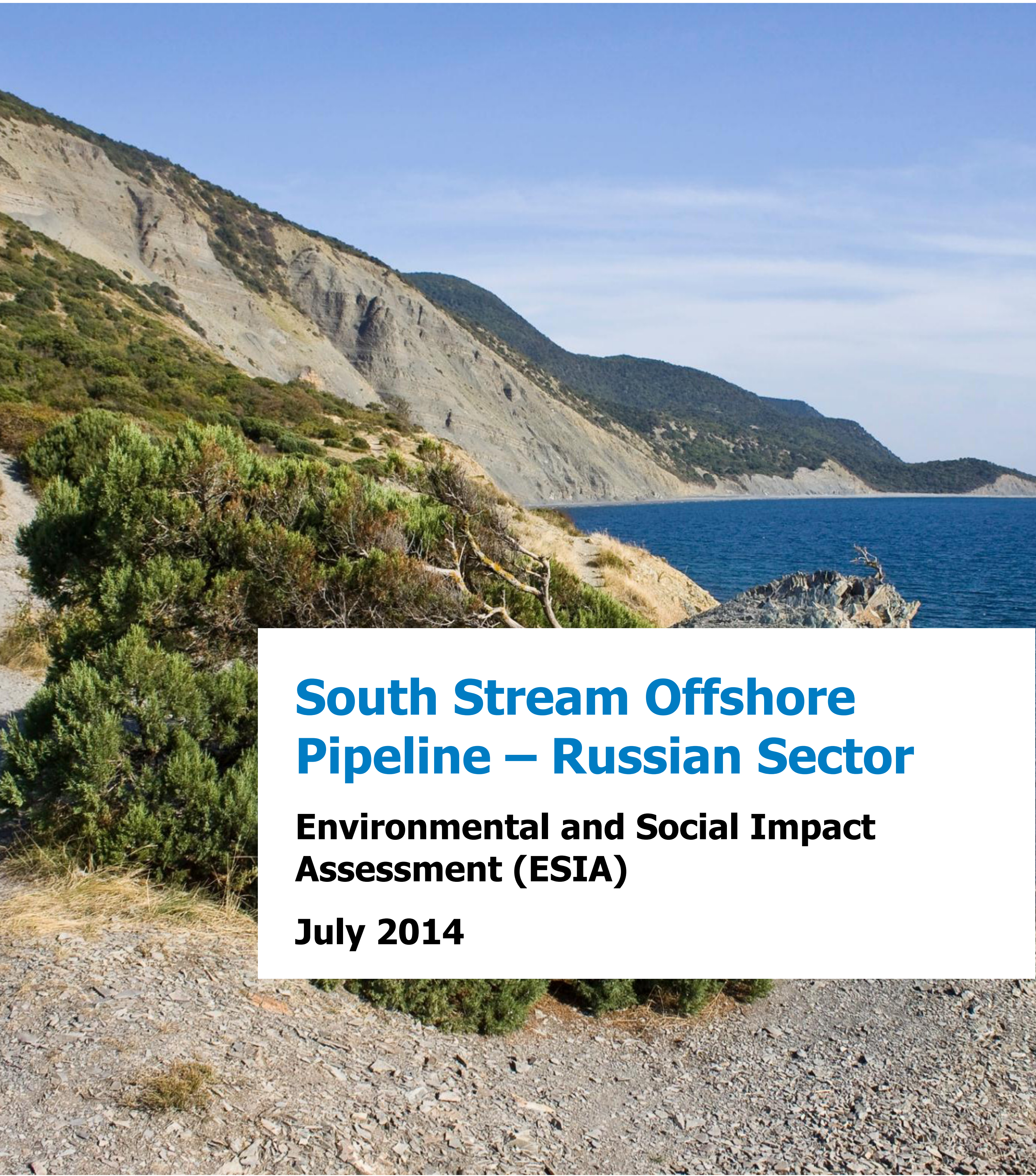

South Stream Offshore Pipeline – Russian Sector

Environmental and Social Impact Assessment (ESIA)

July 2014

This report has been prepared by URS Infrastructure & Environment UK Limited on behalf of South Stream Transport B.V.

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Glossary

Aarhus Convention

An international legal agreement that promotes access to information, public participation in decision making and access to justice in environmental matters.

Abyssal Plain

The deep, flat sea floor that lies between continental margins i.e. the continental shelves and slopes (and other significant features such as mid-ocean ridges and deep ocean trenches).

Acceptance or Approval

The instruments of "acceptance" or "approval" of a treaty have the same legal effect as ratification and consequently express the consent of a state to be bound by a treaty.[1]

Accession

"Accession" is the act whereby a state accepts the offer or the opportunity to become a party to a treaty already negotiated and signed by other states. It has the same legal effect as ratification. Accession usually occurs after the treaty has entered into force.

Acoustic Reflectivity

Sound energy (via sonar) reflected from a surface. The relative reflectivity of a specific material, that is, the tendency to deflect sound energy in a specific medium rather than absorb it.

Acoustic Target

Potential man-made features and localised obstructions present on the sea floor, identified from analysis of acoustic data files, defined according to their spatial extent, configuration, location and environmental context.

Affected Party/Parties

A country involved in a transnational linear project whose territory may be significantly adversely affected by the activity in a Party of Origin. See Party of Origin below.

Aleurite

Silt

Algae

Algae are photosynthetic organisms that occur in the sea, in freshwater and moist habitats on land. They vary from small, single-celled forms (e.g. phytoplankton) to complex multicellular forms (seaweeds).

Alien Species / Invasive Species

A species not native to the environment it inhabits.

Alluvial

Soils carried by water and deposited according to size and specific gravity as the flow rate decreases.

Ambient Air Quality Limits

Ambient air quality limits are are concentrations or air quality indicators recorded over a given time period, which are considered to be acceptable in terms of what is scientifically known about theri effects on health and on the environment. They can be used as a benchmark to indicate whether air quality is being degraded.

Ambient Levels

Sharing the same physical and/or chemical properties as the immediate surroundings.

[1] http://treaties.un.org/Pages/Overview.aspx?path=overview/glossary/page1_en.xml

Anadromous

Fish that migrate up rivers from the sea to breed in fresh water.

Anaerobic

Relating to the absence of free oxygen.

Anionic Surfactant

Chemicals that act as a surface agent to reduce the surface tension of liquids. Commonly used in synthetic detergents but also used in industrial processes such as plastic and paint manufacture.

Annulus

The area between a pair of concentric circles. For the purposes of this document, annulus refers to the space between the microtunnel lining and the pipeline.

Anoxic

Absence of oxygen.

Anthropogenic

Relating to, or resulting from, the influence of human activity on the environment.

Archaeology

The scientific study of the physical evidence of past human societies recovered through collection, artefact analysis, and excavation. Archaeologists not only attempt to discover and describe past cultures but also to formulate explanations for the development of cultures. Conclusions drawn from study and analyses provide answers and predictions about human behaviour that add, complement, and sometimes correct the written accounts of history and prehistory.

Archaeological Context

The physical setting, location, and cultural association of artefacts and features within an archaeological site.

Archaeological Excavation

A programme of controlled, intrusive fieldwork with defined research objectives which examines and records archaeological deposits, features and structures and, as appropriate, retrieves artefacts, environmental evidence and other remains within a specified area or site (on land or underwater). The records made and objects gathered during fieldwork are studied and the results of that study published in detail appropriate to the project design and the significance of the results.

Archaeological Sites

Locations with physical evidence for where people once lived, hunted, farmed, camped, held ceremonies or were buried.

Artefact

An object or part of an object that has been used or created by a human and provides physical clues to the activity carried out by humans in the area of discovery. These include worked stone tools and tool-making waste, bone, pottery and metalwork.

Artisanal Fishery

A fishery involving fishing households (as opposed to commercial companies), using relatively small amount of capital and energy, relatively small fishing vessels (if any), making short fishing trips, close to shore, with the catch being sold, bartered to traded mainly for local consumption (including that of the fishing households).

ART Municipal District

The entire municipal district area known as Anapa Resort Town (ART) including the town of Anapa (urban district) and 11 other rural districts including Supsekh Rural District and Gai Kodzor Rural District.

Assemblage

A group of artefacts related to each other based upon their recovery from a common archaeological context.

Associated Facility

Defined by IFC PS 1 as: "facilities that are not funded as part of the project and that would not have been constructed or expanded if the project did not exist and without which the project would not be viable ".

Atmospheric Dispersion Model

A computer model used to assess air quality impacts. The model uses local meteorological data to enable a realistic assessment of dispersion from the emission sources for weather conditions that are applicable to the site.

Autonomous Underwater Vehicle (AUV)

A robot which travels underwater without requiring input from an operator. AUVs constitute part of a larger group of undersea systems known as unmanned underwater vehicles.

Authigenic Mineral

A mineral that was generated where it was found or observed – i.e formed in situ.

Automatic monitoring station

A type of monitoring equipment that continuously measures air quality parameters. Air is pumped into a series of analysers and the air quality parameter concentrations are recorded. The data are stored by a data logger and accessed remotely by a computer and modem.

Average Permissible Concentration

The annual average quantity/unit of volume of an air quality indicator that is not considered an undue risk to human health and the environment, in accordance with national legislation in the Russian Federation.

Backfill

Material used to refill an excavated area.

Bacterioplankton

The bacterial component of the plankton.

Bar

Metric unit of atmospheric pressure.

Base Case Design

The base case design is the default Project design, and is reached following the consideration of alternative designs in relation to technical, environmental and socio-economic factors.

Baseflow

Contribution of groundwater flow to surface water flow.

Baseline

Term used to describe existing conditions of the physical, biological, socio-economic, and cultural heritage environemtal aspects. The ESIA processes assesses likely impacts on baseline conditions.

Baseline Data

Data gathered during the Environmental and Social Impact Assessment and used to describe the relevant existing conditions (see 'Baseline').

Benthic

Of or relating to the bottom of a sea, lake, or other body of water.

Benthic Sediments

Sediment found at the bottom of a water column.

Benthopelagic

Living and feeding near the bottom as well as in mid-water or near the surface. Feeding on benthic as well as free swimming organisms.

Benthos

Flora and fauna organisms that live on/in sediment at the bottom of a water column.

Bentonite

A natural, inert, non-toxic clay used as a filler, sealing or suspending agent.

Benzene

Benzene is an organic chemical compound with the molecular formula C6H6. It is a colourless, flammable, sweet-smelling liquid which is a natural constituent of crude oil (diesel and petrol).

Biodiversity

A term used to describe aspects of biological diversity, especially including species richness, ecosystem complexity and genetic variation.

Biological Communities

An ecological unit composed of various populations of different organisms found living together in a particular environment.

Biomass

The total mass of living matter present in an ecosystem or at a particular trophic level in a food chain and usually expressed as dry weight or more accurately, as the carbon, nitrogen, or calorific contect per unit area.

Biota

The plant and animal life occupying a place together.

Biotope

An area that is uniform in environmental conditions and in its distribution of animal and plant life.

Bivalve

A marine or freshwater mollusc having a laterally compressed body and a shell consisting of two hinged valves.

Block Valve

A valve installed at various strategic locations along a pipeline to enable a segment of the pipeline to be isolated for maintenance work or in case of a rupture or leak.

Blue Stream Pipeline

A pipeline crossing the Black Sea and carrying natural gas from Russia to Turkey. The pipeline runs from the Beregovaya Compressor Station at Arkhipo-Osipovka on the Black Sea Coast of Russia to the Durusu Terminal near Samsun in Turkey.

Bronze Age

The prehistoric period following the Stone Age and preceding the iron Age characterized by the use of weapons and implements made of bronze and by intense trading activity. It is generally dated from around 3000 BC.

Byzantine

Of or relating to the Byrantine Empire that ended in 1453, the empire in southeastern Europe and Asia Minor formed from the eastern part of the Roman Empire.

Calcareous Argillites

Calcareous Argillites are a fine grained sedimentary rock that is composed of predominantly clay sized particles (and variable amounts of silt sized particles) containing a high proportion of calcium carbonate typically deposited in shallow water near land as muds and oozes, and then lithified (compacted and cemented) to form a well-formed and relatively hard type of mudstone.

Calcareous Marls

Calcareous Marls are a fine grained sedimentary rock that is composed of variable amounts of clay and silt particles and contains a high proportion of calcium carbonate or lime-rich mud. The marl is softer and contains a higher proportion of carbonate material than a Calcareous Argillite.

Cancun Agreement

The agreements, reached on December 11 in Cancun, Mexico, at the 2010 United Nations Climate Change Conference represent key steps forward in capturing plans to reduce greenhouse gas emissions and to help developing nations protect themselves from climate impacts and build their own sustainable futures.

Carbon monoxide (CO)

Carbon monoxide is a colourless, odourless, and tasteless gas that is slightly lighter than air. It is toxic to humans and animals when encountered in higher concentrations.

Carcinogenic

An agent directly involved in causing cancer.

Cathodic Protection System

A method of neutralising the corrosive static electric charges in a submerged steel structure.

Cetacea

Whales, dolphins and porpoises.

Chance Find

An archaeological site or object that was unknown prior to discovery during construction (despite best efforts to identify all sites prior to construction through cultural heritage surveys).

Chance Find Procedure

Chance find procedure is a project-specific procedure that outlines what will happen if previously unknown physical resources are encountered during project construction or operation. The procedure includes record keeping and expert verification procedures, chain of custody instructions for movable finds, and clear criteria for potential temporary work stoppages that could be required for rapid disposition of issues related to the finds.

Chora

Agricultural hinterland of a Greek city (Greek: χώρα).

Coccolithophore

Planktonic flagellate algae with a layer of minute calcareous plates that can form algal blooms colouring the seawater white.

Colluvial

Soils deposited at the base of hill slopes or cliffs through the action of gravity.

Commissioning

Process by which equipment is tested to verify if it functions according to its design objectives or specifications.

Comment Form

A paper form through which stakeholders can submit written comments, views and opinions. Comment forms are distributed at public consultation meetings and made available in locations where ESIA documentation is disclosed and made available for comments.

Compression

The raising of pressure within a substance.

Compressor Station

To ensure that the natural gas flowing through a pipeline remains pressurised, its compression is required periodically along the pipeline. This is accomplished by compressor stations. Compressor stations increase or raise the pressure of the natural gas using gas compression facilities and equipment.

Conservation

The measures taken to extend the life of cultural heritage in ways that will best sustain its significance and heritage values (ICCROM 1998).

Consultation

The process of formally consulting or discussing a subject. For the purposes of this document, consultation involves two-way communication between the project developers and affected or interested stakeholders.

Contamination

The introduction by man, directly or indirectly, of chemicals to the environment resulting in adverse impacts.

Contiguous Zone

A band of water extending from the outer edge of the territorial waters (which are usually 12 NM from the coast) up to 24 NM from the coast, within which a state can exert limited control for the purpose of preventing or punishing infringements of its customs, fiscal, immigration or sanitary laws and regulations.

Construction and Pre-comissioning Phases

2013 to end of 2018 – this phase will involve construction activities including an operational ramp-up period from late 2015 to late 2018.

Construction Corridor

During construction phase, corridor which encompasses all four pipelines.

Continental Shelf

A shallow submarine plain of varying width forming a border to a continent and typically ending in a comparatively steep slope to the deep ocean floor.

Continental Slope

The comparatively steep slope from a continental shelf to the ocean floor.

Copepod

Any of a large subclass (Copepoda) of usually minute freshwater and marine crustaceans.

Corrosion

The eating away of metal by chemical or electrochemical action.

Corrosion inhibitors

Chemicals that reduce the rate of corrosion on metal.

Cnidarian

Radially symmetrical animals having saclike bodies with only one opening and tentacles with stinging structures. They occur in polyp and medusa forms and include anemones, corals, hydroids and jellyfish.

Critical Cultural Heritage

Critical cultural heritage consists of one or both of the following types of cultural heritage: (i) the internationally recognised heritage of communities who use, or have used within living memory the cultural heritage for long-standing cultural purposes; or (ii) legally protected cultural heritage areas, including those proposed by host governments for such designation (IFC 2012 Performance Standard 8, para 13). To be considered critical, the cultural heritage must be internationally recognised prior to the proposal of the project (IFC 2012, Guidance Note 8, paragraph GN24).

Ctenophore

Any of a phylum (Ctenophora) of marine animals superficially resembling jellyfishes but having biradial symmetry and swimming by means of eight bands of transverse ciliated plates —called also comb jelly.

Cultural Heritage

The heritage that includes artefacts, monuments, groups of buildings and sites that have a diversity of values including symbolic, historic, artistic, aesthetic, ethnological or anthropological, religious, scientific and social significance (UNESCO 1972).

IFC Performance Standard 8: Cultural Heritage defines Cultural Heritage as '(i) tangible forms of cultural heritage, such as tangible moveable or immovable objects, property, sites, structures, or groups of structures, having archaeological (prehistoric), paleontological, historical, cultural, artistic, and religious values; (ii) unique natural features or tangible objects that embody cultural values, such as sacred groves, rocks, lakes, and waterfalls; and (iii) certain instances of intangible forms of culture that are proposed to be used for commercial purposes, such as cultural knowledge, innovations, and practices of communities embodying traditional lifestyles' (IFC 2012, Performance Standard 8, paragraph 3).

Cultural Landscape

Landscapes which represent combined works of nature and by humans, and they express a long and intimate relationship between people and their natural environment (UNESCO 2007).

Cultural Resources

Movable or immovable cultural heritage objects, sites, structures, groups of structures, and natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, spiritual, aesthetic, or other cultural significance. Physical cultural resources may be located in urban or rural settings, and may be above or below ground, or under water. Their cultural interest may be at the local, provincial or national level, or within the international community.

Culturally Appropriate

An engagement process that identifies a practical and appropriate approach for sharing information and comments / views / opinions that is compatible with local cultural norms and behaviour.

Cumulative Impact

The combination of multiple impacts from existing projects, the proposed project, and/or anticipated future projects that may result in significant adverse and/or beneficial impacts that would not be expected in case of a stand-alone project.

Cuttings

Fragments of rock and other material displaced during the drilling or boring process.

Decommissioning Phase

Planned shut-down of a building, equipment, plant, etc., from operation or usage. Commencing 2065.

Demersal

Demersal fish live and feed on or near the seabed. They can be contrasted with pelagic fish.

Demography

The statistical study of the characteristics of human populations.

Design Control

The prevention or minimisation of adverse impacts through the use of good practice design controls. Design controls are often defined prior to the detailed consideration of potential impacts and mitigation measures within the ESIA process.

Dewatering

The process of dewatering is to remove the test water from the pipeline, after hydrotesting. This is usually carried out using dewatering PIGs.

Dewatering and Pre-commissioning Spread

The space and equipment needed for the dewatering and pre-commissioning activities.

Diatoms

Planktonic algae possessing a silicaceous cell called a frustule. Globally, diatoms are the most abundant group within the phytoplankton.

Diffusion Tube Monitoring

A type of air quality monitoring equipment that passively absorbs air quality indicators over a given time (i.e., does not pump air over the sample medium). It provides an average concentration for the period of measurement.

Dinoflagellates

A group of single celled organisms possessing a flagellum (whip like locomotory structure). Many are photosynthetic organisms and form a major component of marine phytoplankton.

Direct Impacts

Direct impacts result from a direct interaction between a project activity and the receiving environment (e.g. between a project activity that results in permanent or temporary land take or use and the owner and users of that land).

Disadvantaged and/or Vulnerable Individuals and Groups

Individuals or groups within the project area of influence who could experience adverse impacts from the proposed project more severely than others based on their vulnerable or disadvantaged status. This status may stem from an individual's or group's race, colour, sex, language, religion, political, or other opinion, national or social origin, property, birth or other status. In addition other factors should be considered such as gender, ethnicity, culture, sickness, physical or mental disability, poverty or economic disadvantage, and dependence on unique natural resources. [2]

Disclosure

Release of information into the public domain. For the purposes of this document, disclosure refers to the release of the project and EIA/ESIA information to affected and interested stakeholders.

2 Definition as per the IFC Policy & Peformance Standards and Guidance Notes. Glossary of Terms. Available from www.IFC.org

Diurnal Vertical Migration

Pattern of vertical migration occurring on a daily basis, such as in some copepods and fish.

Draft nets

Single wall of netting attached to a floating head rope and a weighted ground rope, designed so that a bag is formed into which the catch is drafted or hauled. Normally used in rivers or river estuaries.

Dredging

Process of excavating materials (seabed sediments or rock) underwater.

Dry Natural Gas

Natural gas is called 'dry' when it has had most hydrocarbons removed and is therefore almost pure methane. It is also known as 'consumer grade' natural gas.

Dust

'Dust' is generally regarded as particulate matter less than 75 µm.

Ecosystem

A biological community of interacting organisms and their physical environment.

Ecosystem Service

The benefits people obtain from ecosystems. Following the lead of the Millennium Ecosystem Assessment, ecosystem services are typically classified along functional lines into four broad categories:

i. Provisioning services: the products people obtain from ecosystems such as food and fibre, fuel in the form of peat, wood or non-woody biomass, or water from rivers, lakes and aquifers. Goods may be provided by heavily managed ecosystems, such as agricultural and aquacultural systems and plantation forests, or by natural or semi-natural ones, for example in the form of capture fisheries or the harvest of other wild foods;

ii. Regulating services: the benefits people obtain from the regulation of ecosystem processes including, for example, the regulation of climate, hazards, noise, water, soil and air quality, and pollination;

iii. Cultural services: the cultural, spiritual, and educational benefits people obtain from ecosystems through, for example, recreation and tourism, spiritual or religious upliftment, or cultural heritage; and

Supporting services: the natural processes that maintain the other services such as soil formation, nutrient and water cycling, or primary production.

Ecotones

A transitional area of vegetation between two different plant communities, such as forest and grassland. It has some of the characteristics of each bordering plant community.

Electromagnetism

Refers to the interactions between electrically charged particles and magnetic force fields. Weak electromagnetic fields are present naturally. The operation of electrical equipment generates locally stronger electromagnetic fields.

Eluvial

Soils formed by in-situ weathering processes (i.e. wind).

Emergency Preparedness and Response Plan

The Emergency Preparedness and Response Plan defines how South Stream Transport plans, prepares and manages incidents and emergencies.

Emergency Response Plan

Emergency Response Plans are required for each high risk emergency incident/ scenario as identified by the Emergency Risk Analysis. Contractors who will be doing the work will be responsible for preparing Emergency Response Plans for their work activities, and specifically those events identified by the Emergency Threat Analysis.

Emergency Shut Down Valve

A valve designed to stop the flow of gas in the pipeline upon the detection of a dangerous event. This provides protection against possible harm to people, equipment or the environment.

Emergency Threat Analysis

Emergency Threat Analysis determines the risks posed by potential emergencies and the need for specific Emergency Response Plans and related procedures as a contingency for emergency events.

Engagement

A process that involves consultation and/or disclosure.

Environmental/Social Aspect

An element of an organisation or project's activities, products or services that can interact with the environment or a social receptor that affects or can affect the environment.

Environmental/Social Impact

Any change to the environment or social status, whether adverse or beneficial, wholly or partially resulting from an organisation's activities, products or services.

Environmental and Social

For the purposes of this ESIA, the term "Environmental and Social" refer to all environmental, socio-economic and cultural heritage factors of the Project.

Environmental and Social Impact Assessment (ESIA) / Environmental Impact Assessment (EIA)

Systematic review of the environmental or socio-economic changes a proposed project may have on its surrounding environment.

Environmental and Social Management System

A system established to plan, manage, document and monitor an organisation's activities and processes and resultant environmental and social impacts in accordance with requirements of ISO 14001:2004 and IFC Performance Standard 1.

Equator Principles

The Equator Principles (EPs) are a credit risk management framework for determining, assessing and managing environmental and social risk in project finance transactions. The EPs are designed to help financial institutions overcome the challenges of incorporating risks associated with biodiversity and ecosystem services into their lending decisions. [3]

Epiphytes

A plant that grows on another plant but is not parasitic, such as diatoms growing on seaweed.

3 Definition as per the EP website available from www.equator-principles.com

Espoo Convention

The Espoo (EIA) Convention sets out the obligations of Parties to assess the environmental impact of certain activities at an early stage of planning. It also lays down the general obligation of States to notify and consult each other on all major projects under consideration that are likely to have a significant adverse environmental impact across boundaries. The Convention was adopted in 1991 and entered into force on 10 September 1997. [4]

Eurostat

Detailed statistical website on the EU.

Eutrophication

Excessive nutrient enrichment of a body of water, often leading to detrimental ecological changes.

Exclusive Economic Zone

An exclusive economic zone (EEZ) is a seazone for which a state has special rights over the exploration and use of marine resources, including production of energy from water and wind. It stretches from the seaward edge of the state's territorial sea out to 200 nautical miles from its coast (or to a neighbouring EEZ).

Fault

A planar fracture or discontinuity in a volume of rock, across which there has been significant displacement of one side with respect to the other. Rapid movement of faults causes earthquakes.

Fauna

The animals of a particular region, habitat, or geological period.

Feasibility Study

An analysis and evaluation of a proposed project to determine if it is technically feasible, is feasible within the estimated cost, and will be profitable.

Fixed Gillnets

Either stretched between two or more stakes driven into the bottom within the tidal area along the coast to target coastal species or be weighted to the seabed with weights attached to the ground line (footrope) supported by floats on the upper line (headrope). Can be used to catch demersal or pelagic fish.

Flora

The plants of a particular region, habitat, or geological period.

Fluvial

Soils formed by rivers and streams.

Flysch

Sedimentary rocks formed in deep water marine conditions.

Footprint

The spatial impact/ impression on the seabed or land from a project.

Foreign Direct Investment

Foreign Direct Investment (FDI) is the direct investment into production or business in a country by a company located or based in another country.

Fossil Fuels

Hydrocarbon fuels found naturally within the top layer of the Earth’s crust following decomposition of buried dead organisms such as plants and animals over a period of millions of years.

4 Definition as per the UNECE website available from http://www.unece.org/env/eia/eia.html

Front End Engineering Design (FEED)

Engineering that is conducted after completion of Feasibility Study (also known as Conceptual Design).

Frame-first Construction

A term used to describe the procedure in which hulls were constructed by first erecting frames and then attaching the outer skin of planking to them.

Frequency

A measure of the cycles per second in sound pressure fluctuations or vibration in Hertz (Hz). Humans can typically hear sound in the range of approximately 20 Hz to 20 kHz.

Fugitive Source Emissions

Fugitive emissions are non-combustion related emissions, such as gas leaks from pressurised equipment.

Gamma Radiation

Electromagnetic radiation of short wavelength. Gamma radiation is present naturally due to solar and geological processes. Anthropogenic activities may cause increased gamma radiation.

Gastropod

A class of molluscs comprising slugs and snails, typically having a flattened muscular foot with a head bearing stalked eyes.

Gauging

Gauging is undertaken to detect geometric anomalies in pipelines such as obstructions, dents and ovalities (out-of-roundness) that may have occurred during construction activities. This requires passage of a gauging tool (typically an aluminium gauge plate) which is attached to a PIG and passed through the pipeline.

G-20

The G20 is a forum for international cooperation on the most important issues of the global economic and financial agenda. It brings together finance ministers and central bank governors from 19 countries: Argentina, Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, the Republic of Korea, Mexico, Russia, Saudi Arabia, South Africa, Turkey, the United Kingdom, the United States of America plus the European Union, which is represented by the President of the European Council and by Head of the European Central Bank.

Geohazard

Geological or geomorphological situation that represents, or has the potential to develop further into, a situation leading to damage or uncontrolled risk. It includes landslides, seismic faults and volcanic activities, among other situations.

Geomorphology

Refers to the study of the evolution and configuration of landforms and the processes which shape them.

Global Warming

Global warming is an average increase in the temperature of the atmosphere near the Earth's surface and in the troposphere, which can contribute to changes in global climate patterns.

Good International Industry Practice (GIIP)

Good International Industry Practice is the exercise of professional skill, diligence, prudence and foresight that would reasonably be expected from skilled and experienced professionals engaged in the same type of undertaking under the same or similar circumstances globally.[5]

Greenhouse Gases (GHG)

Atmospheric gases considered to contribute to the greenhouse effect by absorbing and emitting radiation, They include carbon dioxide (CO2), methane (CH4), nitrous oxide (NO2), and water vapour.

Grievance

Formal complaint by individuals, groups or organisations who feel they have been adversely affected by project-related activities.

Grievance Mechanism (or Grievance Procedure)

Process of recording and addressing grievances so that they can be tracked through to a resolution.

Gross Domestic Product

The monetary value of all the finished goods and services produced within a country's borders over a certain period of time, usually calculated on an annual basis.

Gross Value Added

The value of goods and services produced by an area, sector or producer minus the cost of the raw materials and other inputs used to produce them. Unlike GDP, GVA does not include taxes or subsidies on the goods and services. GVA is useful for comparing performance across different areas as it is often difficult to allocate taxes and subsidies sub-nationally.

Groundwater

Water within rock pore space below the water table.

5 Definition as per the IFC Policy & Peformance Standards and Guidance Notes. Glossary of Terms. Available from www.IFC.org

Grout

A material that is used for filling voids and sealing joints.

Habitat

The natural home or environment of an animal, plant, or other organism.

Halocline

A vertical gradient in ocean salinity.

Harmful Substances

Harmful substances are natural or man made substances that adversely effect the functioning capability of organisms. In relation to the Convention on the Protection of the Black Sea against pollution, harmful substances are those substances that are identified as marine pollutants in the International Maritime Dangerous Goods (IMDG) Code.

Hazard

The potential to cause harm, including ill health or injury; damage to property, plant, products or the environment; production losses or increased liabilities.

Hazardous Substance

Natural or man-made chemicals that adversely affect human health or ecological functions.

Hellenistic

Relating to postclassical Greek history and culture.

Herpetofauna

Term referring to both reptiles and amphibians.

Holoplankton

Holoplankton are organisms that are planktonic for their entire life cycle.

Examples of holoplankton include diatoms, radiolarians, dinoflagellates, foraminifera, amphipods, krill, copepods, and salps.

Hominin

The group consisting of modern humans, extinct human species and all our immediate ancestors (including members of the genera Homo (e.g. *Homo neanderthalensis*, *Homo erectus*, *Homo habilis*), and various species of Australopithecus, Paranthropus and Ardipithecus).

Hydrocarbon

Organic chemical compounds of hydrogen and carbon atoms that form the basis of all petroleum products. They may exist as gases, liquids or solids, examples being methane, hexane and paraffin.

Hydrogen carbonate (HCO3-)

This is the bicarbonate ion, also referred to as the hydrogen carbonate ion.

Hydraulic Conductivity

A coefficient that relates the discharge through an aquifer to the hydraulic head gradient.

Hydrotesting

Process of checking the integrity of a pipeline by filling it with water under pressure and testing for any loss of pressure (e.g. from leaks).

Hydroid/ Hydrozoa

Class of the phylum Cnidaria, usually with small and plant-like colonies of polyps and small jellyfish generative stages. Colonies are attached to solid forms such as rocks, shells or plants. There are also some planktonic forms such as the floating colony of polyps known as the Portuguese men-of-war.

Ichthyoplankton

Term used to describe the fish egg and fish larvae component of the plankton.

Impressed Current System

Impressed current cathodic protection (ICCP) systems are installed to prevent corrosion of underground metal pipeline systems. Corrosion of underground metal pipelines is a normal, natural process that is the result of an electrochemical reaction in which current flows from areas where corrosion is occurring (anodic areas) to areas where it is not (cathodic areas). A cathodic protection system reverses the process. With an impressed current system, current is discharged from special anodes placed in the same electrolyte (soil) in which the pipelines to be protected are buried.

Indirect Impacts

Indirect impacts result from other activities that happen as a consequence of the project (e.g. project implementation promotes service industries in the region).

Intangible Cultural Heritage

The Convention for the Safeguarding of the Intangible Cultural Heritage defines the intangible cultural heritage as the practices, representations, expressions, as well as the knowledge and skills (including instruments, objects, artefacts, cultural spaces), that communities, groups and, in some cases, individuals recognise as part of their cultural heritage. It is sometimes called living cultural heritage, and is manifested inter alia in the following domains:

- Oral traditions and expressions, including language as a vehicle of the intangible cultural heritage;
- Performing arts;

- Social practices, rituals and festive events;
- Knowledge and practices concerning nature and the universe; and
- Traditional craftsmanship.

Interfluve

The region of higher land between two rivers that are in the same drainage system.

International Finance Corporation (IFC)

Organisation that is a member of the World Bank, and promotes sustainable private sector investment in developing countries. [6]

International Finance Corporation Performance Standards

The Performance Standards provide guidance on how to identify environmental and social risks and impacts, and are designed to help avoid, mitigate, and manage risks and impacts as a way of doing business in a sustainable way. There are eight Performance Standards that clients must meet throughout the life of an investment by IFC. [6]

International Union for Conservation of Nature (IUCN) Red List

The IUCN Red List of Threatened Species provides taxonomic, conservation status and distribution information on plants and animals that have been globally evaluated using the IUCN Red List Categories and Criteria. This system is designed to determine the relative risk of extinction, and the main purpose of the IUCN Red List is to catalogue and highlight those plants and animals that are facing a higher risk of global extinction (those listed as Critically Endangered, Endangered and Vulnerable). The Red List website is http://www.iucnredlist.org

6 Definition as per the IFC website. Taken from www.IFC.org

Invertebrates

Any animal lacking a backbone, including all species not classified as vertebrates, such as an arthropod, mollusc, annelid, coelenterate, etc.

Juniper woodland/scrub

A relatively heterogeneous woodland community, dominated in the tree layer by juniper species, as well as pubescent oak and oriental hornbeam.

Kavkaz Winery

ZAO Agrifirm Caucasus.

Keystone species

A species that exerts a large, stabilizing influence throughout an ecological community, despite its relatively small numerical abundance.

Known Development

The Russkaya CS, the Clearing in the Woods "Lesnaya Polyana" development, the Residence of Utrish development and the Zapovedny (Reserved) development.

Krai

An administrative area or region within the Russian Federation.

Kurgan

Mound of earth and stones raised over a grave or graves in Eastern Europe and Central Asia (Russian: Курган).

Landfall

The point at which the pipeline comes ashore from the sea.

Landfall Facility

The point at which an offshore pipeline reaches the mainland.

Landfall Section

Approximately 3.9 km of onshore pipelines, 2.5 km of which will be buried and 1.4 km of which will be housed in microtunnels. The exit point of the microtunnels will be approximately 400 m from the shoreline at a depth of 23 m. The permanent onshore landfall facilities (approximately 142 m wide) are also included within the landfall section.

Landscape

An area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors (Council of Europe, 2000).

Landscape Impact

Impacct on the landscape as a resource in its own right.

Larva

Juvenile form of an animal, differing in shape and appearance from the adult. Larvae undergo metamorphosis before reaching the adult form. Larvae can form an important component of the plankton in marine systems.

Laydown Area

Areas used for storing construction materials and equipment.

Leachable

To remove soluble or other constituents from soil or waste by the action of a percolating liquid.

Likelihood

The probability that an activity or effect will occur.

Line sources

An emission source that has a linear (one-dimensional) geometry. The most prominent linear sources are road traffic and aircraft air emissions.

Littoral

Zone between the low and high water marks.

Local Community/ies

Communities that have the potential to be affected by the Project. For the purposes of this socio-economic assessment, certain communities (Gai Kodzor, Rassvet, Varvarovka, Sukko and Supsekh) are referred to as 'Local Communities'. These communities were identified as potentially Project-Affected Communities (PACs) in the Scoping Report, together with the town of Anapa but which is not identified as a Local Community in this chapter.

Macroalgae

Large algae including seaweeds.

Macrophyte

A plant large enough to be seen by the naked eye. Includes both seaweeds and marine angiosperms such as sea grass.

Magnetometer

A survey instrument that measures fluctuations in the earth's magnetic fields for the purpose of detecting ferrous material.

Magnitude of Impact

The degree and extent to which a project changes the environment.

Mammal

A class of warm-blooded vertebrates, Mammalia, having mammary glands in the female.

Marginalised Groups

Groups characterised by shared traits such as ethnicity, income levels, or disability that are not present or represented in the mainstream of social, economic or political life of a country. Thus, they may be disproportionally adversely affected by project impacts.

Marshalling Yard

Onshore support facilities. An area where materials and equipment are temporarily stored and location of managerial support for South Stream Transport and its contractors. Located at the Russian ports Temyruk and Novorossiysk. For the purposes of this document, marshalling yards are areas within ports.

Maximum Permissible Concentration

An amount, usually a combination of time and concentration, beyond which any exposure of humans to a chemical or physical agent in their immediate environment is unsafe. For the purpose of this report, these are average limits set by the authorities of the Russian Federation.

Maximum Permissible Level

The concentration of a harmful substance within soil or water below which there are no direct or indirect adverse impacts upon human health (where exposure is continuous over a lifetime).

Meroplankton

Meroplankton are organisms that are planktonic for only a part of their life cycles, usually the larval stage. Examples of meroplankton include the larvae of echinoderms (such as sea urchins and sea stars), crustaceans, marine worms, some marine gastropods and most fish.

Mesophilic meadow

These are grassland and herb communities which are located on a river floodplain. They comprise vegetation communities typical of moist and more nutrient rich environments.

Mesophilic woodland

These woodlands occur in the riverine floodplains and valleys and are dominated by woody species and a diverse woodland ground-flora.

Metocean

Abbreviation of the words 'meteorology' and 'oceanography'.

Meteorological Conditions

The prevailing environmental conditions that include wind, precipitation and sunlight.

Meteorology

Refers to the study of weather

Microtunneling

Microtunneling is a trenchless construction method used to excavate underground tunnels. Microtunneling is defined as a remotely-controlled, guided, ground-boring and pipe-jacking operation that provides continuous support to the excavation face by applying mechanical or fluid pressure to balance groundwater and earth pressures.

Migration

Any regular animal journeys along well-defined routes, particularly those involving a return to breeding grounds.

Millennium Ecosystem Assessment

The Millennium Ecosystem Assessment (MA), a collaboration of over 1,360 experts, was published in 2005 and provided the first state-of-the-art scientific appraisal of the condition and trends in the world's ecosystems and the services they provide and the options to restore, conserve or enhance their sustainable use.

Million tonnes of oil equivalent (mtoe)

A unit of energy representative of the amount of energy released by combustion of one million tonnes of crude oil. Conversion of mtoe to bcm were calculated using a factor of 1 bcm=0.89 mtoe

Mitigation Measures

Management measures put forward to prevent, reduce and where possible, offset any adverse environmental or socio-economic impacts. For the purposes of this document, these measures also include enhancement strategies aimed at increasing beneficial impacts.

Mobile Source Emissions

Exhaust from motor vehicles, airplanes, locomotives, and other engines and equipment that can be moved from one location to another.

Monument

Architectural works, works of monumental sculpture and painting, including cave dwellings and inscriptions, and elements, groups of elements or structures of special value from the point of view of archaeology, history, art or science (UNESCO 1972).

Multi-beam Echo Sounder

A survey instrument that emits multiple acoustic beams of sound waves to determine sea floor depths over a wide area for the purpose of creating bathymetric maps.

Mutagenic

A physical or chemical agent that changes the genetic material, usually DNA, of an organism.

Nauplii

The first larval stage of many crustaceans, having an unsegmented body and three pairs of appendages.

Nearshore Section

Four buried pipelines extending from the exit point of the microtunnels, located approximately 400 m from the coast at a water depth of approximately 23 m, and extends approximately 425 m out to a water depth of 30 m.

Neolithic

The Neolithic culture (c. 7000-2000 BC) developed animal husbandry and agricultural cultivation, alongside hunting wild animals, fishing and gathering wild foods.

Nitrogen dioxide (NO_2)

Nitrogen dioxide is one of several nitrogen oxides and is emitted by (and forms from emissions of) cars, trucks and buses, power plants, and off-road equipment. In addition to contributing to the formation of ground-level ozone, and fine particle pollution, NO2 is linked with a number of adverse effects on the respiratory system.

Nitric oxide (NO)

A colourless, poisonous gas, produced as an intermediate during the manufacture of nitric acid from ammonia or atmospheric nitrogen.

Nitrogen oxides (NO_X)

Also known as oxides of nitrogen. A group of gases emitted from fossil fuel combustion that predominantly comprises nitric oxide, nitrogen dioxide, nitrous acid and nitric acid.

Noise

Unwanted sound.

Non-destructive Testing (NDT)

Methods of inspecting and testing the quality or integrity of infrastructure or equipment which do not involve the removal or testing to destruction of representative sections.

Non-methane Volatile Organic Compounds (NMVOC)

See Volatile Organic Compounds. NMVOC excludes methane from this group of chemicals.

Octave Band Centre Frequency

Used within acoustics to define the centre frequency of each octave where successive higher frequencies are represented by a doubling of the frequency.

OECD Common Approaches

The mission of the Organisation for Economic Co-operation and Development (OECD) is to promote policies that will improve the economic and social well-being of people around the world. The OECD provides a forum in which governments can work together to share experiences and seek solutions to common problems. The OECD Common Approaches are Recommendations of the Council on Common Approaches for Officially Supported Export Credits and Environmental and Social Due Diligence adopted by the OECD Council on 28 June 2012. [7]

7 Definition as per the OECD website. Taken from www.oecd.org

Offshore Section

Four pipelines each approximately 225 km in length laid directly on the sea bed from the maximum water depth where dredging works will take place (30 m) to the boundary between the Russian and Turkish EEZs.

Oil Spill Prevention and Response Plan

All contractors and operators of vessels working on behalf of South Stream Transport will be required to developing and implementing an Oil Spill Prevention and Response Plan which will define actions to be taken to minimise the risks of marine oil spillages, as well as the actions to be undertaken following a spillage.

Oligochaete

Any of various annelid worms of the class Oligochaeta, including the earthworms and a few small freshwater forms.

Operational Phase

Phase commencing at the end of construction and pre-commissioning phase (end of 2018) and ending 2065. The Project will have an operational design life of 50 years.

Orogeny

Period of mountain building due to the movement of tectonic plates in the Earth"s crust.

Oxides of nitrogen (NO_X)

See nitrogen oxides.

Ozone (O_3)

An unstable, poisonous allotrope of oxygen that is formed naturally in the ozone layer from atmospheric oxygen and also emitted at ground level during combustion of fossil fuels. It is a highly reactive oxidizing agent used to deodorize air, purify water, and treat industrial wastes.

Particulates or Particulate Matter

Matter in the form of minute separate solid or liquid particles.

Particulate matter ($PM_{2.5}$)

Particulate matter less than 2.5 micrometres in diameter ($PM_{2.5}$) are called 'fine' particles. These particles can only be detected with an electron microscope. Sources of fine particles include all types of combustion, including motor vehicles, power plants, residential wood burning and some industrial processes.

Particulate matter (PM_{10})

Particulate matter less than 10 micrometres (or 'microns') in diameter. They are small enough to penetrate deep into the lungs, potentially causing serious health problems. This is mainly due to the combustion of fossil fuels (construction dust for example is generally more coarse).

Party/Parties of Origin

A country involved in a transnational linear project where an activity is planned to be undertaken, which may affect an Affected Party. See Affected Party above.

Pelagic

Freely swimming in the upper water column.

Pelite

Clay

Permanent Halocline Layer

Layer of maximal salinity gradient in the water column.

Permanent Right of Way

During Operational Phase, approximately 95 m wide and 2.5 km long along the landfall section pipelines.

Permanganate oxygen demand

Permanganate is a strong oxidising agent. Permanganate oxygen demand gives an indirect indication of the amount of organic matter or reduced species (typically those containing Fe or Mn) present in groundwater; the higher this value the higher the demand for permanganate and therefore the higher the content of organic/reduced species.

Picoplankton

The smallest component of the plankton, ranging from to 0.2 to 2 µm in size, predominantly comp[rising bacteria but with some other organisms.

Pipelaying Vessel

A vessel designed for welding together pipelines and laying them on the seabed.

Photic zone

The depth zone of the water column in the sea or other water body that is exposed to sufficient sunlight for photosynthesis to occur. Also known as the 'euphotic' zone the depth of which depends on the clarity of the water and consequent light penetration.

Phytoflagellates

All photosynthetic flagellates, including dinoflagellates, some planktonic green algae and others.

Phytoplankton

The plant component of the plankton comprising a variety of organisms. The most common components of marine phytoplankton are the diatoms and dinoflagellates.

Pipeline Construction

The construction phase of the pipeline development.

Pipeline Inspection Gauge (PIG)

A bullet shaped, cylindrical or spherical capsule which is inserted into a pipeline and travels along with the fluid in the pipeline. PIGs have a variety of purposes during precommissioning, commissioning and operations, including scraping the pipeline clean from rust, wax or other deposits. More sophisticated PIGs, called intelligent PIGs, carry instrumentation used in pipeline inspection.

Pigging

Pigging is passing a solid plug (PIG) through a pipeline. See above.

Pig Trap Facility

Pig traps are used for inserting PIGs into a pipeline then launching, receiving, and finally removing them without flow interruption.

Pipe Jacking

Pipe jacking is a technique for installing underground pipelines, ducts and culverts. Powerful hydraulic jacks are used to push specially designed concrete pipes through the ground behind a shield or tunnel boring machine at the same time as excavation is taking place. The method provides a flexible, structural, watertight, finished conduit as the tunnel is excavated.

Piscivorous

Habitually feeding on fish; fish-eating

Planktivore

An animal that feeds primarily on plankton

Plankton

Minute plants (phytoplankton) and animals (zooplankton) that drift in the surface waters of seas and lakes.

Polis

Ancient Greek city-state (Greek: πόλις).

Pollution

The introduction by man, directly or indirectly, of substances or energy to the environment resulting in deleterious effects such as harm to living resources.

Polychaete

An important group of segmented marine worms that can be either free-living or tube-dwelling. A major component of the benthos in many areas, polychaete tubes may also form biogenic reefs.

Polypropylene

A thermoplastic polymer used in a wide variety of applications.

Pound nets

Net walls, anchored or fixed on stakes, reaching from the bottom to the surface. Nets are opened at the surface and include various types of fish herding and retaining devices. Normally used to target migrating, pelagic species.

Pottery sherds

The individual pieces of broken ceramic vessels.

Pre-commissioning

Pre-commissioning is the process of proving the ability of a pipeline and piping systems to meet operational requirements prior to putting the pipeline into service.

Prehistoric

The time before recorded history and writing. Includes the Palaeolithic, Epipalaeolithic, Neolithic, Copper Age/Chalcolithic/Eneolithic, Bronze Age and Iron Age periods.

Preservation in place / *in situ*

The preferred sectoral good practice method of treating cultural heritage remains. Where feasible and appropriate, this involves preserving sites in place (in situ). Sites will often be given additional protection and safeguard measures such as flagging, fencing, covering, and signage.

Primary Producer

Organism that is able to synthesize organic material (usually sugar) from less complex compounds such as carbon dioxide. Photosynthesis is the fundamental process of in primary production so most primary producers are plants. Primary production also occurs by a process called chemosynthesis, using chemicals instead of light.

Priority ecosystem services

IFC Performance Standard 6 (para. 24) defines priority ecosystem services as:

i. Those services on which project operations are most likely to have an impact and, therefore, which result in adverse impacts to Affected Communities; and/or

ii. Those services on which the project is directly dependent for its operations (e.g., water).

The Performance Standards also state that *"when Affected Communities are likely to be impacted, they should participate in the determination of priority ecosystem services in accordance with the stakeholder engagement process as defined in Performance Standard 1".*

In order to identify priority services in a transparent and systematic manner which supports participation of Affected Communities, priority services are identified in this assessment as those services for which the impacts are assessed to be of moderate or high significance.

The Project

South Stream Offshore Pipeline – Russian Sector.

Project Affected Community

Communities that are affected by the activities of a project. For the purposes of this document, PACs are defined as communities that lie (at least in part) within 2 km of the landfall section of the Project, and within a 300 m zone either side of potential (existing) access roads.

Project Area

Refers to the Landfall, Nearshore and Offshore Sections (not the access roads or marshalling yards which are considered the 'Project').

Project Area of Influence

Where the project involves specifically identified physical elements, aspects, and facilities that are likely to generate impacts, environmental and social risks and impacts will be identified in the context of the project's area of influence

Project Leaflet

Brief publication containing information about a project which is made available to stakeholders.

Project Proponent

The developer, or sponsor, of a project. For the Project, this is South Stream Transport.

Project Zone of Influence

The geographical area within which views of the construction and operational phases of the Project and the marshalling yards could potentially be possible, including views of vehicles and vessels on the land and sea delivery routes.

Proyekt

The Proyekt is the Russian project design documentation submitted to the Russian Authorities for review. The Final EIA Report is incorporated under Chapter 7 of the Proyekt and submitted to the relevant Russian Federation authorities for review and approval.

Proposed Development

Development detailed in the GDP.

Pycnocline

The layer in which the density gradient is greatest within a body of water.

Public Disclosure

Disclosure of project or ESIA–related information to stakeholders for review and as an input to consultations.

Public Hearing

Often, but not always, refers to a public meeting that must be announced, organised and reported upon according to national regulatory requirements. See 'Public meeting'.

Public Meeting

Open meeting which may be attended by any member of the public. Need not be a meeting required under specific legislation.

Purse seine

A long net, which falls as a curtain from a floating head rope, used to surround shoals of fish. After encirclement, the bottom rope is pulled tight to trap the fish in the 'purse'.

Radionuclide

An atom with an unstable nucleus that decays with the release of radiation. Radionuclides occur naturally or can be produced artificially. Also known as radioisotopes.

Ramp-up

For the purposes of this document, ramp up refers to an increase in the amount of gas being transported through the pipeline(s).

The period after completion of construction of a project during which production begins to increase towards operational / design capacity. In terms of this Project, ramp-up refers to the gradual increase in gas transport rates until operational capacity is met.

Ratified

When a state makes a final approval and formal expression of its consent; for example, to be bound by a treaty or convention. This usually occurs after signature.

Receptor

The aspect of the environment (air, water, ecosystem, human, fauna, etc.) that is affected by/interacts with an environmental or socio-economic impact.

Recycling/Recovery

The conversion of wastes into usable materials and/or extraction of energy or materials from wastes.

Red List / Red Book

For the purposes of this document, this refers the IUCN Red list (see definition below), the National Russian Red Data Book, the regional Krasnodar Red Data

Book or the Black Sea Red Data Book. These books contain animal and plant species that are considered of 'critical' importance under categories such as extinct, endangered and vulnerable. They also list species that are of lower importance under headings such as rare or lower risk. Species are also categorised under data deficient or not evaluated.

Reinstatement Work

The process of returning the landscape affected by the construction of a development back to its previous state.

Remotely Operated Vehicle/ Remotely Operated Towed Vehicle

Remotely Operated Vehicle (ROV) and Remotely Operated Towed Vehicle (ROTV), both of which are used for underwater surveys, are submarine survey robots controlled and powered from the surface by an operator/pilot via an umbilical link.

Reprotoxic

Having a toxic effect on the process of reproduction

Residual Impacts

Residual impacts are impacts that remain after mitigation measures, including those incorporated into the project's Base Case design and those developed in addition to the Base Case design, have been applied.

Reuse

To use a material or product again after it has been used. Reuse may be for the same function or a new function.

Risk

The probability that a specified event will occur and the severity of the consequences of the event.

Routine Activity

An activity that occurs during routine operations when plant, / vessels or equipment is operating as specified within the design base case.

Sacrificial Anode

A metal (usually zinc, aluminium or magnesium) that is placed on offshore steel pipelines to corrode and prevent corrosion of the pipeline by providing cathodic protection (exchange of electrons) of its steel surface.

Salinity

Total amount of salt dissolved in aqueous solution. Salinity is measured in parts per thousand.

Sanitary Protection Zones

A buffer zone between a construction or operating site and nearby residential areas. It is established for industrial facilities that emit pollutants into the atmosphere or have other environmental impacts.

Sapropel

Marine sediment rich in organic matter.

Scoping

Early stage in the ESIA process that appraises the likely key issues requiring detailed assessment. A scoping process (in relation to IFC PS1) is the establishment and maintenance of a process for identifying the initial environmental and social risks and impacts of a project. The aspects of the project (i.e., type, scale and location) along with available baseline data is used to guide the scope and level of effort devoted to the risk and impacts identification in the ESIA. The scoping process is to be consistent with Good International Industry Practice (GIIP) and will determine the appropriate / relevant methods and assessment procedures. The process also involves a mechanism for the collection of comments made by different stakeholders. [8]

Screening

The process by which a decision is taken on whether or not EIA is required for a particular Project.

Seagrass

The only angiosperms that are adapted to living submerged in the sea. They superficially resemble terrestrial grasses and may form extensive submarine "meadows".

Seascape

Landscapes with views of the coast or seas, and coasts and the adjacent marine environment.

Seaweed

Often called macroalgae, large algae often growing attached to rocks or other solid objects, living below the high-water mark.

Secondary Data

Data collected by someone other than the user.

Sediment

Sediment is any particular matter that is broken down by processes of weathering and erosion, and is subsequently transported by the action of wind, water, or ice, and/or by the force of gravity acting on the particle itself.

Sensitive Receptor

Locations where people that could potentially be impacted by the Project, e.g., hospitals, nursing homes, schools, residential housing.

Sensitivity

The recovery rate of the receptor from significant disturbance or degradation.

Sensitivity (of ecological resource)

The recovery rate of flora or fauna from significant disturbance or degradation. Greater levels of sensitivity result in an ecological resource that can more easily be affected or harmed.

Seismicity

The frequency, intensity and distribution of earthquakes in a specific area

Setting (cultural heritage)

The setting of a heritage structure, site or area is defined as the immediate and extended environment that is part of, or contributes to, its significance and distinctive character. Beyond the physical and visual aspects, the setting includes interaction with the natural environment; past or present social or spiritual practices, customs, traditional knowledge, use or activities and other forms of intangible cultural heritage aspects that created and form the space as well as the current and dynamic cultural, social and economic context (ICOMOS 2005 X'ian Declaration on the Conservation of the Setting of heritage structures, sites and areas).

Shell-first Construction

A term used to describe the process by which all or part of the outer hull planking was erected before frames were attached to it.

8 Definition as per the IFC website. Taken from www.IFC.org

Shiblyak

These woodlands are diverse in structure, floristically rich and are dominated by woody species including pubescent oak, oriental hornbeam, and juniper.

Sideboom

A track-type or wheel-type tractor having a boom mounted on the side of the tractor, used for lifting, lowering, or transporting.

Side-scan Sonar

A survey instrument which emits acoustic beams (sound waves) laterally to capture an image of the sea floor for the purpose of locating objects and obstructions.

Signed

When a State expresses its consent to be bound by a treaty.

Site Preparation

The preparation of a site prior to construction of a development, for example levelling of a site to enable access or parking.

Slurry

A suspension of small size solid particles and water. For the purpose of this report this refers to a mix of rock / soil, bentonite and water produced during the excavation of tunnels using a Tunnel Boring Machine.

Soil

A material comprised of a mixture of mineral and organic materials that usually has the ability to support rooted plants in a natural environment.

Source Protection Zone

Equivalent to sanitary zones as defined by the Ministry of Health, Moscow 2002. SanPiN 2.1.4.1110-02.

South Stream Bulgaria AD (SSB)

South Stream Bulgaria AD is a Joint Project Company (JPC) of two major energy companies responsible for the development. The two JPCs are Russian company OAO Gazprom (50% stake) and Bulgarian company Bulgarian Energy Holding EAD (50% stake).

South Stream Offshore Pipeline

The overall South Stream Offshore Pipeline covering all three countries (Russia, Turkey and Bulgaria).

South Stream Transport

Previously, the Project was developed by Gazprom during 2009-2011, and then by South Stream Transport AG during 2011-2012. South Stream Transport then moved head office from Switzerland to the Netherlands and established South Stream Transport B.V., in November 2012.

Spill Prevention and Response Plan

Plan which will be developed and maintained by each Project contractor defining the measures to be taken to minimise the risk of onshore oil spillages and the responses to be taken in the event of a spillage.

Stakeholder

Any individual, group or organisation potentially affected by a project, or which has an interest in, or influence over, a project.

Stakeholder Database

Mechanism for recording stakeholders' comments and concerns, and managing the stakeholder engagement process.

Stakeholder Engagement

As stated by IFC in PS 01 "Stakeholder engagement is the basis for building strong, constructive, and responsive relationships that are essential for the successful management of a project's environmental and social impacts." Thus, it is an activity covering different types of interactions with stakeholders over the life of a project. Can include, but is not limited to disclosure and consultation during preparation of an ESIA Report.

Stakeholder Engagement Plan

A Stakeholder Engagement Plan (SEP) forms part of the ESIA documentation and is intended to provide a plan and implementation strategy to guide stakeholder engagement throughout the project lifecycle.

Stakeholder Identification

A process of identifying individuals or groups likely to be affected by the project both directly and indirectly, and/or who may have an interest in the project or influence over the project.

Stakeholder Mapping

Process of identifying and evaluating stakeholders based on their characteristics and connections to a project, and prioritising them to identify the appropriate type of engagement.

Steppe

A large, flat plain with dominated by grasses and with very few trees.

Steppefied Secondary Meadow

These are meadow areas dominated by grasses and herbaceous species that were previously agricultural land (former vineyards, orchards, fields), which are now derelict.

Stinger

A long heavy horizontal structural piece of framework used as a support for the pipeline during offshore pipelaying.

Stratification

A layered configuration of materials. Often used in the context of sediment stratification that describes the vertical changes in sediment characteristics in an active sedimentary basin, like the Black Sea, or in a rock formation.

Stray Finds

Isolated finds of single archaeological artefacts, often portable objects, which do not form part of a wider archaeological site.

Study Area

The mapped geographical area in which potential impacts are predicted (as determined through scoping) and therefore warrants investigation during the ESIA process. This is different for each biophysical and social environmental aspect.

Sub-bottom Profiler

A survey instrument which emits low frequency pulsed acoustic energy (sound waves) used to image sediments and objects buried beneath the sea floor.

Sulphur Dioxide (SO_2)

A toxic gas that can be released by fossil fuel combustion such as industrial processes and road traffic and which is proportional to the sulphur content in the fuel.

Supralittoral

Also known as the splash zone. The area above the spring high tide line that is regularly wetted but not submerged by water.

Surface Water

Ponded water on the surface of the land predominantly in the form of rivers, streams and lakes.

Swale

A man-made swale is a low tract of land or drain that is designed to manage water runoff, filter pollutants, and increase rainwater infiltration. Swales, by slowing and capturing water runoff and by spreading it horizontally across the landscape, facilitate runoff infiltration into the soil.

Taxon

Plural-Taxa. A group of organisms of any taxonomic rank.

Territorial Waters

A belt of coastal waters extending at most 12 nautical miles from the baseline (low water mark) of a coastal state.

Thermocline

Generally a gradient of temperature change, but applied more particularly to the zone of rapid temperature change between the warm surface waters and cooler deep waters in a thermally stratified water column.

Tommilyar

This habitat type is comprised of herbaceous plant communities with a prevalence of species associated with dry, hot environments.

Total Particulate Matter

All particulate matter is the term for solid or liquid particles found in the air.

Town of Anapa

The urbanised area of the town of Anapa, one of many communities within the Anapa Resort Town municipal district.

Toxicity

Inherent potential or capacity of a substance to cause adverse effects on living organisms.

Trailing Suction Hopper Dredger

A ship that removes sediment from the seabed. A trailing suction hopper dredger (TSHD) trails its suction pipe when working, and loads the dredged material into one or more compartments (hoppers) in the vessel.

Transboundary

Crossing a provincial, territorial or national boundary or border.

Transboundary Impact

An impact which crosses any boundaries between two geopolitical boundaries (i.e. a border).

Transnational Linear Projects

Linear projects that span multiple countries.

Trenching

Process by which excavation or dredging equipment is used to excavate a trench.

Trip Generation

An estimate of how much traffic a project will create, known as trip generation analysis.

Trophic

Of or involving the feeding habits or food relationship of different organisms in a food chain.

Turbid

Water containing suspended particles or sediment.

Turbidite

Sediments which are transported and deposited by density flows known as turbidity currents, which are similar to underwater avalanches.

Turbidity (of water)

Water that is cloudy or hazy as a result of a density difference created by dispersed sediment within the body of the water. It is used as a test of water quality.

Tunnel Boring Machine

Tunnel boring machine (TBM) is the tool used to bore through the ground to create a tunnel – it is a remotely operated steel cylinder with a rotating cutting head.

Vibration Acceleration

A measurement of the ground borne acceleration caused by vibration, usually weighted to consider the frequency dependant human response to vibration of different frequencies.

Vibration Velocity

A measurement of the ground borne velocity of the ground caused by vibration, usually weighted to consider the frequency dependant human response to vibration of different frequencies.

Viniculture

The cultivation of grapevines for winemaking.

Visual Amenity

The overall pleasantness of the views enjoyed by people of their surroundings.

Visual Impact

Impact on specific views and on the general visual amenity experienced by people.

Volatile Organic Compounds

A group of chemicals (methane is excluded) that contain the element carbon in their molecular structure (i.e., are 'organic'). They easily vaporise at room temperature and most of them have no colour or smell.

Vulnerable (or disadvantaged)

Term used to describe individuals and groups who may be directly and differentially or disproportionately affected by a project because of their disadvantaged or vulnerable status. This status may stem from an individual’s or group’s race, colour, sex, language, religion, political or other opinion, national or social origin, property, birth, or other status. Other factors that may contribute to such a status are gender, age, ethnicity, culture, literacy, sickness, physical or mental disability, poverty or economic disadvantage, and dependence on unique natural resources.

Water Table

The water level in an unconfined aquifer at which the pressure head is equal to atmospheric pressure.

Wastewater

Water contaminated with sanitary, commercial, industrial, agricultural or surface runoff wastes.

Waste management facility

An installation which receives waste and either: transfers waste to another destination for processing; prepares the waste for reuse or recycling; carries out a recycling or recovery process; or permanently disposes of the waste.

Wellbeing

The IFC Performance Standards do not provide a definition of well-being although they do make reference to the MA in the context of well-being which defines the term as follows:

"Human well-being is assumed to have multiple constituents, including the basic material for a good life, such as secure and adequate livelihoods, enough food at all times, shelter, clothing, and access to goods; health, including feeling well and having a healthy physical environment, such as clean air and access to clean water; good social relations, including social cohesion, mutual respect, and the ability to help others and provide for children; security, including secure access to natural and other resources, personal safety, and security from natural and human-made disasters; and freedom of choice and action, including the opportunity to achieve what an individual values doing and being. Freedom of choice and action is influenced by other constituents of well-being (as well as by other factors, notably education) and is also a precondition for achieving other components of well-being, particularly with respect to equity and fairness."

Zone of Theoretical Visibility (ZTV)

The zone of theoretical visibility. The geographical area within which the landscape and/or seascape where the Project is theoretically visible.

Zoëa

A stage in the larval development of certain decapod crustaceans, particularly crabs.

Zone of Influence

The geographical area and the ecological features within it which have the potential to be impacted by the Project.

Zoophytes

A plant-like animal, esp. a coral, sea anemone, sponge, or sea lily.

Zooplankton

The animal component of the plankton, including holoplankton (animals that are permanently planktonic) and meroplankton (larval and juvenile stages of non-planktonic animals).

Abbreviations and Acronyms

Abbreviation/Term	Description
3LPP	Three-layer-polypropylene
A	Amp
AADT	Annual Average Daily Traffic
A_{atm}	Sound absorption provided by the atmosphere.
A_{bar}	Sound absorption provided by barriers and topography.
AC	Alternating Current
ACCOBAMS	Agreement on the Conservation of Cetaceans in the Black Sea, Mediterranean Sea and contiguous Atlantic area
AD	Anno Domini
ADPS	Automatic Diesel Power Station
A_{geo}	Sound absorption provided by the geographical spreading of sound.
A_{gr}	Sound absorption provided by the ground.
ALARP	As Low As Reasonably Practicable
A_{misc}	Sound absorption provided by miscellaneous factors, i.e. trees, dense buildings, etc.
AMSS	Adopted Marine Sediment Standard
Anapa GDP	Anapa Growth Development Plan
AP	Action Plan
APC	Approximate Permissible Concentration
APEC	Asia-Pacific Economic Cooperation
API	American Petroleum Institute
ART	Anapa Resort Town
ASNT	American Society for Non-destructive Testing
ASTM	American Society for Testing Materials

Abbreviation/Term	Description
AUT	Automated Ultrasonic Testing
AUV	Autonomous Underwater Vehicle
BAP	Biodiversity Action Plan
BC	Before Christ
bcm	Billion Standard Cubic Metres
BCT	Bat Conservation Trust
BDV	Blow Down Valve
Bq/kg	Becquerels per kilogram
BMP	Biodiversity Management Plan
BOD	Biological Oxygen Demand
BOD_5	Biochemical consumption of oxygen
BP	Before Present
BS	British Standard
BS-FOCS	Black Sea Fibre Optic Cable
BSI	British Standard Institution
BUCR	Back Up Control Room
c.	Circa
ca.	Approximately
CATS	Corrective Action Tracking System
CBD	Convention on Biological Diversity
cm	Centimetre
cm_3/kg	Cubic centrimetres per kilogram
cm/s	Centimetres per second
CCGT	Combined Cycle Gas Turbine

Abbreviation/Term	Description
CCR	Central Control Room
CCTV	Closed-Circuit Television
CEIP	Centre on Emission Inventories and Projections
CEO	Chief Executive Officer
CFP	Chance Find Procedure
CH_4	Methane
CHO	Cultural Heritage Object
CHP	Combined Heat and Power
CIA	Cumulative Impact Assessment
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CMP	Construction Management Plans
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CO_2-eq	Carbon Dioxide Equivalent
COD	Chemical Oxygen Demand
CoE	Council of Europe
COP-17	United Nations Framework Convention on Climate Change (UNFCCC) 17th Conference of the Parties
CPUE	Catch Per Unit Effort
CR	Critically Endangered (IUCN Red List of Threatened Species)
^{137}Cs	Caesium-137
CS	Compressor Station
CSD	Cutter Suction Dredger
CSR	Corporate Social Responsibility

Abbreviation/Term	Description
CTMP	Construction Traffic Management Plan
^{0}C	Degrees Celsius
D	Directivity Factor
dB	Decibel. The logarithmic ratio of the sound pressure to a reference of 2 x 10-5 Pascals.
dB(A)	A weighted decibel. The logarithmic ratio of the sound pressure to a reference of 2 x 10-5 Pascals, which is then corrected with a frequency dependant weighting to reflect the human ear's response to sound of different frequencies.
DC	Direct Current
DD	Data Defficient (IUCN Red List of Threatened Species)
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethylene
DDT	Dichlorodiphenyltrichloroethane
DEFRA	Department for Environment Food and Rural Area
DMRB	Design Manual for Roads and Bridges
DNV	Det Norske Veritas
DP	Dynamic Positioning
DSL	Digital Subscriber Line
EC	European Commission
ECA	Export Credit Agency
ECoW	Ecological Clerk of Works
EEA	European Environment Agency
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EIS	Environmental Impact Study

Abbreviation/Term	Description
EHS	Environmental Health and Safety
EN	European Standards
EN	Endangered (IUCN Red List of Threatened Species)
ENVIID	Environmental Impact Identification
EMEP	European Monitoring and Evaluation Programme
EMF	Electromagnetic Field
EMSA	European Maritime Safety Agency
EP	Equator Principles
EPC	Engineering, Procurement and Construction
EPFI	Equator Principles Financial Institutions
EPRS	Emergency Pipeline Repair Strategy
ERP	Emergency Response Plan
ESD	Emergency Shutdown
ESIA	Environmental and Social Impact Assessment
ESIVI	Ecosystem Services Identification, Valuation, and Integration
ESMP	Environmental and Social Management Plan
ESMS	Environmental and Social Management System
ESS	Ecosystem Services
ESVs	Emergency Shutdown Valves
EU	European Union
EU-27	The term used to group the 27 countries that are official member states of the EU: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden, United Kingdom.
EWG	Expert Working Group on the Assessment of Black Sea Stocks

Abbreviation/Term	Description
EXW	Extinct in the Wild (IUCN Red List of Threatened Species)
E&I	Electrical and Instrumentation
FCV	Flow Control Valve
FEED	Front End Engineering and Design
FFA	Federal Fisheries Agency
FOC	Fibre Optic Cable
FVR	Fishing Vessel Register
FWCC	Federal Waste Classification Catalogue
F&G	Fire and Gas
g	Grams
$g/s/m^2$	Grams per second per square metre
GDP	Gross Domestic Product
GDP	Growth Development Plan (Anapa District)
GFCM	General Fisheries Commission for the Mediterranean
GFMU	Gas Flow Rate Metering Unit
GFRP	Glass-Fibre Reinforced Plastic
GHG	Green House Gas
GIIP	Good International Industry Practice
GIS	Geographic Information System
GPa	Gigapascal
GPU	Gas Pumping Unit
GR	Group Risk
GRP	Gross Regional Product
GRT	Gross Registered Tonnage

Abbreviation/Term	Description
GSM	Global System for Mobile Communications
GT	Gross Tonnage
GVW	Gross Vehicle Weight
ha	Hectare
HAZCON	Hazard Construction
HAZID	Hazard Identification
HAZOP	Hazard and Operability Study
HCB	Hexachlorobenzene
HCH	Hexachlorocyclohexane
HDD	Horizontal Directional Drilling
HEMP	Hazards and Effects Management Process
HFO	Heavy Fuel Oil
HGV	Heavy Goods Vehicle
HP	Horse Power
HRA	Health Risk Assessment
HSS	Heat Shrink Sleeve
HSSE	Health, Safety, Security and Environmental
HSSE-IMS	Health Safety Security and Environmental Integrated Management System
HVAC	Heating Ventilation Air Conditioning
HVL	High Voltage Lines
Hz	Hertz
H_2S	Hydrogen Sulphide
IA-MAS	Institute of Archaeology - Moscow Academy of Sciences
IAQM	Institute of Air Quality Management

Abbreviation/Term	Description
IBA	Important Bird Area
ICCP	Impressed Current Cathodic Protection
ICNIRP	International Commission on Non-Ionizing Radiation Protection
ICOMOS	International Council on Monuments and Sites
ICPC	International Cable Protection Committee
ID	Inside Diameter
IEA	International Energy Agency
Ifa	UK Institute for Archaeologists
IFC	International Finance Corporation
IFC PS	International Finance Corporation Performance Standards
IFI	International Financial Institutions
IFO	Intermediate Fuel Oil
ILO	International Labour Organisation
IMDG	International Maritime Dangerous Goods
IMO	International Maritime Organisation
IR	Individual Risk
ISO	International Organization for Standardization
ITUR	Italy-Turkey-Ukraine-Russia
IUCN	International Union for the Conservation of Nature
JBIC	Japan Bank for International Cooperation
JSA	Job Safety Analysis
JSC	Joint Stock Company
kg	Kilogram
kg/m^3	Kilograms per Cubic Metre

Abbreviation/Term	Description
Kg/s	Kilograms per Second
kJ	Kilojoule
km	Kilometre
kV	Kilovolt
kVa	Kilovolt Amp
kV/m	Kilovolts per metre
kW	Kilowatt
^{40}K	Potassium-40
KK	Krasnodar Krai
KP	Kilometre Post
KPIs	Key Performance Indicators
KSHAM	Krasnodar State Historic-Archaeological Museum named Felitsin
KSU	Kuban State University
l	Litre
L_{Aeq}	A-weighted, Equivalent Sound Level
L_{eq}	The energy equivalent noise. The constant noise levels that will convey the same acoustic energy as a varying noise level over a specified time period. The LAeq is the same but has been A weighted to represent the human perception to sound of different frequencies.
L_{AFmax}	The maximum noise level measured during a specified time period, usually measured with a fast time weighting, A-weighted to represent human hearing response and is representative of impulsive noise events.
L_{max}	The maximum noise level measured during a specified time period, usually measured with a fast time weighting, and is representative of impulsive noise events.
LC	Least Concern (IUCN Red List of Threatened Species)
LCA	Landscape Character Area
LDV	Light Duty Vehicle

Abbreviation/Term	Description
LLC	Limited Liability Company
LNG	Liquefied Natural Gas
LOA	Length Over All
LVIA	Landscape and Visual Impact Assessment
L_W	The Sound Power Level of a noise source.
m	Metre
m^2	Square Metre
m^3	Cubic Metre
mbsl	Metres below sea level
m+BS	Metres above Black Sea
mg	milligram (0.001 g)
mg/kg	Milligram per kilogram
mg/l (or mg/L)	Milligram per litre
$\mu g/m^3$	Micrograms per cubic metre of air
mg/m^3	Milligrams per metre cubed
mm	Millimetre
µM	Micromolar
µm	Micrometre (0.000001 m)
MPa	Megapascal
m/d	Metres per day
m/s	Metres per second
mSv/h	Millisieverts per hour
µT	MicroTesla
mV	Millivolt

Abbreviation/Term	Description
MW	Megawatt
Ma	Million years ago
MA	Millennium Ecosystem Assessment
MAC	Maximum Allowable Concentrations
MAH	Major Accidents Hazard
MBSC	Main Black Sea Current
MDO	Marine Diesel Oil
MDS	Multi-dimensional Scaling
MED	Materials and Equipment Depot
MEG	Mono Ethylene Glycol
MFE	Mass Flow Excavation
MGO	Marine Gas Oil
MMCM	Million Cubic Metres
MMO	Marine Mammal Observers
MMSCM	Million Standard Cubic Metres
MoC	Ministry of Culture of the Russian Federation
MNRE	Ministry of Natural Resources and Environment
MPC	Maximum Permissible Concentrations
MPE	Maximum Permissible Emissions
MPL	Maximum Permissible Levels
MSDS	Material Safety Data Sheet
MSL	Mean Sea Level
MSV	Multi Service Vehicle
mtoe	Million tonnes of oil equivalent.

Abbreviation/Term	Description
MW (Physical Environment)	Moment Magnitude
ng	Nanogram (0.000 000 001 g)
N_2	Nitrogen
Na_2CO_3	Sodium Carbonate (also known as Soda Ash)
NACE	National Association of Corrosion Engineers
NAFA	National Agency of Fisheries and Aquaculture (Bulgaria)
NDE	Non-Destructive Examination
NDJB	Negative Distribution Junction Box
NGO	Non-Governmental Organisation
NO_2	Nitrogen dioxide
NO	Nitric oxide
NO_x	Nitrogen Oxide
NM	Nautical Mile
NMVOC	Non-methane Volatile Organic Compounds
NR	Near Threatened (IUCN Red List of Threatened Species)
NTS	Non-Technical Summary
n/a	'not available' or 'not appraised'
O_3	Ozone
OCP	Organochlorine Pesticides
OD	Outside Diameter
OECD	The Organisation for Economic Co-operation and Development
OGP	International Association of Oil & Gas Producers
OH&S	Occupational Health and Safety

Abbreviation/Term	Description
OMP	Operations Management Plans
OSCAR	Oil Spill Contingency and Response
OSPAR	Oslo Paris Commission
OWS	Oily Water Separator
PABX	Private Automatic Branch Exchange
PAC	Project-affected Community
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated biphenyl
PIG	Pipeline Inspection Gauge
PIMS	Pipeline Integrity Management System
PLONOR	Pose Little or No Risk to the Environment
PM	Total particulates
PM_{10}	Particulate matter with a diameter of 10 microns or less
$PM_{2.5}$	Particulate matter with a diameter of 2.5 microns or less
POP	Persistent Organic Pollutants
ppb	Parts per billion
ppm	Parts per million
PS	Performance Standards (of the International Finance Corporation)
PSD	Process Shut Down
PSDC	Project Specific Design Code
PSTN	Public Switched Telephone Network
PSU	Practical Salinity Units
PSV	Pipe Supply Vessel
pW	pico Watt

Abbreviation/Term	Description
QRA	Quantified Risk Assessment
^{226}Ra	Radium-226
RAS	Russian Academy of Sciences
RDB	Red Data Book
RDB KK	Red Data Book of the Krasnodar Krai region
RDB RF	Red Data Book Russian Federation
RDL	Red Data List
RF	Russian Federation
Rosstat	Russian Federal State Statistical Service
ROTV	Remotely Operated Towed Vehicle
ROV	Remotely Operated Vehicle
RoW	Right of Way
RSFSR	Russian Soviet Federative Socialist Republic
RTU	Remote Terminal Unit
RUB	Russian Roubles
Russkaya CS	Russkaya Compressor Station
RV	Research Vessel
s	Second
SAR	Search and Rescue
SCA	Seascape Character Area
SCADA	Supervisory Control and Data Acquisition
SCD	Stakeholder and Consultation Database
SEER	State Environmental Expert Review
SEMS	Stakeholder Engagement Management System

Abbreviation/Term	Description
SEP	Stakeholder Engagement Plan
SER	State Expert Review
SIMOPS	Simultaneous Operations
Sm^3	Standard Cubic Metre
SMPEP	Shipboard Marine Pollution Emergency Plan
SNiP	Russian National Standards - Construction Norms and Rules
SOLAS	Safety of Life at Sea
SOPEP	Shipboard Oil Pollution Emergency Plan
SO_2	Sulphur dioxide
Sp	Species
SPA	Sanitary Protection Area
SPNA	Special Protected Natural Area
SPZ	Sanitary Protection Zones
^{90}Sr	Strontium-90
SSB	South Stream Bulgaria AD
SSS	Side-scan Sonar
SSSD	Side-scan Sonar Device
SSTTAG	South Stream Transport A.G.
SSTTBV	South Stream Transport and Trading B.V.
STECF	Scientific, Technical and Economic Committee for Fisheries
TAC	Total Allowable Catch
TBM	Tunnel Boring Machine
TCS	Telecommunication System
TCV	Temperature Control Valve

Abbreviation/Term	Description
TEEB	The Economics of Ecosystems and Biodiversity
^{232}Th	Thorium-232
Ti-MMO	Titanium-Mixed Metal Oxide
ToR	Terms of Reference
TPC	Tentative Permissible Concentrations
TPE	Temryuk Port Expansion
TPH	Total Petroleum Hydrocarbons
TR	Transformer Rectifier
TRTF	Transmitting Radio-technical Facilities
TSHD	Trailing Suction Hopper Dredger
WMP	Waste Management Plan
WRI	World Resources Institute
UGS	United Gas Supply system
UHF	Ultra High Frequency
UK	United Kingdom
UNECE	United Nations Economic Commission for Europe
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
URS	URS Infrastructure and Environment UK Limited
USB	Ultra-Short Baseline
USEPA	United States Environmental Protection Agency
USSR	Union of Soviet Socialist Republics
UV	Ultraviolet
UXO	Unexploded Ordnance

Abbreviation/Term	Description
V	Volt
VEC	Valued Environmental and Social Component
VIV	Vortex Induced Vibration
VOC	Volatile Organic Compound
VoIP	Voice-over-Internet Protocol
VSAT	Very Small Aperture Terminal
Vu	Vulnerable (IUCN Red List of Threatened Species)
WHO	World Health Organization
WRB	World Reference Base for Soil Resources
WRI	World Resources Institute
ZTV	Zone of Theoretical Visibility

Chapter 1: Introduction

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1 Introduction

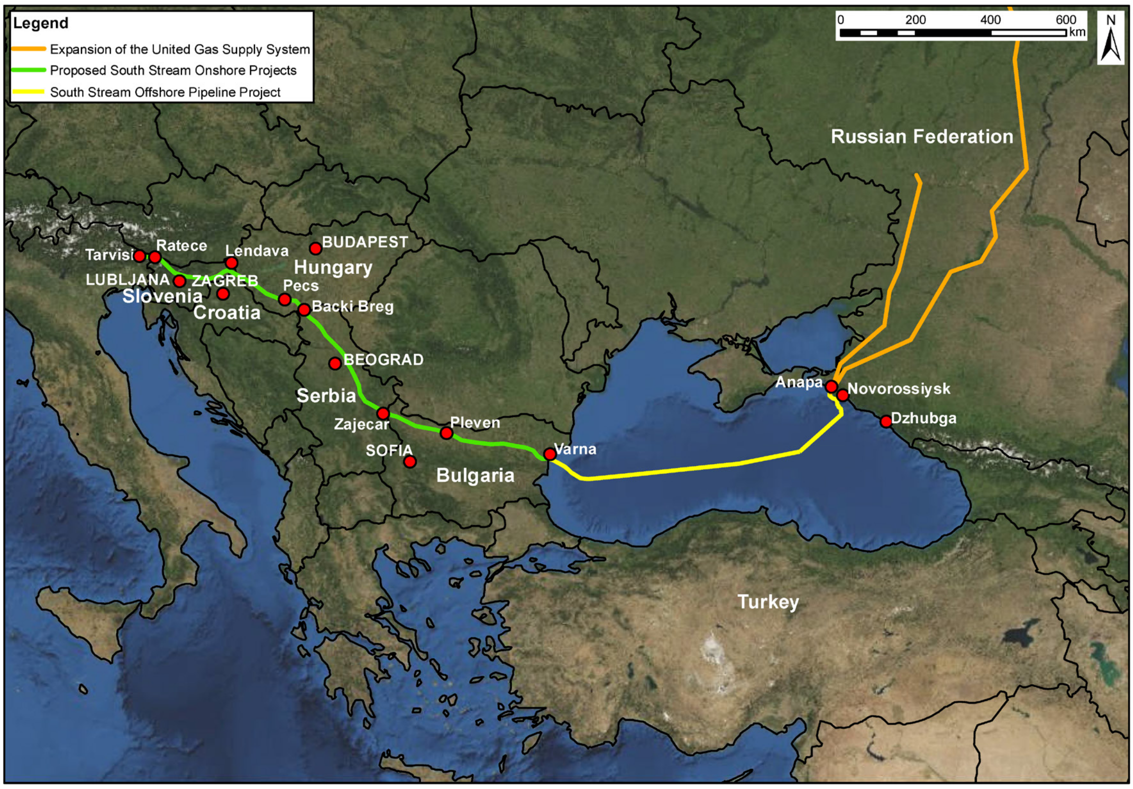
1.1 South Stream Offshore Pipeline Overview

The South Stream Offshore Pipeline is the offshore component of the South Stream Pipeline System that will transport natural gas extracted in Russia to countries of Central and South-Eastern Europe (Figure 1.1).

This Environmental and Social Impact Assessment (ESIA) Report has been prepared specifically for the Russian Sector of the South Stream Offshore Pipeline, referred to as the 'South Stream Offshore Pipeline – Russian Sector' or as 'the Project' throughout this Report[1].

Separate ESIA Reports have been prepared by South Stream Transport B.V. (South Stream Transport) for the Turkish and Bulgarian Sectors of the South Stream Offshore Pipeline. In addition, separate Environmental Impact Assessments (EIAs) have been undertaken by other companies for the other components of the South Stream Pipeline System.

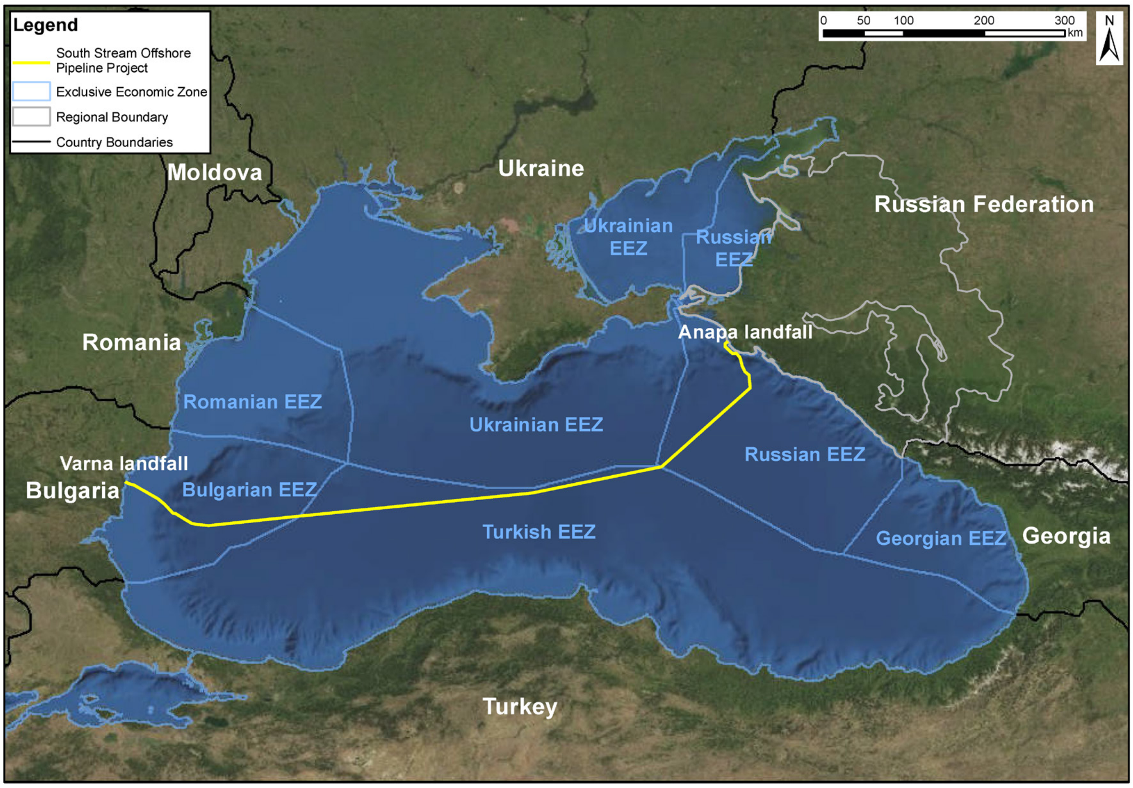
Figure 1.1 South Stream Pipeline System



[1] Where this report refers to the 'South Stream Offshore Pipeline', and not to 'the Project', the intent is to refer to the overall South Stream Offshore Pipeline covering all three countries (Russia, Turkey and Bulgaria).

The South Stream Offshore Pipeline will comprise four adjacent pipelines extending approximately 931 kilometres (km) across the Black Sea from the Russian coast near Anapa, through the Russian, Turkish, and Bulgarian Exclusive Economic Zones (EEZs), to the Bulgarian coast near Varna (Figure 1.2). In addition to the offshore pipelines, the South Stream Offshore Pipeline will consist of short onshore sections in Russia and Bulgaria, with facilities to meter the gas prior to and after transportation through the offshore system. When complete, the South Stream Offshore Pipeline will be able to transport 63 billion cubic metres (bcm) of natural gas annually. Each of the four pipelines will have a maximum flow rate of approximately 15.75 bcm per year, and a maximum design pressure of 300 bar.

Figure 1.2 South Stream Offshore Pipeline



All geographic boundaries depicted in maps in this ESIA Report relate to February 2014.

This chapter provides an overview of the proposed development in Russia, the impact assessment process, the scope of the ESIA Report, the anticipated schedule for development, and the structure and content of this ESIA Report.

1.1.1 Need for the South Stream Offshore Pipeline

1.1.1.1 Current European Union Gas Consumption, Demand, and Pipeline Capacity

Natural gas plays a significant role in Europe's energy mix: in 2011 approximately 24% (Ref. 1.1) of the European Union (EU) member states' (EU-28) primary energy consumption came from natural gas, with only around 41% of that demand being met by domestic EU-28 production (i.e. by gas fields within the EU).

In 2011, EU gross inland consumption (production plus net import) of dry natural gas was approximately 492 bcm (Ref. 1.2), production was approximately 185 bcm (Ref. 1.3), and net imports amounted to approximately 308 bcm (Ref. 1.4).

The EU secures imports from a variety of sources, including traditional suppliers such as Russia, Norway and Algeria (Ref. 1.5). Within the broader European region (i.e. not limited to the 28 EU member states), Russia supplied approximately 130 bcm in 2012 (Ref. 1.6).

1.1.1.2 European Union Production and Demand Forecasts

Future estimates of EU production and demand are inherently uncertain and require a number of assumptions regarding, for example, changes in gross domestic product (GDP), population, energy sector composition and prices, and government policy. Given these uncertainties, this section incorporates forecasts from two sources: International Energy Agency (IEA) (Ref. 1.1 to 1.5), which is an independent agency that produces yearly reports on the World energy and production and consumption and Wood Mackenzie (WM) (Ref. 1.7), an energy consulting company engaged by South Stream Transport as Lenders' Gas Market Consultant to carry out a market analysis with specific reference to the South Stream Offshore Pipeline. Each source analyses three scenarios designed to reflect future demand relative to supply. The following sections present the results from each of these reports.

The results from the IEA and WM reports are not directly comparable because they are based on different future demand scenarios and geographical scope. The IEA report bases its forecasts on a definition of Europe that is reflected by the 28 members of the European Union, whereas the WM report defines Europe[2] as the 28 member states as well as Bosnia and Herzegovina, Norway, Serbia, Switzerland and Turkey. It should be noted that the inclusion of, particularly, Norway (production) and Turkey (demand) is a key source of the differences in the forecasts.

International Energy Agency (IEA) Forecasts

Table 1.1 describes the IEA scenarios for future EU demand and the assumptions that underpin them.

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[2] The WM data presented in this report reflects the forecast conventional natural gas supply for the following countries: Austria, Bulgaria, Croatia, Czech Republic, Denmark, France, Germany, Hungary, Ireland, Italy, Norway, Netherlands, Poland, Romania, Serbia, Slovakia, Spain, Turkey, and United Kingdom. Forecast demand for conventional gas is presented for the following countries: Austria, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Macedonia, Netherlands, Norway, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, and United Kingdom.

Table 1.1 IEA: Future Demand Scenarios for EU

	Scenario Assumptions
New Policies Scenario	The New Policies Scenario incorporates policies and measures that affect energy markets and that had been adopted as of mid-2013. It also takes account of other relevant commitments that have been announced, even when the precise implementation measures have yet to be fully defined. These commitments include programmes to support renewable energy and improve energy efficiency, initiatives to promote alternative fuels and vehicles, carbon pricing and policies related to the expansion or phase-out of nuclear energy, and initiatives taken by G-20[3] and Asia-Pacific Economic Cooperation (APEC) economies to reform fossil-fuel subsidies. Under the New Policies Scenario, gas demand in the EU is forecast to reach 505 bcm per year by 2035.
Current Policies Scenario	The Current Policies Scenario takes into account only those policies and measures affecting energy markets that were formally enacted as of mid-2013. It describes a future in which governments do not implement any recent commitments that have yet to be backed-up by legislation or introduce other new policies bearing on the energy sector. The scenario is designed to provide a baseline picture of how global energy markets would evolve if established trends in energy demand and supply continue unabated. Under the Current Policies Scenario, gas demand in the EU is predicted to reach 566 bcm per year by 2035.
"450" Scenario	The "450 Scenario" shows what is needed to set the global energy sector on a course comparable with a near 50% chance of limiting the long-term increase in the average global temperature to two degrees Celsius (2°C). This scenario leads to a peak in the concentration of greenhouse gases (GHGs) in the atmosphere around the middle of this century, at a level above 450 parts per million (ppm), but not so high as to be likely to precipitate changes that make the 2°C objective unattainable. For the period to 2020, policy action aiming at fully implementing the commitments under the Cancun Agreements is assumed to be undertaken. After 2020, the Organisation for Economic Co-ordination and Development (OECD) countries and other major economies are assumed to implement emissions reduction measures that, collectively, ensure a trajectory consistent with the target. From 2020, OECD countries are assumed to mobilise US $100 billion in annual financing from a variety of sources for abatement measures in non-OECD countries. Under the 450 Scenario, gas demand in the EU is predicted to be 384 bcm per year by 2035.

Table 1.2 contains estimated future demand for natural gas in the EU for all IEA scenarios to 2035. It also contains forecast EU production over the same period.

[3] G-20 refers to the group of 20 finance ministers and central bank governors

Table 1.2 IEA: Predicted Gas Demand in EU (bcm)

	2020	2025	2030	2035
New Policy Scenario	452	477	491	505
Current Policy Scenario	467	n/a	533	566
450 Scenario	426	n/a	401	384
EU production (bcm)	135	122	114	104

Converted from mtoe to bcm using conversion factor of 1.11

In contrast to increasing demand, EU natural gas production is forecast by IEA to fall from 185 bcm per year in 2011 to 104 bcm per year in 2035 (Ref. 1.1). Reduced domestic gas production means that under the New Policy Scenario approximately 79% of EU forecast demand in 2035, or 401 bcm per year in absolute terms, will have to be met by natural gas imports (Ref. 1.1). Table 1.3 shows the predicted net import requirements for all future scenarios, given forecast demand.

Table 1.3 IEA: Gas Demand EU minus Domestic Production: Net Import Requirements (bcm)

	2020	2025	2030	2035
New Policy Scenario	317	355	377	401
Current Policy Scenario	332		419	462
450 Scenario	291		287	280

Wood Mackenzie (WM) Forecasts

Table 1.4 describes the WM scenarios for future EU demand and the assumptions that underpin them.

Table 1.4 WM: Future Demand Scenarios for Europe

	Scenario Assumptions
Base case	Demand growth will be driven by increasing energy intensity in emerging European economies as well as recovery in the power sector. Gas demand in the power sector will recover somewhat gas utilisation from the current record low levels. This will be supported by a fundamental rebalancing of the EU Emission Trading Scheme taking effect towards the end of the forecast period, against a backdrop of coal retirements. In mature markets such as Italy, Germany and the UK gas demand will remain flat or decline slightly. Gas markets in Central and Eastern Europe, including Turkey, have greater long term scope for gas penetration driven by gas infrastructure developments and increasing energy demand per capita. Under the Base Case scenario, gas demand is estimated to be 623 bcm by 2035.
High case	This scenario assumes a faster economic recovery, lower efficiency gains and greater penetration of gas in the power sector. Total gas demand is forecast to reach 760 bcm by 2035.
Low case	This scenario assumes that gas demand declines in mature economies continue, however this is offset by increased energy intensity in emerging European economies, notably Turkey and new uses for gas such as LNG bunkering. Total gas demand is forecast to grow, albeit at a slower rate. Gas demand grows from 502 bcm in 2013 to 544 bcm in 2035.

Table 1.5 contains estimated future demand for natural gas in Europe for all WM scenarios to 2035. It also contains forecast European production over the same period. As with the IEA report, it shows demand for natural gas increasing at the same time that European production is declining.

Table 1.5 WM: Predicted Gas Demand in Europe (bcm)

	2020	2025	2030	2035
Base case	568	590	600	623
High case	637	683	719	760
Low case	523	533	531	544
European production (base case)	261	224	201	185

Reduced domestic gas production means that under the Base Case Scenario approximately two thirds of European forecast demand in 2035, or 438 bcm per year in absolute terms, will have to be met by natural gas imports (Ref. 1.7).

Table 1.6 contains the predicted net import requirements for all future scenarios, given forecast demand.

Table 1.6 WM: European Gas Demand minus Domestic Production: Net Import Requirements (bcm)

	2020	2025	2030	2035
Base case	307	366	399	438
High case	375	459	517	575
Low case	261	309	330	354

Summary

The South Stream Offshore Pipeline will respond to increased demand for foreign natural gas by providing transport capacity of 63 bcm per year, which will be directed to the European supply network.

Results from the IEA report suggest that this capacity could contribute to the expected increased reliance on imported natural gas resulting from the combination of declining EU production and increased demand in 2035 under the New Policy scenario (Figure 1.3).

Figure 1.3 EU Gas Demand and Import Forecast – New Polices Scenario 2010-2035 (bcm)

The results from the WM report suggest that the South Stream Offshore Pipeline will contribute to the expected increase in imported natural gas resulting from the combination of declining European production and increased demand in 2035, under the Base Case scenario (see Figure 1.4).

Figure 1.4 Europe Gas Demand and Import Forecast – Base Case 2013-2035

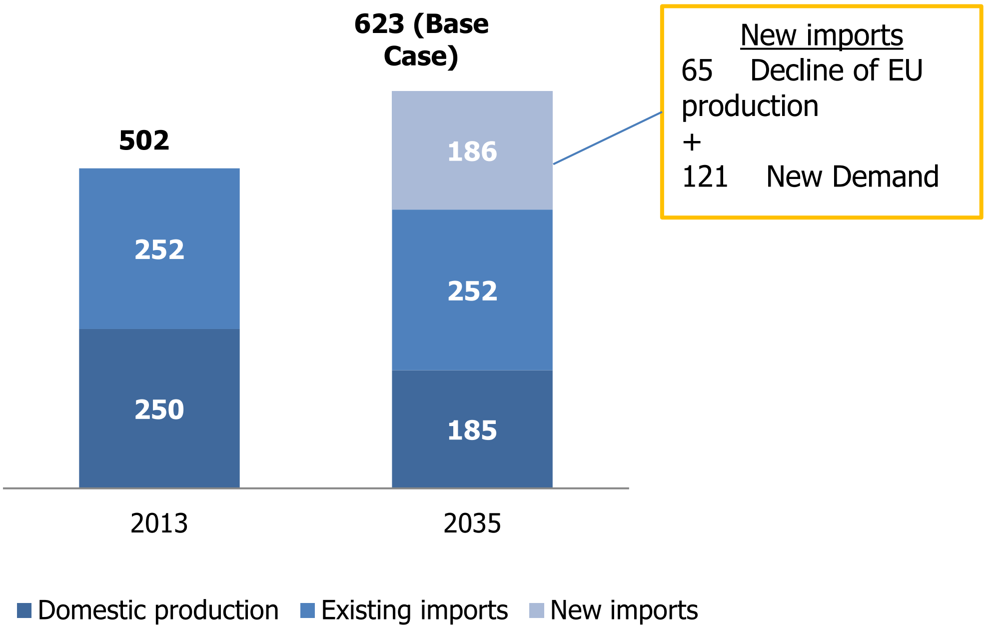


Table 1.7 contains the forecast contribution of the South Stream Offshore Pipeline to meeting future import demand for natural gas, for all IEA and WM scenarios. It shows that the contribution of the South Stream Offshore Pipeline is estimated to range from 11% to 22% under the future scenarios presented in the IEA and WM reports.

Table 1.7 South Stream Offshore Pipeline Forecast Maximum Contribution to Import Demand, 2035

	Potential Maximum Contribution to Total Import Demand
IEA Results	
New Policy scenario	16%
Current Policy scenario	14%
450 scenario	22%

Continued...

	Potential Maximum Contribution to Total Import Demand
WM Results	
Base case	14%
High case	11%
Low case	18%

It should be noted that these forecasts are based on the pipeline operating at full capacity.

Complete.

Although both the IEA 'New policy' and WM 'Base case' scenarios result approximately in the same estimated contribution being made to total import demand (i.e. 16% and 14% respectively), this does not necessarily reflect agreement between the two estimates. As previously stated, the IEA and WM forecasts are not directly comparable because different future scenarios and geographical scopes have been used.

1.1.2 South Stream Offshore Pipeline Proponent

The South Stream Offshore Pipeline is being developed by South Stream Transport B.V. (South Stream Transport)[4], an international joint venture established on 14 November 2012 in Amsterdam, the Netherlands, for the planning, construction, and subsequent operation of the offshore gas pipeline through the Black Sea. The Russian company Gazprom holds a 50% stake in South Stream Transport, the Italian company Eni has a 20% stake and the French energy company EDF Group and German company Wintershall each hold 15%.

1.1.2.1 Gazprom, Russia

Gazprom is the world's largest supplier of natural gas, accounting for approximately 15% of global gas production in 2012. It was established as a joint stock company in 1993, and is partly owned by the Russian state (50.002%). The company's core activities include the exploration, production, transportation, storage, processing and marketing of hydrocarbons, as well as the generation and marketing of heat and electric power.

Gazprom controls 72% of Russian gas reserves producing 74% of all Russian natural gas output. A leading company in the construction and operation of gas pipelines, it controls the world's largest gas transmission network – the United Gas Supply System of Russia with a total length of over 168 thousand kilometres.

[4] Previously, the Project was developed by Gazprom during 2009-2011, and then by South Stream Transport AG during 2011-2012. The head office of South Stream Transport was then moved from Switzerland to the Netherlands, where the Shareholders established South Stream Transport B.V. in November 2012.

1.1.2.2 Eni, Italy

Headquartered in Italy, Eni is one of the world's major integrated energy companies, operating in the sectors of oil and gas exploration and production, international gas transportation and marketing, power generation, refining and marketing, chemicals and oilfield services.

1.1.2.3 EDF Group, France

The EDF Group, one of the leaders in the European energy market, is an integrated energy company active in all areas of the business: generation, transmission, distribution, energy supply and trading, including provision of natural gas supplies. The EDF Group is the leading electricity producer in Europe.

1.1.2.4 Wintershall, Germany

Wintershall, based in Kassel, Germany, is a wholly-owned subsidiary of BASF. The company has been active in the exploration and production of crude oil and natural gas for over 80 years and is now Germany's largest crude oil and natural gas producer.

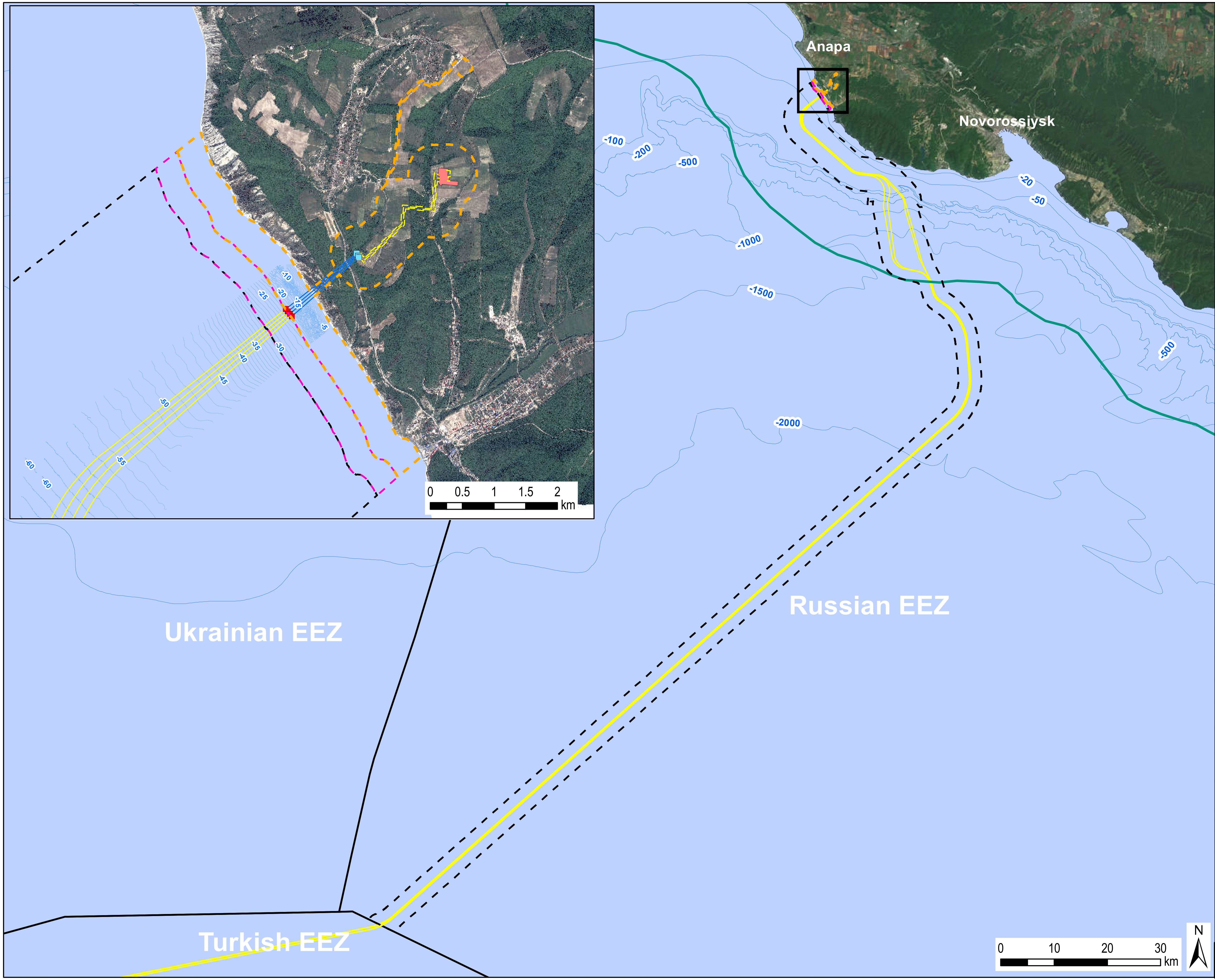
1.2 Project Overview

The Russian Sector extends approximately 230 km in length from a location approximately 10 km south of the town of Anapa, in the Krasnodar Krai (or Region), to the border between the Russian and Turkish EEZs (Figure 1.2) in the Black Sea. Of the 230 km, approximately 5 km are onshore, 50 km are within the territorial waters of the Russian Federation, and 175 km are within the EEZ of the Russian Federation.

The coastal region surrounding Anapa is a popular holiday destination because of its beaches, warm climate and the presence of sites of cultural, historical and natural interest. Anapa is categorised by Russian Federation legislation as a "health-improving" resort area[5], and has a sanitary protection area (SPA) that consists of three distinct zones, each with different restrictions. The proposed Project infrastructure does not fall within any zones of the SPA. Further details on the SPA are included in **Chapter 2 Policy, Regulatory and Administrative Framework**.

Land use in the vicinity of the Project is largely agricultural and includes a number of vineyards. The Project is also located in proximity to the Utrish State Nature Reserve but does not traverse its territory. The Utrish reserve is located approximately 4 km southeast of the landfall section and owes its protected status to the natural habitats that include botanical and faunal species of local, national, and international importance. The majority of the Project is located offshore, as depicted in Figure 1.5.

[5] The boundaries and management of this area were established by the Decree of the Council of Ministers of the Soviet Union dated January 30, 1985 N 45 (Ref. 1.8).



LEGEND

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Landfall facilities
- Proposed microtunnels
- Proposed offshore pipelines
- Microtunnel entry shaft
- Microtunnel exit pit
- Project Area - landfall section (indicative)
- Project Area - nearshore section (indicative)
- Project Area - offshore section (indicative)
- Russian Territorial Waters boundary
- Exclusive Economic Zone boundary
- Isobaths

NOTE

Note that for the marine ecology assessment, the nearshore is considered to also include the area from the shore to 23 m water depth, because these two sections of the Project Area are ecologically contiguous.

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: For Information

Client: South Stream Offshore Pipeline — Stream ENERGISING EUROPE

Project Title: SOUTH STREAM OFFSHORE PIPELINE

Drawing Title: SOUTH STREAM OFFSHORE PIPELINE - RUSSIAN SECTOR

Drawn	Checked	Approved	Date
DH	RW	MW	15 Apr 2014

URS Internal Project No.	Scale @ A3
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URS

Drawing Number: Figure 1.5

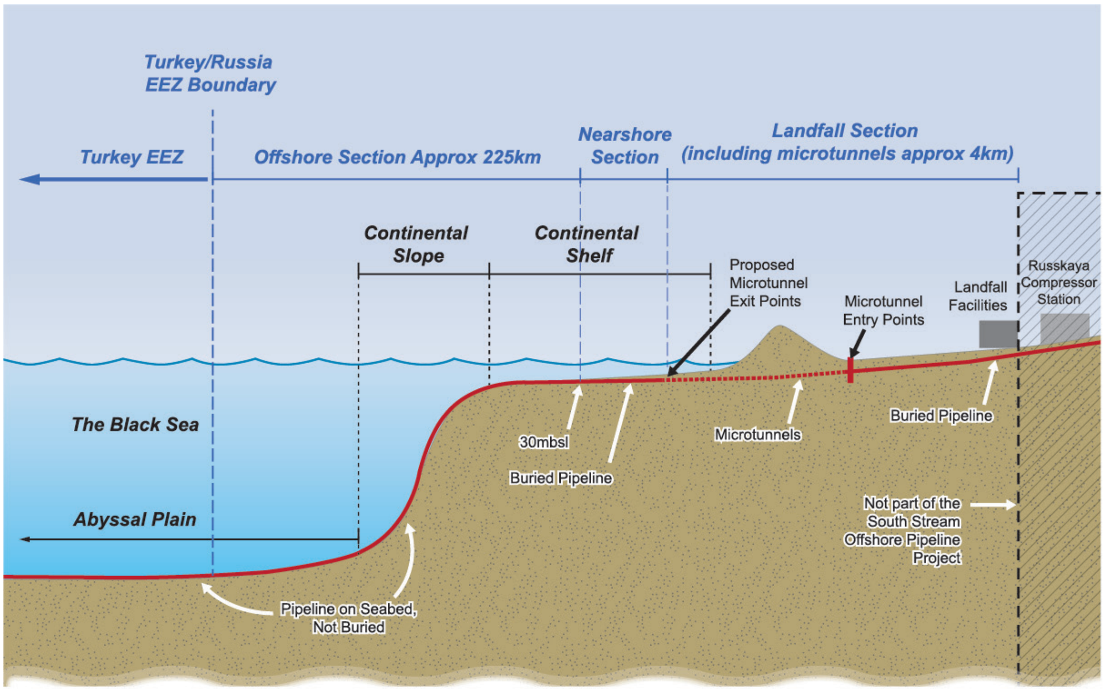
Rev

Further details of the Project Area are provided in the Section 1.2.1. In summary, the four pipelines are routed along the continental shelf, down the continental slope, and then along the abyssal plain to the border of the Russian and Turkish EEZs (Figure 1.5). The water depth and the physical characteristics of the Black Sea present a challenge for the Project and have influenced a number of key technical decisions, including the routing of the pipelines and the siting of the landfall facilities.

1.2.1 Project Area

For the purpose of this ESIA Report, the Project is divided into three sections: the landfall section, the nearshore section and the offshore section (see Figure 1.5 and Figure 1.6). Each of these is discussed in turn in Sections 1.2.1.1 to 1.2.1.3.

Figure 1.6 South Stream Offshore Pipeline – Russian Sector



1.2.1.1 Landfall Section

The landfall section is approximately 4 km long and consists of permanent landfall facilities, which will include metering equipment, pipeline inspection gauge (PIG) trap facilities, and emergency shutdown valves (ESDs), along with the four buried pipelines. Within this section, 2.4 km of the pipelines will be buried with a minimum soil cover of 1.5 metres (m).

As there is a steep sea cliff at the shore crossing, for the remaining 1.4 km the pipelines will be housed in microtunnels. The microtunnels will terminate approximately 400 m from the coast (the exit point) in a water depth of approximately 23 m. The area of the landfall section is defined by the maximum operational safety exclusion zone of 410 m width surrounding the

Pipeline and the landfall facilities. While the entirety of this area may not experience physical impacts, there will be restrictions on future land use and development within the operational safety exclusion zone.

Deliveries of pipe and equipment to the landfall construction areas will be made by road. The Project will require the upgrade of some existing roads and will also require some new roads to be built for access during construction. Further detail is provided in **Chapter 5 Project Description**.

1.2.1.2 Nearshore Section

The nearshore section commences at the exit point of the microtunnels, located approximately 400 m from the coast at a water depth of approximately 23 m and extends approximately 425 m to a water depth of 30 m. The lateral boundaries of the nearshore section consist of a corridor 3 km either side[6] of the outermost pipeline. From the microtunnel exit point, the pipelines will be buried in trenches to a depth of approximately 2.5 to 3 m for a distance of approximately 170 m. From here, out to the edge of the nearshore section, the pipelines will be coated in concrete and laid directly on the seabed.

Construction activities associated with the installation of the pipelines in the nearshore section will require a number of seagoing vessels. All construction activities in this section of the Project will be carried out at sea.

The pipeline construction work will require support from an onshore support facility, known as a marshalling yard, for the inbound delivery, storage and load out of pipe, plant and equipment. The marshalling yards will be located in Bulgaria and are discussed in the separate ESIA Report for the South Stream Offshore Pipeline – Bulgarian Sector.

1.2.1.3 Offshore Section

The offshore section has an overall length of approximately 225 km. It extends from the edge of the nearshore section at 30 m water depth to the border of the Russian and Turkish EEZs in the Black Sea. The lateral boundaries of the Project Area consists of a corridor 3 km either side of the outermost pipelines, beginning at the boundary of the nearshore section to the 600 m water depth contour. The corridor decreases to 2 km width either side of the outermost pipeline from the 600 m water depth contour to the Russian EEZ boundary[6].

In this section the pipelines are laid along the continental shelf, down the continental slope, and across the abyssal plain. The abyssal plain lies at the base of the continental slope and gently slopes to the west to a maximum depth of approximately 2,200 m. In the offshore section, the pipelines will be laid directly on the seabed. The pipelines will be coated in concrete out to a water depth of approximately 88 m.

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[6] As defined by the Construction Phase safety exclusion zone around construction vessels.

1.2.2 Associated Facilities

Associated Facilities are defined by the OECD Common Approaches[7] (Ref. 1.9) as follows:

"…facilities that are not a component of the project but that would not be constructed or expanded if the project did not exist and on whose existence the viability of the project depends; such facilities may be funded, owned, managed, constructed and operated by the buyer and/or project sponsor or separately from the project."

The Equator Principles (EP) (Ref. 1.10) reference Associated Facilities indirectly through the International Finance Corporation (IFC) Performance Standards (PSs) (Ref. 1.11)[8]. The Project's Associated Facilities are consistent with these definitions and include:

- The Russkaya compressor station (CS) and the four pipelines connecting the compressor station with the Project, which are located immediately upstream of the Project in Russia and that are developed and managed by Gazprom Invest (GPI); and
- Designated existing quarries for sourcing material / aggregates, where those existing quarries would require significant expansion for the sole purpose of supplying the Project.

1.2.2.1 Russkaya Compressor Station

The landfall facilities will be connected to the Russkaya CS via four 3.2 km onshore pipelines (Figure 1.7). The Russkaya CS and the four 3.2 km connecting pipelines are not part of the Project and will be designed and installed as part of a separate project known as "Expansion of the United Gas Supply (UGS) System" which is being constructed by Gazprom Invest. However, the CS provides the pressure necessary to drive gas through the Project pipelines across the Black Sea, and therefore it is considered to be an associated facility.

The Russkaya CS has followed a separate engineering and approval process, which included the execution of an EIA and review and approval by Russian authorities. The findings of the EIA are summarised in Appendix 20.1: Environmental Impacts of Associated Facilities: Russkaya Compressor Station (CS) of this ESIA Report, along with a benchmarking of the EIA against international standards. Further consideration of the Russkaya CS is also given in **Chapter 20 Cumulative Impact Assessment,** including cumulative impacts associated with the construction and operation of the Russkaya CS amongst other nearby developments (see Section 1.4.2). Further details on the Project and Associated Facilities including proposed activities that will be carried out are provided in **Chapter 5 Project Description**.

---

[7] OECD Common Approaches are the primary environmental and social standards applicable to the Project. Further details are provided in **Chapter 2 Policy, Regulatory and Administrative Framework**.

[8] IFC PS1 paragraph 8: Associated Facilities are defined as facilities that are not funded as part of the project and that would not have been constructed or expanded if the project did not exist and without which the project would not be viable.

1.2.3 South Stream Pipeline System

The South Stream Pipeline System consists of one offshore and four onshore components as summarised in Table 1.8.

Table 1.8 South Stream Pipeline System

Component / Developer	Key Data	EIA Status (as of April 2014)
South Stream Offshore Pipeline being developed by South Stream Transport.	**Length:** 931 km (Russia 230 km, Turkey 470 km, Bulgaria 230 km)	**Russia:** EIA was approved by State Expert Review in March 2014. **Turkey:** EIA report approved by Ministry of Environment and Urbanisation expected in May 2014. **Bulgaria:** EIA approved by the Ministry of Water and Environment in January 2014.
South Stream Pipeline Bulgaria being developed by South Stream Bulgaria AD.	**Length:** 538 km **Compressor Stations:** 3 (Varna, Lozen and Rasovo) 300 MegaWatt (MW) aggregate capacity	EIA approved by the Ministry of Environment and Water in August 2013.
South Stream Pipeline Serbia being developed by South Stream Serbia AG.	**Length:** 422 km **Compressor Stations:** two (with 225 MW aggregate capacity)	EIA approved by the Ministry of Energy Development and Environmental Protection in December 2013.
South Stream Pipeline Hungary being developed by South Stream Hungary Zrt.	**Length:** 299 km **Compressor Stations:** one (100 MW capacity)	EIA to be submitted to authorities in January 2015.
South Stream Pipeline Slovenia being developed by South Stream Slovenia d.o.o.	**Length:** 266 km **Compressor Stations:** two (128 MW aggregate capacity)	EIA to be submitted to authorities in 2014/2015.
TOTAL	***Length:*** 2,456 km ***Compressor Stations:*** 8	

The components of the South Stream Pipeline System on the territory of Bulgaria, Serbia, Hungary, and Slovenia are separate projects and are subject to separate EIAs in compliance with national legislation.

LEGEND

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Landfall facilities
- Proposed microtunnels
- Proposed offshore pipelines
- Right of way
- Microtunnel entry shaft
- Microtunnel exit pit

United Gas Supply System

- United Gas Supply System pipelines
- Russkaya compressor station

Projection: Lambert Conformal Conic

Revision Details	By	Check	Check Date	Suffix

Purpose of Issue: For Information

Client: South Stream Offshore Pipeline — ENERGISING EUROPE

Project Title: SOUTH STREAM OFFSHORE PIPELINE

Drawing Title: PROJECT INTERFACE WITH UPSTREAM PIPELINE

Drawn	Checked	Approved	Date
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URS Internal Project No.	Scale @ A3
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Drawing Number: Figure 1.7

Rev

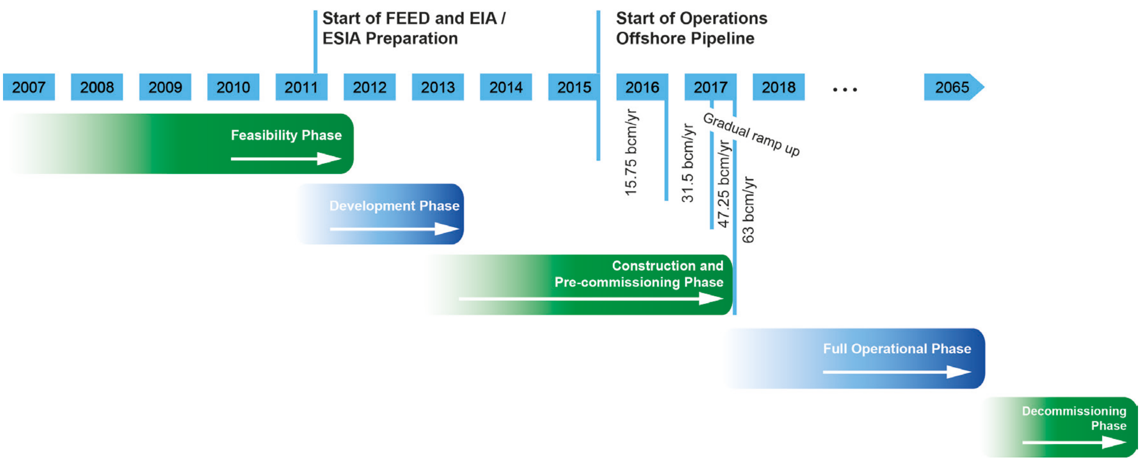
1.2.4 South Stream Offshore Pipeline Phases and Timeline

South Stream Offshore Pipeline development includes five key phases:

- **Feasibility Phase** (2007 to early 2012) initiated by Gazprom. This phase involved the development of Feasibility Studies in which a number of gas pipeline routes and landfall options were assessed and a preliminary engineering (conceptual) design was developed. The phase also included a Preliminary EIA developed for Russian permitting requirements that was approved by the State Environmental Expert Review on 24 September 2010;
- **Development (or Design) Phase** (late 2011 to late 2013) undertaken by South Stream Transport. This phase involves development of the Front End Engineering and Design (FEED) together with Russian Project Design Documentation (Proekt) and national EIA. This phase also includes development of the ESIAs and Environmental and Social Management Plan (ESMP) to meet the international standards and guidelines for financing;
- **Construction and Pre-Commissioning Phase** (2014 to end 2017). This phase will involve construction activities and a number of activities, known as pre-commissioning activities, which will be undertaken after each pipeline has been installed to ensure that the pipelines meet operational requirements;
- **Operational Phase (consisting of Commissioning and Full Operational Phase)** (2017 to 2065). The Project will have an operational design life of 50 years; and
- **Decommissioning Phase** (2065 onwards).

An indicative timeline for the South Stream Offshore Pipeline is provided in Figure 1.8.

Figure 1.8 South Stream Offshore Pipeline Timeline



1.3 EIA and ESIA Requirements for the Project

The Project is subject to impact assessments for both national regulatory and international financing requirements. As the Project is located within the territory and waters of the Russian Federation, the Project has also submitted EIA documentation in accordance with Russian Federation legal requirements.

As the Project will be subject to project finance, this ESIA Report is aligned with the environmental and social performance standards and guidelines of international financing.

The environmental and social standards and guidelines of the Project are as follows:

- The OECD Common Approaches on the Environment and Officially Supported Export Credits, dated 2012 (Ref. 1.9);
- The Equator Principles III (2013) (Ref. 1.10);
- Japan Bank for International Cooperation (JBIC) Guidelines for Confirmation of Environmental and Social Consideration, dated 2012 (Ref. 1.12); and
- The IFC Performance Standards (2012) and World Bank Group EHS Guidelines (Ref. 1.11), which underpin the OECD Common Approaches and Equator Principles III.[9]

This ESIA Report has been prepared by URS Infrastructure and Environment UK Limited (URS) in accordance with the international standards and guidelines described above. Peter Gaz (a registered Russian company) prepared the EIA documentation required under Russian law.

Information from the national EIA process preceded and therefore informed the ESIA. URS further addressed a number of issues that were necessary to meet requirements and standards for international financing. URS and Peter Gaz coordinated the technical development of the ESIA and EIA chapters to ensure consistency of methodology, approach and content as far as practicable.

Nevertheless, there are differences between the two documents in relation to their content and in the quantification of some impacts. These variances are due mainly to the difference between the Russian Federation EIA regulatory requirements and conventional ESIA practice as set out in the standards and guidelines for international financing.

1.4 Objectives of this ESIA

In accordance with the Equator Principles, the OECD Common Approaches and JBIC Guidelines, the objectives of this ESIA Report are based on those of IFC PS1: Assessment and Management of Environmental and Social Risks (Ref. 1.13), which are:

---

[9] As per IFC PS, South Stream Transport is committed to implementing Good International Industry Practice (GIIP) in relation to environmental and social performance in all phases of the South Stream Offshore Pipeline. Further details on the standards and guidelines relevant to this ESIA Report are included in **Chapter 2 Policy, Regulatory and Administrative Framework**.

- *"To identify and evaluate environmental and social risks and impacts of the project;*
- *To adopt a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimize, and, where residual impacts remain, compensate / offset for risks and impacts to workers, affected communities, and the environment;*
- *To promote improved environmental and social performance of clients through the effective use of management systems;*
- *To ensure that grievances from affected communities and external communications from other stakeholders are responded to and managed appropriately; and*
- *To promote and provide means for adequate engagement with affected communities throughout the project cycle on issues that could potentially affect them and to ensure that relevant environmental and social information is disclosed and disseminated."*

1.4.1 Area of Influence of the Project

This ESIA Report has been prepared taking into consideration the definition of Project Area of Influence provided by IFC PS1 (Ref. 1.13) which states:

"Where the project involves specifically identified physical elements, aspects, and facilities that are likely to generate impacts, environmental and social risks and impacts will be identified in the context of the project's area of influence. This area of influence encompasses, as appropriate:

- *The area likely to be affected by:*
  - *The project and the client's activities and facilities that are directly owned, operated or managed (including by contractors) and that are a component of the project;*
  - *Impacts from unplanned but predictable developments caused by the project that may occur later or at a different location; or*
  - *Indirect project impacts on biodiversity or on ecosystem services upon which Affected Communities' livelihoods are dependent.*
- *Associated Facilities, which are facilities that are not funded as part of the project and that would not have been constructed or expanded if the project did not exist and without which the project would not be viable; and*
- *Cumulative impacts that result from the incremental impact, on areas or resources used or directly impacted by the project, from other existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted."*

Consistent with the definition provided above, the Project Area of Influence includes those areas likely to be affected by the main Project facilities (including the Project Area and Associated Facilities described above), and in the case of cumulative impacts, incremental impacts from other developments, unrelated to the Project, that will take place within the vicinity of the Project Area.

The assessment of the potential environmental and social impacts of Associated Facilities has been carried out taking into account the timing and location of their construction, and reasonable efforts have been made to benchmark against relevant international standards using the available information. In the event of risks and impacts in the Project's Area of Influence resulting from a third party's actions, South Stream Transport will address those risks and impacts in a manner commensurate with South Stream Transport's control and influence over the third parties, and with due regard to conflict of interest.

1.4.2 Cumulative and Transboundary Impacts

While the activities associated with a single project may or may not result in significant impacts, the "cumulative" effects of simultaneous projects, may be more significant and should be considered within an ESIA. This ESIA adopts the IFC PS (Ref. 1.13) definition of cumulative impacts which are defined as:

"Cumulative impacts are those that result from the incremental impact of the Project when added to other existing, planned and reasonably predictable future projects and developments."

Cumulative impacts may occur as a result of interactions between any residual (i.e. post-mitigation) Project impacts, and the impacts of other activities or developments in the vicinity of the Project Area.

The assessment of cumulative impacts includes the Russkaya CS and well as a number of known and proposed developments within the proximity of the Project. Further details of the approach and schemes considered within the cumulative impact assessment are provided in **Chapter 20 Cumulative Impact Assessment**.

Where specific impacts are anticipated to extend across Project Area boundaries (see Section 1.2.1), the ESIA Report provides a description of the potential geographical extent associated with the impact. In particular, the potential for transboundary impacts (i.e. the potential for the Project Area of Influence to extend across Russian national boundaries) is discussed in **Chapter 21 Transboundary Impact Assessment.**

1.4.3 Structure of the ESIA Report

The ESIA chapter titles and a summary of the approach and content are provided below:

Table 1.9 ESIA Report Structure

Report Structure	
1. Introduction	Presents an overview of the South Stream Offshore Pipeline - Russian Sector and the objectives of the ESIA. This chapter also details the purpose and scope of the ESIA Report.

Continued…

Report Structure	
2. Policy, Regulatory and Administrative Framework	The chapter includes: • A description of the Russian regulatory process to be followed for all Project Activities; • Identification of Russian environmental and social legislation of relevance to the Project; • Identification of international treaties and conventions to be adhered to; and • Identification of international standards and guidelines of relevance to the Project.
3. Impact Assessment Methodology	The chapter includes: • A description of the ESIA process; and • A description of the impact assessment methodology and of the adopted impact significance criteria.
4. Analysis of Alternatives	A comparison of the developmental options considered in the Project design phase including the 'zero' option, alternative gas transportation options, routing options and facility and operational options considered.
5. Project Description	A detailed description of: • Onshore and offshore infrastructure; • Construction methodologies and staging; • Hydrotesting and commissioning works; • Operational conditions and maintenance requirements; and • Decommissioning process.
6. Stakeholder Engagement	A summary of all Project consultation undertaken, the issues raised, and where these issues have been addressed within the ESIA documentation. The Chapter also describes future consultation activities.
7. Physical and Geophysical Environment	A description of the methods used and results from surveys and secondary data review to define baseline conditions for the physical and geophysical environment. This incorporates a number of aspects including seismology, geology, electromagnetic fields, and ionising radiation.

Continued…

Report Structure	
8. Soil, Groundwater and Surface Water *9. Air Quality* *10. Noise and Vibration* *11. Terrestrial Ecology* *12. Marine Ecology* *13. Landscape and Visual* *14. Socio-Economic* *15. Community Health, Safety and Security* *16. Cultural Heritage*	These chapters include: • Description of the methods used and results from surveys and secondary data review to define baseline conditions relevant to the technical discipline; • Assessment of potential impacts arising from all phases of the Project and related activities; • Identification of practicable mitigation measures to be applied; and • Assessment of residual impacts associated with the Project following mitigation and the need for monitoring of residual impacts.
17. Ecosystem Services	The chapter includes: • Description of the methods used and results from surveys and secondary data review to define the scope of the ecosystem services assessment and the baseline conditions for the ecosystems present in the Project Area and their associated services and benefits (e.g. crop productivity, water supply, air, soil and water quality regulation, cultural services and biodiversity); • Nature and significance of the potential impacts on ecosystem services and their beneficiaries arising from all phases of the Project and related activities; • Priority ecosystem services; • Practicable mitigation measures to be applied; and • Nature and significance of residual impacts associated with the Project following mitigation and the need for monitoring of residual impacts.

Continued...

Report Structure	
18. Waste Management	The chapter includes: • Description of the legal and regulatory framework applicable to the Project based on wastes anticipated to be generated by Project activities; • Identification of available waste facilities for the Project; • Assessment of potential impacts arising from the management of wastes; • Identification of practicable mitigation measures to be applied; and • Assessing the significance of the residual impacts post mitigation implementation.
19. Unplanned Events	The chapter includes: • Description of the potential unplanned events and impacts that may arise as a result of the Project; • Identification of design control and mitigation measures able to be undertaken; and • Discussion of the residual risk posed by the identified unplanned events and relevant monitoring requirements.
20. Cumulative Impact Assessment	A summary of the potential cumulative impacts as a result of Project associated development and other existing and proposed developments in the vicinity of the Project Area.
21. Transboundary Impact Assessment	A description of the potential for transboundary impacts that may arise as part of the Project.
22. Environmental and Social Management	An outline of the key management measures, processes and monitoring requirements to be undertaken, based on the outcomes of the impact assessment.
23. Conclusions	A summary of the residual impacts arising as a result of the Project and provision of overall conclusions as to the overall environmental and social significance of impacts arising from the Project.

Complete.

As a supplement to the ESIA Report, a non-technical summary (NTS) has been prepared. The NTS describes the findings of the ESIA Report, including the potential environmental and social impacts, and actions that will eliminate, reduce, or mitigate those impacts.

1.5 Related South Stream Offshore Pipeline Impact Assessment Documents

In addition to this ESIA Report and the EIA documentation that have been prepared specifically for the Russian Sector, additional impact assessment documentation has been prepared for the other host countries affected by the South Stream Offshore Pipeline, including:

- A Turkish EIA Report to meet Turkish legislative requirements;
- A Turkish ESIA Report to address international financing requirements for the Turkish Sector;
- A Bulgarian EIA Report to meet Bulgarian legislative requirements; and
- A Bulgarian ESIA Report to address international financing requirements for the Bulgarian Sector.

References

Number	Reference
Ref. 1.1	International Energy Agency, World Energy Outlook 2013, Annex A.
Ref. 1.2	International Energy Agency, World Energy Outlook 2013, Table 3.2.
Ref. 1.3	International Energy Agency, World Energy Outlook 2013, Table 3.4.
Ref. 1.4	International Energy Agency, World Energy Outlook 2013, Table 3.6.
Ref. 1.5	International Energy Agency, World Energy Outlook 2013.
Ref. 1.6	BP, Statistical Review of World Energy 2013.
Ref. 1.7	Wood Mackenzie (2013), South Stream Offshore Pipeline Lenders' Gas Market Consultant: Final Draft Gas Market Report.
Ref. 1.8	Decree of the Council of Ministers of the Soviet Union dated January 30, 1985 N 45.
Ref. 1.9	Organisation for Economic Co-operation and Development (OECD) Revised Council Recommendation on Common Approaches for officially supported export credits and environmental and social due diligence (June 2012). Available at: http://search.oecd.org/officialdocuments/. Accessed 24 September 2013.
Ref. 1.10	Equator Principles (June 2013). Available at: http://www.equator-principles.com Accessed 24 September 2013.
Ref. 1.11	International Finance Corporation (IFC) (January 2012), Performance Standards and Guidance Notes on Environment and Social Sustainability available from: http://www.ifc.org. Accessed 18 June 2013.
Ref. 1.12	Japanese Bank for International Cooperation (August 2012), available from: http://www.jbic.go.jp/en. Accessed 31 October 2013.
Ref. 1.13	IFC (2012), Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts. Available at: http://www1.ifc.org. Accessed 21 January 2013.

Chapter 2: Policy, Regulatory and Administrative Framework

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South Stream Offshore Pipeline ENERGISING EUROPE

Tables

Figures

2 Policy, Regulatory and Administrative Framework

2.1 Introduction

This chapter provides an overview of the policy, regulatory and administrative framework relevant to the Project.

As the Project is located within the territory and waters of the Russian Federation, this ESIA Report will take into consideration relevant Russian Federation regulatory requirements and administrative structures.

South Stream Transport is also committed to implementing Good International Industry Practice (GIIP) in relation to environmental and social performance during all Project Phases: Construction and Pre-Commissioning, Operational and Decommissioning Phases.

As part of GIIP, various guidance documents are referred to within this ESIA Report as listed below. Measures contained therein will be adopted as project standards where relevant and practical:

- Sector Guidance Note Integrated Pollution Prevention and Control (IPPC) S1.2 (Guidance for the Gasification, Liquefaction and Refining Sector) (Ref.2.1);
- The Oil and Gas Industry: Operating in Sensitive Environments 23 – International Petroleum Industry Environmental Conservation Association (IPIECA) (Ref. 2.2); and
- Environmental Management in Oil and Gas Exploration and Production 1997 – United Nations Environment Program Industry and Environment (UNEP IE) and the Oil Industry International Explorations and Production Forum (E&P Forum) (Ref. 2.3).

The Project is being carried out in accordance with standards and guidelines for international financing, including those for Environmental and Social Impact Assessment (ESIA). This commitment is reflected in South Stream Transport's *Health and Safety, Security and Environmental Policy.*

This chapter includes an overview of the following:

- South Stream Transport's relevant corporate policies (Section 2.2);
- Russian Federation regulatory and administrative structures (Section 2.3);
- Russian Environmental Impact Assessment (EIA) process and other federal legislation relevant to the Project (Section 2.4);
- Russian local and regional legislative requirements relevant to the Project (Section 2.5);
- International and regional conventions signed or ratified by Russia relating to environmental protection, sustainable development, cultural heritage, socio-economic and human rights that are relevant for the Project (Section 2.6); and

- International standards and guidelines for financing that the Project will be undertaken in accordance with (Section 2.7), namely:
  - The Organisation for Economic Co-operation and Development (OECD) Revised Council Recommendation on Common Approaches on the Environment and Officially Supported Export Credits (OECD Common Approaches) (Ref. 2.4);
  - The Equator Principles (EP) III (Ref. 2.5);
  - Japan Bank for International Cooperation (JBIC) Guidelines for Confirmation of Environmental and Social Consideration. (Ref. 2.6); and
  - The International Finance Corporation (IFC) Performance Standards (PS) and Word Bank Group EHS Guidelines, which underpin the OCED Common Approaches and EPIII (Ref. 2.7).

2.2 Corporate Policies

South Stream Transport has two policies that are relevant to this ESIA Report: a *Health and Safety, Security, and Environmental Policy*, and a *Corporate Social Responsibility and Sustainability Policy*. Both were signed into action by South Stream Transport's Chief Executive Officer (CEO) on 10 October 2013. The policy text is provided verbatim below and copies of the signed policies are available upon request.

2.2.1 Health and Safety, Security and Environmental Policy

The South Stream Transport *Health and Safety, Security and Environment Policy* is provided verbatim below.

"South Stream Transport B.V. (South Stream Transport) aims to provide reliable and secure energy to the European market responsibly and sustainably whilst creating value for society. We will do this by creating a major new infrastructure through the Black Sea; a gas pipeline that is safe, reliable and efficient.

South Stream Transport is committed to integrating social, economic, environmental and governance considerations into the everyday conduct of our business as we design, build and operate the South Stream Offshore Pipeline.

We are committed to environmentally and socially responsible management, in accordance with national, international and EU legislation, and internationally recognised standards for health and safety, security and environmental and social performance.

Our guiding principles are to:

- *Seek to achieve ZERO incidents and consequences related to health and safety, security and environment (HSSE);*
- *Ensure compliance with the requirements of applicable laws and regulations;*
- *Ensure compliance with applicable national and international standards and industry good practice;*

* *Set clear and transparent HSSE objectives and targets, and plan, implement and monitor performance in order to realise these goals;*
* *Prevent pollution and protect the environment by minimising adverse impacts throughout the project lifecycle;*
* *Manage construction and operational activities in a responsible and sustainable manner;*
* *Provide a safe and healthy workplace for employees, contractors and other persons to prevent injury or ill health, including definition of HSSE roles and responsibilities, measures to prevent injuries and ill health or minimise risks, information, instruction and training, and investigation of any incidents;*
* *Engage with Government and local authorities, Non-Governmental Organisations, local communities and members of the public, and other interested parties;*
* *Communicate and work closely with employees, contractors and other interested parties to ensure their understanding and shared commitment to conformance with this policy; and*
* *Ensure continual improvement of HSSE performance.*

This corporate policy applies to all our staff and across all our business activities, it guides our strategy, management, decisions and actions, it is incorporated into the documents governing our relationships with our suppliers and contractors, and guides our relationships with joint venture and other business partners.

We recognize that leadership and commitment from senior management is an essential component of success, and we are committed to ensuring that all senior executives and directors of the Company are fully conversant with, and committed to, our policy and goals."

2.2.2 Corporate Social Responsibility and Sustainability Policy

The South Stream Transport Health and Safety, Security and Environment Policy is provided verbatim below.

"South Stream Transport aims to provide reliable and secure energy to the European market responsibly and sustainably whilst creating value for society. We will do this by creating a major new infrastructure through the Black Sea - a gas pipeline that is safe, reliable and efficient.

South Stream Transport is committed to integrating social, economic, environmental and governance considerations into the everyday conduct of our business as we design, build and operate the South Stream Offshore Pipeline.

We are committed to good corporate citizenship in all the countries in which we operate, and intend to enter into transparent and respectful dialogue with our stakeholders enabling us to take their interests into account in our long term planning and everyday decision-making.

We aim to make the South Stream Offshore Pipeline safe, socially responsible and economically beneficial by:

* *Contributing to reducing climate change by delivering natural gas as a clean and efficient fossil fuel;*

- *Preserving the Black Sea environment, biodiversity and avoid any irreversible impact;*
- *Minimising our negative impacts and enhancing our positive impacts on the environment and communities;*
- *Applying good international industry practice in assessing and addressing any potential impacts;*
- *Adhering to international construction and quality standards in design, building and operating the gas pipeline and promoting best international safety standards and reducing risks for employers and local communities; and*
- *Development of opportunities for employers, suppliers and the wider community.*

Our guiding principles are to:

- *Guaranteeing the sustainability of its activities by applying a long-term strategy, providing a coherent framework for innovation development as well as integrated risk management and risk prevention management strategy;*
- *Respecting internationally recognized Human Rights in our own operations and promoting the respect of the aforementioned rights with regard to activities assigned to or carried out with Business Partners and in our relationships with stakeholders; and*
- *Conducting business with loyalty, fairness, transparency, honesty, and integrity and in compliance with the laws, regulations, similar mandatory requirements, and international standards and guidelines, both domestic and foreign that apply to its business.*

In operating, we shall respect the UN Global Compact Principles, including:

- *Protection of international human rights;*
- *Rights to free association, collective bargaining and employment non-discrimination;*
- *Protection and preservation of the environment; and*
- *Elimination of corruption, including bribery and extortion.*

This policy applies to all our staff and across all our business activities, it guides our strategy, management, decisions and actions, it is incorporated into the documents governing our relationships with our suppliers and contractors, and guides our relationships with joint venture and other business partners.

We recognize that leadership and commitment from senior management is an essential component of success, and we are committed to ensuring that all senior executives and directors of the Company are fully conversant with, and committed to, our policy and goals."

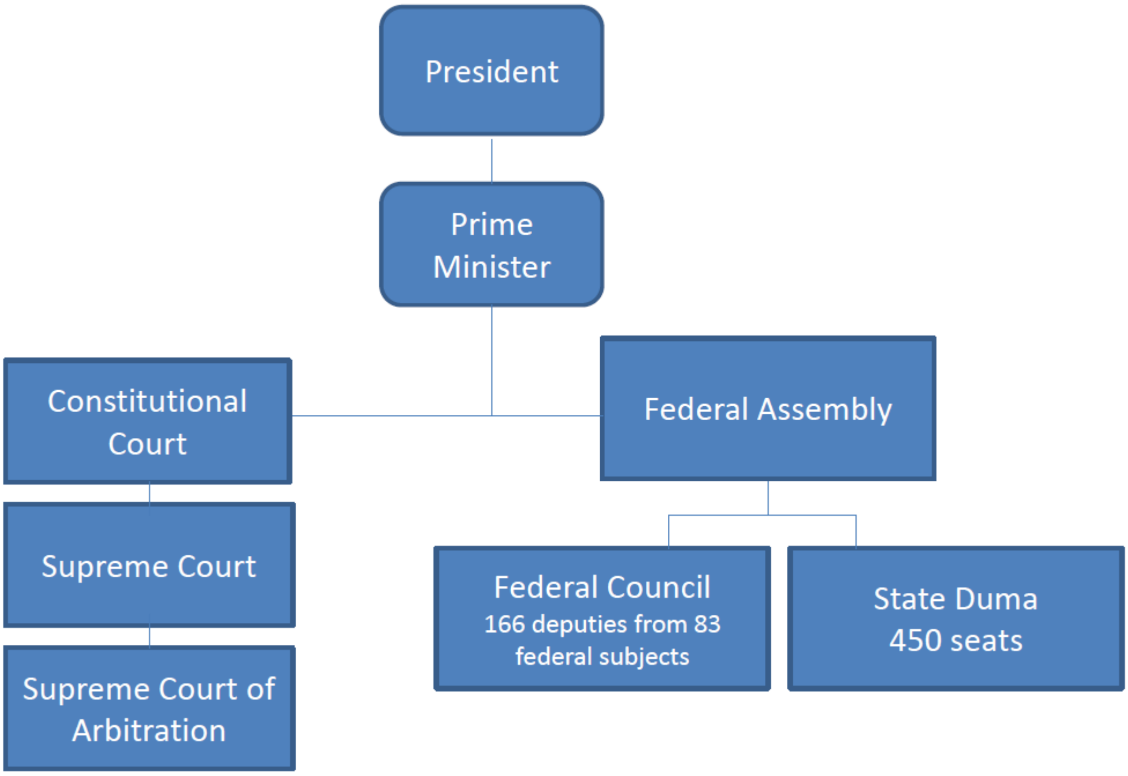
2.3 Overview of Russian Federation Regulatory and Administrative Structures

2.3.1 Federal Government Structure

The Russian Federation is structured as a multi-party representative democracy, with the federal government composed of three branches (Figure 2.1):

- **Legislative:** This is known as the Federal Assembly and is comprised of two houses, the 450-member State Duma and the 166 member Federal Council. It is responsible for adopting federal law, declaring war, approving treaties, and has budgetary authority and the power to impeach the President;
- **Executive:** The President is the commander-in-chief of the military and can veto legislative bills before they become law on the basis that such rulings do not contravene their constitution and federal laws already in place; and
- **Judicial:** This comprises the Constitutional Court, Supreme Court, Supreme Court of Arbitration and lower federal courts (Regional, District and Magistrate Courts). The Constitutional Court is the only judicial body with the ability to rule on the constitutional law and examine the interactions of the other courts. Judges are appointed by the Federal Council on the recommendation of the President.

Figure 2.1 Russian Federal Government's Structure



In general, the regional and federal state authorities follow a similar structure of administration, with regional government bodies reproducing the major features of federal government bodies. However, local government structures vary amongst municipalities with only general principles of organisation being established by federal and regional legislation.

2.3.2 Administrative Units

The Russian Federation is made up of 83 federal administrative subjects (units), which are classified as territories (Krais), regions (Oblasts), cities of federal importance, autonomous regions and autonomous area (Ref. 2.7) (Figure 2.2). Each administrative unit is equally represented in the Federation Council, with two delegates each.

These federal administrative units are grouped together into eight federal districts. These federal districts were created in 2000 to assist in controlling laws and practices of the administrative units (Ref. 2.8). The administrative units are also grouped together into economic regions. Each economic region is made up of administrative units with comparative economic conditions (Ref. 2.9).

The landfall section of the Project lies within Krasnodar Krai, which is grouped within the Southern Federal District and within the North Caucasus economic region. The landfall section of the Project lies within Krasnodar Krai, which is grouped within the Southern Federal District and within the North Caucasus economic region.

2.3.3 Government Ministries, Agencies and Services

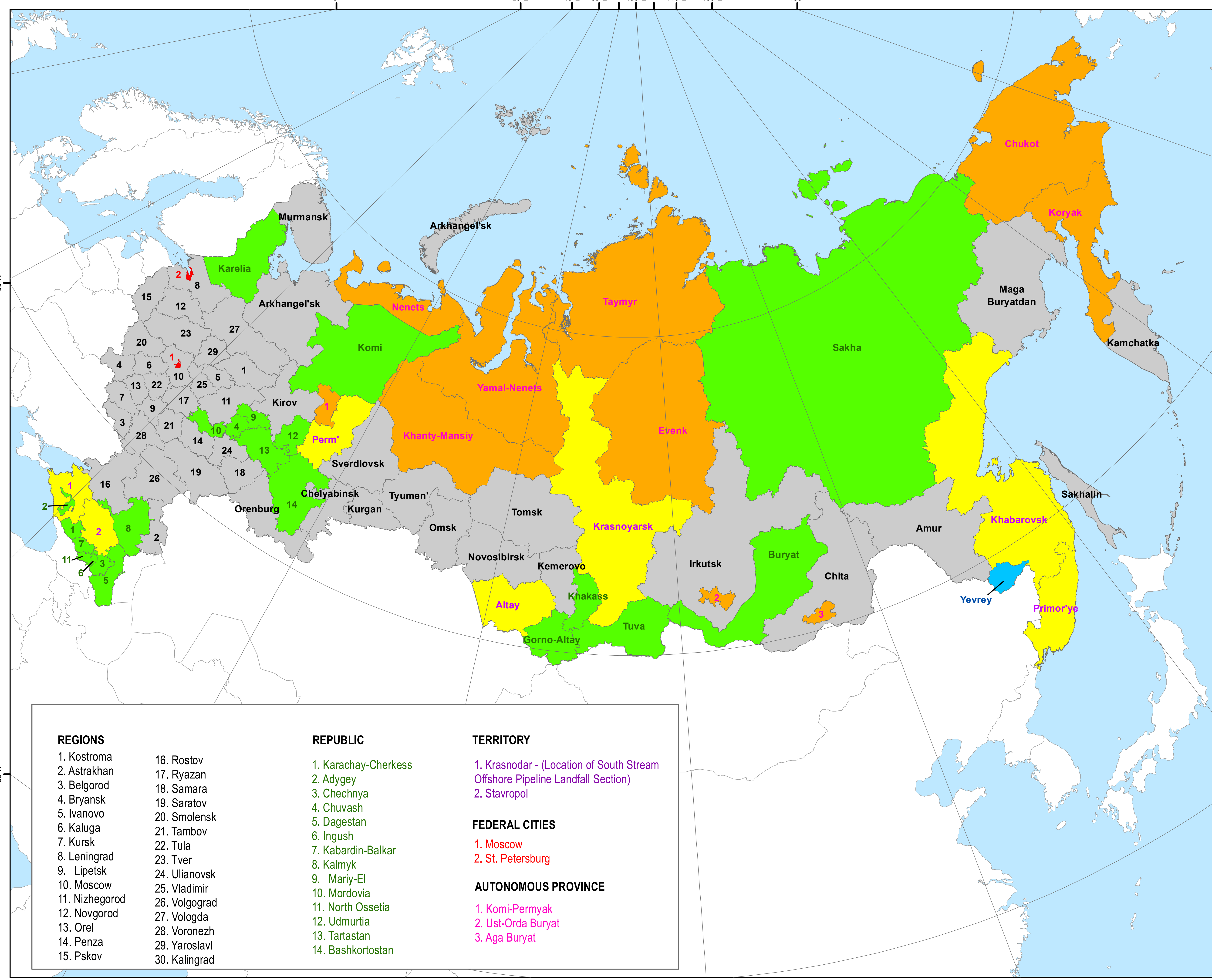
National level government organisations (ministries, agencies, services) with EIA regulatory functions relating to the Project include:

- Ministry of Natural Resources and Environment (MNRE);
- Ministry of Regional Development;
- Federal service on customers' rights protection and human well-being surveillance; and
- Russian Federal Fisheries Agency (FFA).

Federal ministries, such as the MNRE, create policies and legislation and perform compliance assurance functions. The MNRE also coordinates and supervises the activities, within its jurisdiction, of the following (Ref. 2.10):

- Federal Service for Hydrometeorology and Environmental Monitoring;
- Federal Service for Supervision of Natural Resource Management (Rosprirodnadzor);
- Federal Agency for Water Resources (Rosvodresursy);
- Federal Agency for Subsoil Management (Rosnedra); and
- Federal Agency for Forestry (Rosleskhoz).

The federal services and agencies listed above supervise environmental management and issue licenses and permits for activities under their jurisdiction.



LEGEND

- Autonomous province
- Autonomous region
- Federal city
- Region
- Republic
- Territory

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: For Information

Client: South Stream Offshore Pipeline — Stream ENERGISING EUROPE

Project Title: SOUTH STREAM OFFSHORE PIPELINE

Drawing Title: ADMINISTRATIVE UNITS OF THE RUSSIAN FEDERATION

Drawn	Checked	Approved	Date
AH	GH	GH	07 Jul 2014

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46369082	1:24,000,000

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Drawing Number: Figure 2.2 | Rev

Plot Date: 07 Jul 2014
File Name: I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 2 Legislation\Figure 2-2 Administrative Units of the Russian Federation.mxd

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Federal ministries, such as the MNRE, create policies and legislation and perform compliance assurance functions. The MNRE also coordinates and supervises the activities, within its jurisdiction, of the following (Ref. 2.10):

- Federal Service for Hydrometeorology and Environmental Monitoring;
- Federal Service for Supervision of Natural Resource Management (Rosprirodnadzor);
- Federal Agency for Water Resources (Rosvodresursy);
- Federal Agency for Subsoil Management (Rosnedra); and
- Federal Agency for Forestry (Rosleskhoz).

The federal services and agencies listed above supervise environmental management and issue licenses and permits for activities under their jurisdiction.

There is also a Russian Federal Service for Environmental, Industrial and Nuclear Supervision (Rostekhnadzor). Rostekhnadzor performs supervision of the following:

- Safe work practices relating to the use and protection of mineral resources;
- Industrial safety;
- Safe use of nuclear power;
- Safety of electrical and heating units and networks;
- Safety of hydroelectric facilities at industrial and power generation facilities; and
- Safety in production, storage and use of industrial explosives.

2.3.4 Hierarchy of Laws

The hierarchy of Russian Federation legislation can be summarised as follows:

- **Level 1**: *Federal Laws and Federal Codes* are created by the State Duma (the lower house of the Federal Assembly of Russia) and then adopted by the Federal Council of Russia (the upper house of the Federal Assembly of Russia);
- **Level 2**: Bylaws (includes three groups):
    - **Group 1:** *Presidential decrees and directives* – In accordance with Article 90 of the *Constitution of the Russian Federation* (Ref. 2.7), the Russian Federation President can issue decrees and directives. Decrees are legal acts that concern all jurisdictions. Directives are acts that concern specified entities;
    - **Group 2:** *Acts of the Government of the Russian Federation* – In accordance with Article 114 of the *Constitution of the Russian Federation* (Ref. 2.7), the powers of government are exercised via acts based on the *Constitution of the Russian Federation*, Federal Laws, and Presidential decrees and directives. Acts issued by the Government of the Russian Federation are binding throughout the entire territory of the Russian Federation; and
    - **Group 3:** *Acts of the Ministries and other executive federal / government agencies* – All environmental protection ministries and agencies have the right to issue legal and regulatory acts within the scope of their competence. Such acts are binding upon any

other ministries or agencies, individuals or legal persons, and are issued as orders, resolutions, instructions, rules, provisions, articles, and directives.

2.4 Federal Legislation

2.4.1 The Constitution

The *Constitution of the Russian Federation* came into force on 25 December 1993 (Ref. 2.7), following a national referendum. It is the primary and fundamental statement of law and is based on world standards for human rights and basic principles of democratic state-building, such as neutrality of the state, competitive elections, and separation of powers. The Constitution establishes a semi-presidential system, whereby the President is the head of state and the Prime Minister is the head of government.

The President is elected by popular vote for a six-year term and can be eligible for a second term. The President, with the parliament's approval, is responsible for appointing the Prime Minister. Government ministers (such as the Premier and his deputies) are also appointed by the President on the recommendation of the Prime Minister.

2.4.2 Environmental and Socio-Economic Legislation and Statutory Requirements

Associated with legal requirements for EIA, is a range of statutory requirements and guidelines.

Russian environmental and social legislation applicable to the Project is outlined in Appendix 2.1. Any specific requirements arising out of this legislation that influence the impact assessment process are detailed in the relevant technical chapters of this ESIA Report. A Health, Safety, Security and Environment (HSSE) Legal Register has been produced for the Project which lists all legislation relevant to all stages of the Project, not only those covered within this ESIA Report. This HSSE register has formed the basis of Appendix 2.1 and the legislation detailed in each technical chapter of this ESIA Report.

2.4.2.1 Legal Framework of the Sanitary Protection Area of Anapa

The Resort town of Anapa was assigned the status of a federal resort by President Decree No. 1954 dated 22 September 1994 (Ref. 2.11). It was given this status due to its recreational value as a 'health improving' (spa) resort area.

The original boundaries of the area were established by Decree of the Council of Ministers of the Soviet Union dated 30 January 1985, No. 45 (Ref. 2.12). The Decree specifies the overall boundary of the area and three distinct zones with different levels of protection, detailed below:

- **First Exclusion Zone:** within this zone, the only permitted works are those associated with the therapeutic use of the natural resources. All commercial activities not connected to the natural resources of the area or which may cause an adverse impact on the area are prohibited;

- **Second Limitation Zone:** within this zone, construction is allowed for works that are directly related to the development and improvement of the natural resources of the area. All activities that could cause pollution to soil, water and air, damage to forests, green areas, increase erosion processes or adversely impact any natural health resources (water bodies etc.) are prohibited; and
- **Third Monitored Zone:** within this zone, works which do not adversely impact the natural resources and the sanitary conditions of the resort are permitted.

The Project had initially been located within zones 1, 2 and 3 of the sanitary protection area of Anapa. To allow construction of the pipelines, an application to change the boundaries of this area was made and approved by the Russian Federal Government Decree No. 1087 dated 22 October 2012 '*on the partial change of Decree of the Council of Ministers of Russian Soviet Federative Socialist Republic (RSFSR) No.45 of 30 January 1985*' (Ref. 2.12).

Although the Project no longer falls within any of the sanitary protection area zones, the proximity of this protected area has been considered in the relevant technical chapters of this ESIA Report, including **Chapter 8 Terrestrial Soil and Groundwater**, **Chapter 9 Air Quality**, **Chapter 10 Noise and Vibration**, **Chapter 11 Terrestrial Ecology and Biodiversity**, **Chapter 12 Marine Ecology** and **Chapter 17 Ecosystem Services**. The revised boundaries of the sanitary protection area are shown in Figure 2.3.

The restrictions associated with these three zones were specified by the Russian Federation Government Decree No. 1425 dated 07 December 1996 (Ref. 2.13).

2.4.2.2 Anapa Bank

The Anapa Bank was initially designated as a restricted fishing area in 1986 by a Decree of the Ministry of Fisheries of the Union of Soviet Socialist Republics (USSR), No. 321, 18 June 1986 (Ref. 2.14). The 1986 Decree imposed a ban on trawl fishing to ensure that there was a steady supply of fish for a fish farm that was planned at the Utrish state nature reserve. The proposed offshore pipelines of the Project fall within the Anapa Bank as shown in Figure 2.4.

The originally designated area of Anapa Bank included a deeper water section on the continental shelf (heading onto the continental slope[1]), in which trawling for species such as anchovy and sprat was seasonally restricted. However, the geographic area was reduced to 730 km^2 by the Resolution of the Scientific Fishery Council of the Azov and Black Sea Basin in 1999 (Ref. 2.15). Fishing with stationary nets with a mesh size more than 50 mm is also forbidden in the Anapa Bank.

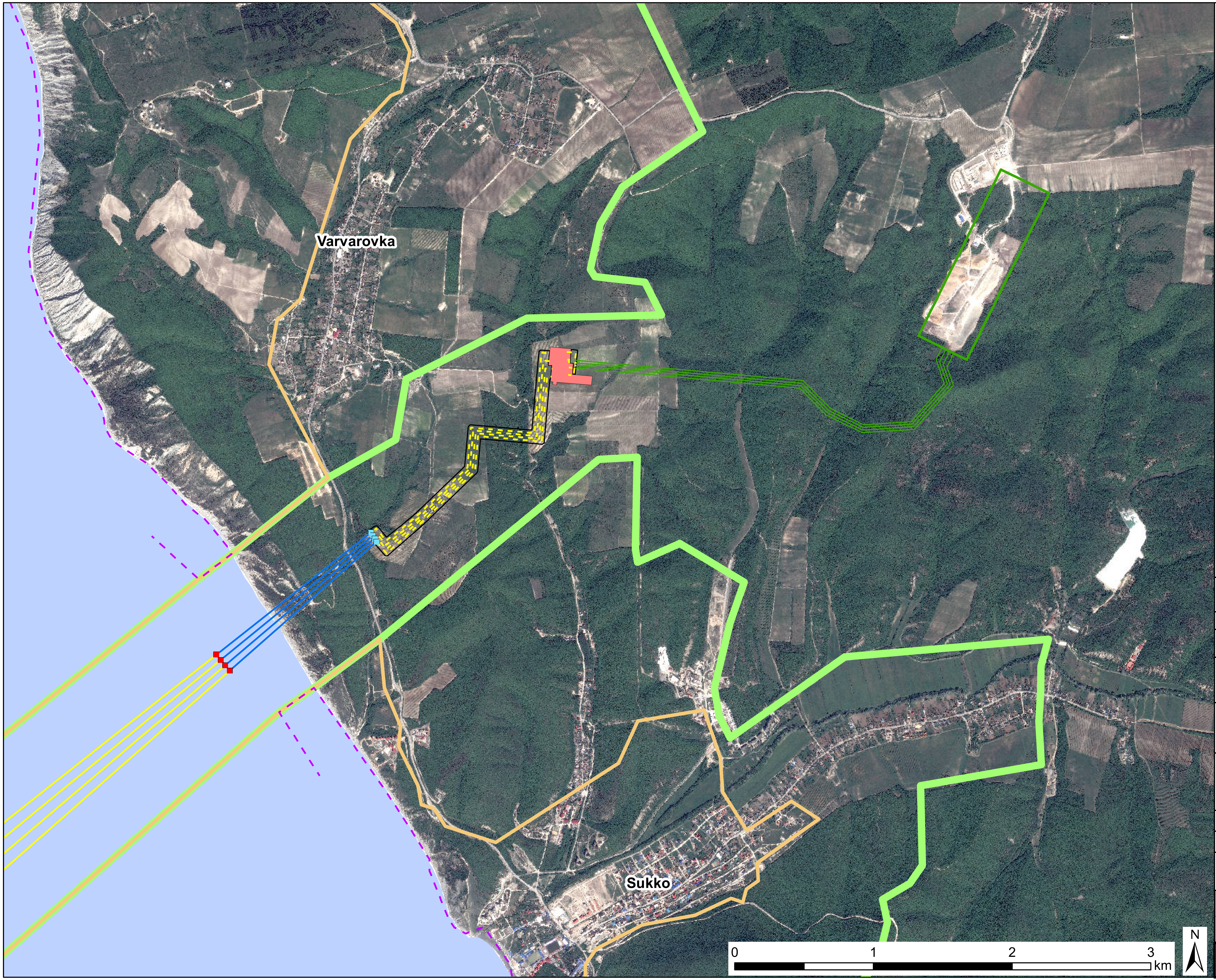
In 2011, the fishing ban was further relaxed to allow trawling of sprat and anchovy in certain areas, with seasonal restrictions to enable the replenishment of fish stocks. The Order of Roslybolovstvo No. 16, issued on 14 January 2011 (Ref. 2.16), specifies periods of the year and the water depths in which trawling for sprat and anchovy is permitted:

---

[1] The continental slope is part of the continental margin, which is the area between the continental shelf and the abyssal plain and comprises a steep continental slope followed by the flatter continental rise.

- For sprat, between 1 July and the 30 September in water depths of more than 40 m; and
- For anchovy, between 1 October and the 15 March in water depths of more than 20 m.

The Ministry of Fisheries administers these restrictions over Russian legal entities, individual entrepreneurs and citizens who practice fishing within the Anapa Bank, and the internal waters of the Russian Federation, through the issuing of fishing permits to all operating fishing vessels. The current boundaries of the Anapa Bank are shown in Figure 2.4.



LEGEND

- The boundary of the first area of sanitary protection zone (exclusion zone)
- The boundary of the second area of sanitary protection zone (limitation zone)
- The boundary of the third area of sanitary protection zone (monitored zone)

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Landfall facilities
- Proposed microtunnels
- Proposed offshore pipelines
- Right of way
- Microtunnel entry shaft
- Microtunnel exit pit

United Gas Supply System

- United Gas Supply System pipelines
- Russkaya compressor station

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue
For Information

Client
South Stream Offshore Pipeline ENERGISING EUROPE

Project Title
SOUTH STREAM OFFSHORE PIPELINE

Drawing Title
ANAPA SANITARY PROTECTION AREA BOUNDARIES

Drawn	Checked	Approved	Date
DH	RW	MW	04 Mar 2014

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Figure 2.3

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Plot Date: 04 Mar 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA\Chapter 2 Russian Legislation\Figure 2.3 Anapa Sanitary Protection Area Boundaries.mxd

2.4.2.3 Relevant Legislation for Permitting

The procedure for obtaining a construction permit is governed by Article 51 of the Town Planning Code of the Russian Federation dated 29 December 2004, No.190-FL (Ref. 2.17).

Once the national EIA has been approved, South Stream Transport will apply for a construction permit which states the conformity of Project documentation with the requirements of the relevant territorial planning system. The construction permit provides the builder with the right to undertake construction, reconstruction of capital development, as well as capital repairs; except for cases stipulated by the Town Planning Code of the Russian Federation.

Offshore construction within the EEZ requires a construction permit issued by a federal executive body. A construction permit within an area which is not subject to town planning regulations or for which urban regulations are not established can be issued by a federal executive body, by an executive authority of the Russian Federation or by a competent local authority.

2.4.2.4 Relevant Legislation for the Offshore Section of the Project

Legislation relevant for the offshore section of the Project includes:

- Russian Federation Law "On Russian Exclusive Economic Zone, Territorial Waters and Adjacent Offshore Areas of the Russian Federation", No. 155-FZ, 31 July 1998 (Ref 2.18);
- Water Code of the Russian Federation No. 74-FZ, 3 June 2006 (Ref. 2.19);
- Russian Federation Law "*On the Continental Shelf of the Russian Federation*", No. 187-FZ, 30 November 1995 (Ref. 2.20);
- Russian Federation Government Order "On Approval of the Procedure for the Construction of Underwater Cables and Pipelines in the Internal Maritime Waters and Territorial Sea of the Russian Federation", No. 68, 26 January 2000 (Ref. 2.21);
- Russian Federation Government Enactment "*On the Adoption of Issuing Permits for Underwater Cabling and Piping on the Continental Shelf*", No. 417, 9 June 2010 (Ref. 2.22);
- Russian Federation Government Enactment "*On the List of Facilities Subject to Federal Environmental Control*", No. 85, 16 February 2008 (Ref. 2.23);
- Russian Federation Law "*On State Border of the Russian Federation*", No. 4730-1, 1 April 1993 (Ref. 2.24);
- Russian Federation Government Enactment "*On Procedure for Adoption of Permissible Standards of Substances and Microorganisms Discharge into Water Bodies for Users of the Water Bodies*", No. 469, 23 July 2007 (Ref. 2.25);
- Russian Federation Government Order "*On Adoption the List of Harmful Substances Prohibited to Discharge from Ships and Other Watercrafts, Aircrafts, Artificial Islands, Installations and Structures in the Exclusive Economic Zone of the Russian Federation*", No. 251, 24 March 2000 (Ref. 2.26);

- Russian Federation Government Order "*On Approval of the Permissible Concentrations Limits and Conditions for Discharge of Harmful Substances in the Exclusive Economic Zone of the Russian Federation*" (as amended) No. 748, 3 October 2000 (Ref. 2.27); and
- Russian Federation Government Order "*On Approval of the Order of Construction, Operation and Use of Artificial Islands, Structures and Plants in Internal Waters and Territorial Sea of Russian Federation*", No. 44, 19 January 2000 (Ref. 2.28).

2.4.3 EIA and Associated Legislation

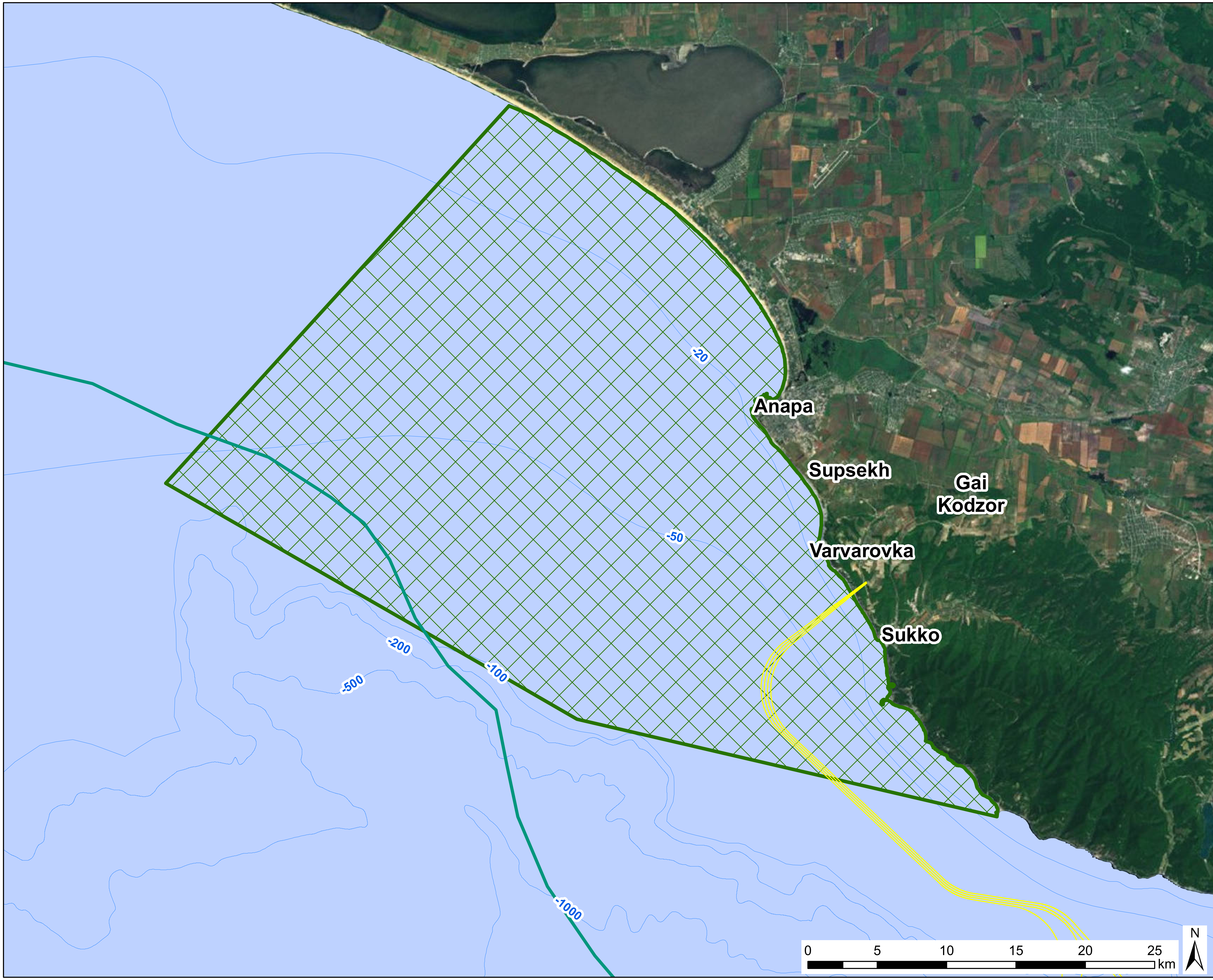
The EIA process in the Russian Federation is controlled at the national level by the following laws:

- Article 32 of the Federal Law '*On Environmental Protection*', No. 7-FZ, 10 January 2002 (Ref. 2.29); and
- '*Regulations on Environmental Impact Assessment*' sanctioned by the Goskomekologii (the former State Committee for Environment Protection which was responsible for environmental regulation and protection in Russia until it was dissolved in 2000) (Ref. 2.30) of the Russian Federation in Order No. 372 dated 16 May 2000, and registered in the Russian Federation Ministry of Justice, No. 2302, 04 July 2000 (Ref. 2.31).

According to Order No. 372, the Russian Federation EIA process comprises three main stages:

- **Stage 1:** Preliminary Stage, includes notification, pre-assessment to support the development of Terms of Reference (ToR) for EIA, and consultations on the ToR;
- **Stage 2:** EIA Study, includes the development of a Draft EIA Report, disclosure of the Draft EIA to the public for information, and Public Hearings to consult public opinion; and
- **Stage 3:** Finalisation of the EIA Report, taking into consideration the results of public consultation.

The requirements of Order No. 372 are often read in association with the City Planning Code, No. 190-FZ (adopted 29 December 2004) (Ref. 2.17) and with Governmental Order No. 87 (Ref. 2.32) which clarifies the requirements for the Project Design Documentation (the 'Proekt').



LEGEND

Russian Sector of South Stream Offshore Pipeline

- Proposed offshore pipelines
- Anapa Bank
- Russian territorial waters boundary
- Isobaths

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue

For Information

Client

South Stream Offshore Pipeline — Stream ENERGISING EUROPE

Project Title

SOUTH STREAM
OFFSHORE PIPELINE

Drawing Title

ANAPA BANK BOUNDARY

Drawn	Checked	Approved	Date
DH	RW	MW	04 Mar 2014

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Drawing Number

Figure 2.4

Rev

Plot Date: 04 Mar 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA\Chapter 2 Russian Legislation\Figure 2.4 Anapa Bank Boundary.mxd

Under Russian Federation requirements[2], the Final EIA Report, the Environmental Protection Measures, and Environmental Monitoring Programme are usually incorporated under Section 7 of the Project Design Documentation for linear facilities. For context, paragraphs 34-42 of Order No. 87 require that Project Design Documentation for linear infrastructure include ten sections:

- Section 1: Explanatory Note;
- Section 2: The Project Right of Way (RoW);
- Section 3: Technological and Design Solutions of Linear Objects and Artificial Structures;
- Section 4: The Buildings, Structures and Facilities that are Included in the Infrastructure of the Linear Object;
- Section 5: Project Construction Management;
- Section 6: Project Organization Demolition (Dismantling) of a Linear Object;
- Section 7: Measures on Environmental Protection;
- Section 8: Fire Safety Measures;
- Section 9: Construction Budget; and
- Section 10: Other Documentation in the Cases Stipulated by Federal Law.

2.4.3.1 Russian Authority Review and Approval Process

The main law that prescribes the review and approval process is the Russian Federation Urban Planning Code, No. 190-FL of 29 December 2004 (Ref. 2.17). Law 190-FL requires that Project Design Documentation should pass through State Environmental Expert Review (SEER) and State Expert Review (SER) (Article 49) in cases where the planned activity is within the Continental Shelf, Territorial Sea or EEZ. The requirements for SEER are provided in:

- Federal law "*On Environmental Expert Assessment*", No. 174-FZ of 23 November 1995 (Ref. 2.33).

SEER requires, as part of documentation submitted for their review, decision and recommendations of Federal Fisheries Authority (FFA). The requirements for FFA review and approval are provided in Federal law "*On Fisheries and the Protection of Water Bio-resources*", No. 166-FZ of 20 December 2004 (Ref. 2.34), and associated Russian Federation Government regulation No. 569 of 28 July 2008 (Ref. 2.35).

In summary, these laws require:

1. Review and approval of fish damage calculations and mitigation measures for aquatic bio-resources by the Federal Fisheries Authority ('Rosrybolovstvo');

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[2] Governmental Order No.87, 16 February 2008. On "The Composition of Design Documentation and Requirements for Content" (Ref 2.32).

2. Review and approval of the offshore design documentation by the State Environmental Expert Review ('Ecologicheskaia Expertiza'); and
3. Review and approval of the whole design documentation by the State Expert Review ('Glavgosexpertiza').

The review and approval process takes place consecutively in this order.

2.4.3.2 History of the Project with Reference to National Requirements

With reference to the above legal frameworks, the history of the Project to date can be summarised as follows:

Stage 1: Preliminary Stage of Project Elaboration (Feasibility Study):

- In April 2010, prior to establishment of South Stream Transport A.G. and South Stream Transport B.V. [3], Gazprom submitted a Declaration of Intent for the Project to the Krasnodar Krai Administration;
- On behalf of Gazprom, DIEM prepared a Preliminary EIA[4] as part of a feasibility study that was reviewed and approved by State Environmental Expert Review on 24 September 2010. In summary, SEER concluded that the Feasibility Study and Preliminary EIA complied with regulatory requirements of the Russian Federation; SEER considered the predicted environmental impacts as acceptable; and SEER made recommendations for consideration during the detailed design process and production of the Final EIA Report; and
- South Stream Transport A.G. was then established on 03 October 2011 and became the new proponent of the South Stream Offshore Pipeline.

Stage 2: Development of Project Design Documentation, including EIA according to ToR

During 2012 and 2013, Peter Gaz prepared design documentation for Russian Federation approvals:

- Based on the Preliminary EIA, South Stream Transport prepared a draft ToR for the Project EIA. The ToR was disclosed for public comment in July 2012, and the ToR was finalised in August 2012. The Final ToR for the Project can be found in Russian on the South Stream Transport website at www.south-stream-offshore.com;
- EIA studies were undertaken in accordance with the ToR;
- South Stream Transport moved headquarters from Switzerland to The Netherlands; South Stream Transport B.V. was established on 14 November 2012 and formally became the new proponent of the South Stream Offshore Pipeline;

[3] Previously, the Project was developed by Gazrpom during 2009-2011, and then by South Stream Transport AG during 2011-2012. South Stream Transport then moved its head office from Switzerland to the Netherlands and established South Stream Transport B.V. in November 2012.

[4] Note that a Preliminary EIA was not required to be submitted for SEER review and approval by prevailing legislation. It was Gazprom's voluntary initiative to obtain a preliminary opinion from SEER.

- Sediment dispersion modelling was performed, fish damage calculations prepared, and mitigation measures for aquatic bio-resources were designed in accordance with requirements. The "FFA Package" was submitted to the FFA on 17 April 2013, and was approved by the FFA on 30 May 2013, and by the Azov – Black Sea Territorial Administration (regional branch of FFA) on 16 July 2013; and
- The Draft EIA Report was disclosed for public comment on 29 April 2013, more than 30 days prior to the public hearing that took place in Anapa on 31 May 2013. The public disclosure and public hearing provided opportunities for the public and any non-statutory stakeholders to express their opinions on the Project, and were conducted in conformance with procedures required by Order No. 372.

Stage 3: Finalisation of the EIA Report

- The Offshore EIA was finalised by Peter Gaz in July 2013 taking into consideration the results of public disclosure and hearing. The Onshore EIA was finalised by Peter Gaz in November 2013.

Results of the national EIA, the Environmental Protection Measures, and Environmental Monitoring Programme were incorporated under Section 7 of the Proekt in accordance with Governmental Order No, 87. Project Design Documentation for the marine area (Ref. 2.32), together with FFA approval, was submitted to SEER on 22 July 2013. Approval of the documentation for the offshore component of the Proekt was issued by SEER on 28 October 2013. Project Design Documentation was submitted to SER, in late November to early December 2013. Approval was granted by SER on 13 March 2014.

2.5 Local and Regional Legislation

This section describes the local and regional legislation of relevance to the Project. Key legislation relevant to the Project is described below. A detailed listing of all legislation is included in Appendix 2.2.

2.5.1 Cultural Heritage Sites of Regional Importance

Law No. 313-KZ of the Krasnodar Krai on "*Immovable Historical and Cultural Monuments of Historical and Cultural Regional Importance, situated in Krasnodar Krai"* dated 17 August 2000 (Ref. 2.36), sets out an approved list of cultural heritage sites located within Krasnodar Krai. These sites are also included in the 'United States Registry of the Cultural Heritage Sites' as sites of regional importance. Law of the Krasnodar Krai No. 2316-KZ dated 19 July 2011 *"On the Designated Areas and Protection Zones of Immovable Cultural Heritage (Historical And Cultural Monuments) of Regional and Local Value Located in the Krasnodar Region"* (Ref. 2.37) specifies the procedure for changing the protection status of the sites, requirements and limitations of land use associated with the cultural heritage objects, and outlines protection measures including appropriate exclusion zones.

2.5.2 Red Data Book of the Krasnodar Krai

The Decree of the Head of the Administration for Krasnodar Krai, 'On the Red Data Book of Krasnodar Krai', dated 21 December 2010 No.1202 (Ref. 2.38), outlines protection principles for the Red Data Book of Krasnodar Krai, as well as the procedure for keeping records and the protection categories of the listed species.

The Krasnodar Red Data Book provides information with regards to the conservation importance or rarity of species, their taxonomy and their distribution. Species listed are assigned a code based on their level of conservation concern and degree of threat. This scale comprises the following categories:

- *Probably Extinct* – Taxa and populations that inhabited Russian territory (or marine area) in the past and whose presence has been not confirmed in 50 years;
- *Endangered* – Taxa and populations whose abundance has decreased down to critical levels so that they can become extinct in the near future;
- *Decreasing Number* – A species identified as being 'Vulnerable' is considered to be facing a high risk of extinction in the wild;
- *Rare* – An 'Endangered' species that is considered to be facing a very high risk of extinction in the wild;
- *Uncertain Status* – A 'Critically Endangered' species that is considered to be facing an extremely high risk of extinction in the wild; and
- *Rehabilitated and Rehabilitating* – Taxa and populations whose number and distribution is recovered or recovering due to the undertaking of protective measures. They are close to the state of stable existence without any urgent measures on protection and rehabilitation.

These categories are aligned with those used by the Red Data Book of the Russian Federation, and are comparable to categories of the IUCN Red List. **Chapter 3 Impact Assessment Methodology**, **Chapter 11 Terrestrial Ecology**, and **Chapter 12 Marine Ecology** describe how these classifications have been used in determining the species sensitivity within the impact assessment process.

2.6 International and Regional Environmental and Social Conventions and Treaties

Russia has ratified international conventions regarding environmental protection, sustainable development, socio-economics and human rights. Table 2.1 outlines the conventions and protocols relevant to the Project.

2.6.1 Espoo Convention

The UNECE Convention on Environmental Impact Assessment in a Transboundary Context, 1991 (Espoo Convention) came into force internationally on 10 September 1997 (Ref. 2.43).

The main objective of the Convention is to promote environmentally sustainable economic development, as a preventive measure against transboundary environmental degradation. The Espoo Convention stipulates obligations of parties to assess transboundary environmental impacts of a project in the early planning stages. It also specifies the obligation of Parties of Origin (parties under whose jurisdiction a planned activity is due to take place) to notify and consult Affected Parties (parties anticipated to be affected by transboundary impacts of a proposed activity) when a project in their territory is likely to have a significant adverse transboundary impact. Parties of origin can ask the developer to undertake further public consultation, in addition to normal EIA requirements.

The Russian Federation signed the Espoo Convention in 1991; however it has yet to be ratified. Nevertheless, in line with IFC Performance Standards, transboundary impacts have been assessed in **Chapter 21 Transboundary Impact Assessment**.

2.6.2 Bucharest Convention

The Convention on the Protection of the Black Sea Against Pollution (Bucharest 1992), also referred to as the Bucharest Convention, was signed and ratified by the Russian Federation, Georgia, Ukraine, Romania, Bulgaria and Turkey.

The basic objective of the Bucharest Convention is to ensure that the contracting parties implement the necessary legislation in order to reduce and control the pollution in the Black Sea and to protect and preserve its marine environment. The Convention also provides a legal framework for co-operation and coordination of the signatory parties.

The Bucharest Convention foresees an obligation on Signatory Parties to assess the impact of and notify the results of this assessment to the Black Sea Commission for any activity under the jurisdiction of that party which may cause substantial pollution or significant and harmful changes to the environment of the Black Sea. Mitigating measures should also be communicated.

South Stream Transport met with the Permanent Secretariat of Black Sea Commission in November 2012 to inform them about the Project and the national EIA and ESIA being undertaken in Russia, Turkey and Bulgaria for the South Stream Offshore Pipeline (further information is provided in **Chapter 6 Stakeholder Engagement**). It should be noted, however, that the obligation to notify activities that may significantly impact the environment of the Black Sea is the responsibility of the national governments of the respective signatory parties rather than the responsibility of the project owner.

Table 2.1 International Conventions and Protocol's Relevant to the Project

Convention	Status	Reference	Purpose / Relevance to the Project
Environment			
Convention Concerning the Protection of the World Cultural and Natural Heritage, 1972	Ratified (1988)	Ref. 2.39	The Convention confirms the protection and preservation of the world's cultural and natural heritage. / There may be disturbance to cultural / natural heritage sites in the Project Area.
Convention for the Protection of the Ozone Layer (Vienna Convention), 1985	Ratified (1986)	Ref. 2.40	The Convention aims to ensure global co-operation for the protection of the Ozone Layer. / The Project should aim to reduce or eliminate emissions of manmade ozone depleting substances.
Convention on Biological Diversity (Rio), 1992	Ratified (1995)	Ref. 2.41	The Convention promotes conservation of biological diversity and sustainable use of its components. / The Project pipeline corridor and temporary facilities will impact habitats.
Convention on Environmental Impact Assessment in Transboundary Context (Espoo Convention), 1991	Signed not ratified (1991) See Section 2.7	Ref. 2.42	The Convention obliges parties to assess transboundary impacts. / The Project will have transboundary impacts.
Convention on Long-Range Transboundary Air Pollution (Geneva Convention), 1979	Ratified (1980)	Ref. 2.43	The Convention agrees to reduce and prevent transboundary air pollution. / The Project will produce air pollution that may be transboundary.

Continued…

Convention	Status	Reference	Purpose / Relevance to the Project
Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (Basel Convention), 1992	Ratified (1995)	Ref. 2.44	The Convention regulates the transboundary movements of hazardous wastes and provides obligations to its Parties to ensure that such wastes are managed and disposed of in an environmentally sound manner. / The Project may generate hazardous wastes.
Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention), 1972	Ratified (1975)	Ref. 2.45	The Convention controls pollution of the sea by dumping, and to encourage regional agreements supplementary to the Convention. / The Project will generate offshore wastes.
Convention on the Protection of the Black Sea Against Pollution (Bucharest Convention), 1992	Ratified (1993)	Ref. 2.46	The Convention is an agreement on controlling land-based pollution, waste, and accidents (e.g. spills). / The Project will produce land-based pollution and waste.
Convention on the Transboundary Effects of Industrial Accidents (Helsinki Convention), 1992	Ratified (1994)	Ref. 2.47	The Convention sets measures to protect human beings and the environment against the effects of industrial accidents, and to promote active international cooperation between the contracting parties before, during and after such accidents. / The Project may have industrial accidents and is transboundary.
Convention on Wetlands of International Importance, especially as Waterfowl Habitat (Ramsar), 1971	Ratified (1976)	Ref. 2.48	The Ramsar Convention promotes the importance of the ecological functions of wetlands. / The Project's onshore facilities may impact on wetlands.

Continued…

Convention	Status	Reference	Purpose / Relevance to the Project
International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 (MARPOL Convention) Annex I – VI	Ratified (1985)	Ref. 2.49	The Convention covers the prevention of pollution of the marine environment by ships from operational or accidental causes. Annex I includes regulations for the Prevention of Pollution by Oil. Annex II includes regulations for the Control of Pollution by Noxious Liquid Substances in Bulk. Annex III includes regulations for the Prevention of Pollution by Harmful Substances Carried by Sea in Packed Form. Annex IV includes regulations for the Prevention of Pollution by Sewage from Ships. Annex V includes regulations for the Prevention of Pollution by Garbage from Ships. Annex VI includes regulations for the Prevention of Air Pollution from Ships. / The Project will generate pollution from vessels used during offshore construction.
International Convention on Civil Liability for Bunker Oil Pollution Damage (BUNKER), 1978	Ratified (1984)	Ref. 2.50	The Convention aims to ensure that adequate, prompt, and effective compensation is available to persons who suffer damage caused by spills of oil, when carried as fuel in ships' bunkers. / Accidents may result in spills to sea from vessels during construction and operation.
International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC), 1990	Ratified (2009)	Ref. 2.51	The Convention sets the requirement for all ships to carry a shipboard oil pollution emergency plan (SOPEP) and to report incidents of pollution to coastal authorities and the convention details the actions that are then to be taken. / For vessels over 400 tons to be used during the Project will need to carry a SOPEP and comply with regulations in this Convention should any spills occur.
Protocol to the United Nations Framework on Climate Change (Kyoto Protocol), 1997	Ratified (2004)	Ref. 2.52	The Protocol introduces emission targets. / The Project will form part of Russia's total emissions output.
United Nations Framework Convention on Climate Change (UNFCC), 1992	Ratified (1994)	Ref. 2.53	The Convention seeks to reduce climate change. / The Project will produce emissions.

Continued…

Convention	Status	Reference	Purpose / Relevance to the Project
Stockholm Convention on Persistent Organic Pollutants	Ratified (2011)	Ref. 2.54	To ensure the limitation of pollution by persistent organic pollutants (POPs), the Convention defines the substances in question, while leaving open the possibility of adding new ones, and it also defines the rules governing the production, importing and exporting of those substances. / Substances covered by this convention may potentially be used on this Project and guidance or restrictions governing these substances will be adhered to.
Labour			
International Labour Organization (ILO) Convention (No.29) on Forced Labour	Ratified (1956)	Ref. 2.55	The Convention adopts proposals to eliminate forced or compulsory labour. / The Project will need to employ people and recognise these principles.
ILO Convention (No. 87) on Freedom of Association and Protection of the Right to Organize	Ratified (1956)	Ref. 2.55	The Convention protects the right to freedom of association and protection of right to organise. / The Project will need to employ people and recognise these principles.
ILO Convention (No.98) on the Right to Organize and Collective Bargaining	Ratified (1956)	Ref. 2.55	The Convention determines that workers shall have protection from discrimination and interference. / The Project will need to employ people and recognise these principles.
ILO Convention (No.100) on Equal Remuneration	Ratified (1956)	Ref. 2.55	The Convention adopts proposals on the principle of equal remuneration for men and women for work of equal value. / The Project will need to employ people and recognise these principles.

Continued…

Convention	Status	Reference	Purpose / Relevance to the Project
ILO Convention (No.105) on the Abolition of Forced Labour	Ratified (1998)	Ref. 2.55	The Convention stipulates that all parties shall eliminate and will not make use of any form of compulsory or forced labour. / The Project will need to employ people and recognise these principles.
ILO Convention (No.111) on Discrimination (Employment and Occupation)	Ratified (1961)	Ref. 2.55	The Convention promotes equality of opportunity and treatment in employment and occupation. / The Project will need to employ people and recognise these principles.
ILO Convention (No.138) on Minimum Age (of Employment)	Ratified (1979)	Ref. 2.55	The Convention pursues the abolition of child labour and increases the minimum age for admission to employment. / The Project will need to employ people and recognise these principles.
ILO Convention (No. 182) on the Worst Forms of Child Labour	Ratified (2003)	Ref. 2.55	The Convention obliges parties to take effective measures to prohibit and eliminate the worst forms of child labour. / The Project will need to employ people and recognise these principles.
ILO Convention (No. 98) Concerning the Application of the Principles of the Right to Organize and Bargain Collectively	Ratified (1956)	Ref. 2.55	The aim of the Convention is to establish the rights of union members to organise independently, without interference by employers. / The Project will need to employ people and recognise these principles.
UN Convention on the Rights of the Child, Article 32.1	Ratified (1990)	Ref 2.56	The aim of the Convention is to set standards for the defence of children against the neglect and abuse they face to varying degrees in all countries every day and it allows for different cultural, political and material realities among states with the most important consideration being the best interest of the child. / The project will adhere to these standards in regards to local project affected communities.

Continued…

Convention	Status	Reference	Purpose / Relevance to the Project
UN Convention to Suppress the Slave Trade and Slavery, 1926	Party to	Ref. 2.57	The Convention undertakes to prevent and suppress the slave trade and to progressively bring about the complete elimination of slavery in all its forms. / The Project will need to employ people and recognise these principles. (See also IFC PS4 paragraph 22 – Forced Labour)
Socio-Economic and Human Rights			
International Covenant on Economic, Social and Cultural Rights, 1966	Ratified (1973)	Ref. 2.58	The Convention promotes equal rights of men and women to enjoy all economic, social and cultural rights. / The Project will need to employ people and recognise these principles.
UN Convention on the Elimination of All Forms of Discrimination against Women, 1979	Ratified (1981)	Ref. 2.59	The Convention sets out agenda to end discrimination against women. / The Project will need to employ people and recognise principles of equality of men and women.
UN Convention on the Rights of Persons with Disabilities, 2006	Ratified (2012)	Ref. 2.60	The Convention promotes non-discrimination and equality of opportunity. / The Project will need to employ people and recognise these principles.
International Convention on the Elimination of All Forms of Racial Discrimination, 1966	Ratified (1969)	Ref. 2.61	The Convention undertakes to eliminate racial discrimination in all its forms and promote understanding. / The Project will need to employ people and recognise these principles.
Convention for the Suppression of the Traffic in Persons and of the Exploitation of the Prostitution of Others, 1950	Ratified (1954)	Ref. 2.62	The Convention requires state signatories to punish any person who "procures, entices or leads away, for purposes of prostitution, another person, even with the consent of that person", "exploits the prostitution of another person, even with the consent of that person" / The Project will need to employ people and recognise that all employees must adhere to these principles.

Continued…

Convention	Status	Reference	Purpose / Relevance to the Project
European Convention for the Protection of Human Rights and Fundamental Freedoms	Ratified (1998)	Ref. 2.63	The Convention is designed to protect human rights and fundamental freedoms in Europe. / The Project will need to employ people and recognise these principles.
UN Convention on the Political Rights of Women, 1953	Ratified (1954)	Ref. 2.64	The Convention gives women the right to vote or hold office, as established by national law, on equal terms with men and without discrimination on the basis of sex. / The Project will need to employ people and recognise these principles.
Supplementary Convention on the Abolition of Slavery, the Slave Trade, and Institutions and Practices Similar to Slavery	Ratified (1957)	Ref. 2.65	The Convention bans debt bondage, serfdom, early and servile marriage and child servitude. / The Project will need to employ people and recognise these principles.
UN Convention on the Elimination of All Forms of Racial Discrimination	Ratified (1969)	Ref. 2.66	The Convention commits its members to the elimination of racial discrimination and the promotion of understanding among all races. / The Project will need to employ people and recognise these principles.
UN Covenant on Civil and Political Rights	Ratified (1973)	Ref. 2.67	The Covenant commits its parties to respect the civil and political rights of individuals, including the right to life, freedom of religion, freedom of speech, freedom of assembly, electoral rights and rights to due process and a fair trial. / The Project will need to employ people and recognise these principles.
UN Convention Relating to the Status of Refugees	Ratified (1993)	Ref. 2.68	The Convention sets out the rights of individuals who are granted asylum and the responsibilities of nations that grant asylum. / The Project acknowledges the Russian Federation's obligations under this convention.

Continued…

Convention	Status	Reference	Purpose / Relevance to the Project
UN Protocol Relating to the Status of Refugees	Ratified (1993)	Ref. 2.69	This protocol removes the temporal and geographical boundaries of the previous Convention of 1951. / The Project acknowledges the Russian Federation's obligations under this convention.
Protocol Additional to the Geneva Conventions of August 12, 1949, and Relating to the Protection of Victims of International Armed Conflicts (Protocol I)	Ratified (1997)	Ref. 2.70	The Protocol reaffirms the international laws of the original Geneva Conventions of 1949, but adds clarifications and new provisions to accommodate developments in modern international warfare that have taken place since the Second World War. / The Project acknowledges the Russian Federation's obligations under this convention.
Protocol Additional to the Geneva Conventions of August 12, 1949, and Relating to the Protection of Victims of Non-International Armed Conflicts (Protocol II)	Ratified (1989)	Ref. 2.71	The Protocol defines certain international laws that strive to provide better protection for victims of internal armed conflicts that take place within the borders of a single country. / The Project acknowledges the Russian Federation's obligations under this convention.
UN Convention on the Elimination of All Forms of Discrimination Against Women	Ratified (1981)	Ref. 2.72	The Convention establishes an agenda of action for putting an end to sex-based discrimination. / The Project will need to employ people and recognise these principles.
Convention Against Torture and Other Cruel, Inhuman or Degrading Treatment or Punishment	Ratified (1987)	Ref. 2.73	The Convention requires states to take effective measures to prevent torture within their borders, and forbids states to transport people to any country where there is reason to believe they will be tortured. / The Project acknowledges the Russian Federation's obligations under this convention.

Continued…

Convention	Status	Reference	Purpose / Relevance to the Project
Convention on the Rights of the Child	Ratified (1990)	Ref. 2.74	The Convention is a human rights treaty setting out the civil, political, economic, social, health and cultural rights of children. / The Project acknowledges the Russian Federation's obligations under this convention.
Health and Safety			
International Convention for the Safety of Life at Sea (SOLAS), 1974	Ratified (1980)	Ref. 2.75	The Convention specifies the minimum standards for the construction, equipment and operation of ships compatible with their safety. / The Project will use vessels which must adhere to the SOLAS Convention.
International Convention on Maritime Search and Rescue (SAR), 1979	Ratified (1988)	Ref. 2.76	The Convention aims to develop an international SAR plan, so that, no matter where an accident occurs, the rescue of persons in distress at sea will be co-ordinated by a SAR organization and, when necessary, by co-operation between neighbouring SAR organizations. / The vessels used during this Project will adhere to this Convention.
International Convention on Standards of Training, Certification and Watch Keeping for Seafarers (STCW), 1978	Ratified (1984)	Ref. 2.77	The Convention establishes basic requirements on training, certification and watch keeping for seafarers on an international level. / The personnel on board vessels used during the offshore Project Phases must comply with these requirements.

Complete.

2.7 Standards and Guidelines for International Financing

The Project is being carried out in accordance with applicable standards and guidelines for financing, including the OECD Common Approaches, the Equator Principles III, the Japanese Bank for International Cooperation Guidelines for Confirmation of Environmental and Social Consideration and the International Finance Corporation Performance Standards.

2.7.1 Equator Principles III

The Equator Principles[5] (EP) is a set of ten voluntary environmental and social standards to be adhered to if the Project is to be financed by Equator Principles Financial Institutions (EPFIs). EPFIs are financial service providers that are contracted by a client to carry out banking services for a Project. The Equator Principles were first launched in 2003, subsequently updated in 2006 (EPII) and then again in 2013 (EPIII).

For this Project, EPIII apply. EPIII draw on the 2012 version of the IFC PS and the World Bank Group Environmental, Health and Safety (EHS) Guidelines. The EPs focus on project environmental and social standards and responsibilities. The EPs, in particular, highlight the protection of indigenous peoples, labour standards, and the importance of consultation with locally affected communities. Principles 1 to 6 are most applicable to the ESIA Stage of the Project and have been described below.

2.7.1.1 Principle 1: Review and Categorisation

Principle 1 applies where total Project capital costs are US$10 million or more and includes the steps to be taken by the EPFIs to determine the project category in relation to its potential impacts. Ahead of a formal categorisation by EPFIs South Stream Transport has proceeded with this ESIA process on the assumption that EPFIs will give the Project the categorisation of "A" on the basis that it fits the Category A description: *'Projects with potential significant adverse environmental and social risks and/or impacts that are diverse, irreversible or unprecedented.'*

2.7.1.2 Principle 2: Environmental and Social Assessment

Principle 2 highlights the need to conduct a Social and Environmental Assessment (e.g. a full-scale ESIA process, a limited or focused audit, or a straight-forward application of environmental siting, pollution standards, design criteria, or construction standards depending on the categorisation and likely significance of impacts) to address relevant social and environmental impacts and risks of the Project. The assessment should also propose mitigation and management measures relevant and appropriate to the nature and scale of the Project.

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5 http://www.equator-principles.com/

Given the nature and scale of this Project, a comprehensive ESIA process has been undertaken. Table 2.2 outlines where the ESIA process has addressed the following issues in accordance with Principle 2.

Table 2.2 Principle 2 Illustrative List of Potential Social and Environmental Issues to be Addressed in the ESIA Report

Specified Information	Location within ESIA Report
Assessment of the baseline social and environmental conditions	Technical Chapters 7 to 18
Consideration of feasible environmentally and socially preferable alternatives.	Chapter 4 Analysis of Alternatives
Requirements under host country laws and regulations, applicable international treaties and agreements.	Chapter 2 Policy, Regulatory and Administrative Framework
Protection of human rights and community health, safety and security (including risks, impacts and management of project's use of security personnel).	Chapter 14 Socio-Economics
Protection of cultural property and heritage.	Chapter 16 Cultural Heritage
Protection and conservation of biodiversity, including endangered species and sensitive ecosystems in modified, natural and critical habitats, and identification of legally protected areas.	Chapter 11 Terrestrial Ecology and Biodiversity Chapter 12 Marine Ecology
Sustainable management and use of renewable natural resources (including sustainable resource management through appropriate independent certification systems).	Chapter 22 Environmental and Social Management
Use and management of dangerous substances.	Chapter 5 Project Description Chapter 22 Environmental and Social Management
Major hazards assessment and management.	Chapter 5 Project Description Chapter 19 Unplanned Events
Labour issues (including the four core labour standards), and occupational health and safety.	Chapter 14 Socio-Economics
Fire prevention and life safety.	Chapter 5 Project Description Chapter 22 Environmental and Social Management

Continued...

Specified Information	Location within ESIA Report
Socio-Economic impacts.	Chapter 14 Socio-Economics
Land acquisition and involuntary resettlement.	No physical resettlement is foreseen Chapter 4 Analysis of Alternatives Chapter 17 Ecosystem Services Chapter 22 Environmental and Social Management
Impacts on affected communities, and disadvantaged or vulnerable groups.	Chapter 14 Socio-Economics
Impacts on indigenous peoples, and their unique cultural systems and values.	Chapter 14 Socio-Economics
Cumulative impacts of existing projects, the proposed project, and anticipated future projects.	Chapter 20 Cumulative Impact Assessment
Consultation and participation of affected parties in the design, review and implementation of the project.	Chapter 6 Stakeholder Engagement
Efficient production, delivery and use of energy.	Chapter 5 Project Description
Pollution prevention and waste minimisation, pollution controls (liquid effluents and air emissions) and solid and chemical waste management.	Chapter 8 Terrestrial Soil and Groundwater Chapter 9 Air Quality Chapter 12 Marine Ecology Chapter 18 Waste Management

Complete.

2.7.1.3 Principle 3: Applicable Environmental and Social Standards

Principle 3 sets out responsibility of an ESIA Report to establish the Project's overall compliance with (or justified deviation from) the relevant host country laws, respective IFC PS, and EHS Guidelines. The ESIA process has been structured in light of this requirement. Section 2.4.4 and this Section 2.7 provide details of compliance with host country laws, respective IFC PSs and EHS guidelines.

2.7.1.4 Principle 4: Environmental and Social Management System and Equator Principles Action Plan

Principle 4 defines the need for Category A (and B) projects to maintain or establish an Environmental and Social Management System (ESMS) which addresses the management of impacts, risks, and corrective actions required to comply with applicable host country social and environmental laws and regulations, and requirements of the applicable IFC PS and EHS

Guidelines. Where the applicable standards are not met to the EPFI's satisfaction, the client and the EPFI will agree an EP Action Plan (AP).

Principle 4 will therefore be addressed through the development and implementation of a Health, Safety, Security and Environmental Integrated Management System (HSSE-IMS), which will be developed in accordance with GIIP and in line with the requirements of ISO 14001:2004 (Environmental Management System) and OHSAS 18001:2007 (Health and Safety Management System). The HSSE-IMS will be developed and refined during the lifetime of the Project. The overall approach to environmental and social management of the Project is summarised in **Chapter 22 Environmental and Social Management**.

2.7.1.5 Principle 5: Stakeholder Engagement

Principle 5 establishes the requirement to consult with Project Affected Communities in a structured and culturally appropriate manner. For projects with significant adverse impacts on Affected Communities, the client will conduct an Informed Consultation and Participation process and facilitate informed participation by Project Affected Communities to establish whether a project has adequately incorporated their concerns.

The Project has consulted and will continue to consult with relevant stakeholders (people or groups who may be affected by the Project, or who have an interest in it). This engagement to date has included consultation and dialogue about the ESIA process and content, including Project design, expected impacts and measures taken to mitigate and manage impacts.

The South Stream Offshore Pipeline – Russian Sector: Scoping Report (available on the South Stream Transport website) was made publicly available for review on 20 November 2012 for a period of 30 days. During this time, stakeholders had the opportunity to review and comment on the Scoping Report. During this period, South Stream Transport held meetings with a range of stakeholders, including local businesses, local marine users, representatives and general public from affected communities and local, regional and national NGOs.

Further details on consultation and disclosure are included in **Chapter 6 Stakeholder Engagement** and **Chapter 14 Socio-Economics**.

2.7.1.6 Principle 6: Grievance Mechanism

Principle 6 sets out responsibility to establish a grievance mechanism as part of the management system that allows the proponent to receive and facilitate concerns and grievances about the Project's social and environmental performance raised by individuals or groups. The proponent should inform the affected communities about the mechanism in the course of its community engagement process and ensure that the mechanism addresses concerns promptly and transparently, in a culturally appropriate manner, and is readily accessible to all segments of the affected communities.

The requirements for a Grievance Mechanism will be incorporated into the Project HSSE-IMS. As detailed in **Chapter 6 Stakeholder Engagement**, feedback forms have been used during the Scoping Report consultation process and will continue to be used throughout all Project Stages as part of the on-going stakeholder engagement process. The HSSE-IMS will be developed in accordance with GIIP and in line with the requirements of ISO 14001:2004 (Environmental

Management System) and OHSAS 18001:2007 (Health and Safety Management System). The overall approach to environmental and social management of the Project is summarised in **Chapter 22 Environmental and Social Management**.

2.7.2 OECD Common Approaches, 2012

Governments provide official export credits, through Export Credit Agencies (ECAs), to support national exporters competing for overseas sales. The Common Approaches for Officially Supported Export Credits and Environmental and Social Due Diligence (hereafter referred to as 'Common Approaches') recognise that the export credit policy can contribute positively to sustainable development and sets out common approaches for considering environmental and social risks in decisions to offer official support for export credits. The 2012 Common Approaches, as applied to this Project, draw heavily upon the application of recognised international financing institution standards (e.g. EPs and IFC PSs) and apply to all officially supported export credits for capital goods and/or services, excluding military equipment and agricultural commodities.

The Common Approaches objectives are to:

- Promote coherence between members' policies on officially supported export credits, their international environment, climate change, social and human rights policies, and their commitments under relevant international agreements and conventions;
- Develop common procedures and processes relating to the environment and social aspects for official support of export credits to reduce potential for trade distortion;
- Promote good practice and consistent review and assessment processes to achieve a high level of environmental and social performance as measured against international standards;
- Enhance efficiency of official support procedures and ensure administrative processes are relative to the objectives of the Common Approach; and
- Promote a global level playing field for officially supported export credits and increase awareness and understanding among non-members.

The Russian Federation is one of the many non-member countries with which the OECD has a working relationship, in addition to its member countries. The OECD has been cooperating with the Russian Federation since 1992 and the OECD formally acknowledged in 1997 that the accession of the Russian Federation as a full member of the OECD is the ultimate objective of their cooperation.

To satisfy the requirements of the Common Approaches, South Stream Transport:

- Has commissioned this ESIA Report (prepared to meet international standards including relevant IFC PS);
- Will prevent or mitigate (as far as practicable) adverse environmental and social impacts of the Project;
- Will undertake consultation with relevant stakeholders throughout the life of the Project and encourage transparency through information disclosure; and

- Will implement an HSSE-IMS to monitor and improve performance of the Project in accordance with PS1.

2.7.3 Japan Bank for International Cooperation (JBIC) Environmental Guidelines

The Japan Bank for International Cooperation (JBIC) Guidelines for Confirmation of Environmental and Social Consideration (Ref. 2.4) aims to contribute to efforts towards sustainable development, through consideration of the environmental and social aspects in all projects subject to lending or other financial operations by JBIC and the Nippon Export and Investment Insurance (NEXI).

2.7.4 International Finance Corporation Performance Standards

For this Project the most current 2012 IFC PS will apply. The IFC PSs are voluntary standards that set out underlying principles of sustainable project management, including impact and risk assessment, mitigation strategies, public consultation and performance monitoring. The IFC PSs are mandatory for projects seeking funding from the IFC and are also frequently adopted by other financial institutions, including EPFIs and ECAs. Due to their wide application, South Stream Transport has elected to adhere to 2012 IFC PSs regardless of the source of Project financing.

The PS, their relevance to the Project and a brief description of how they have been addressed in the ESIA process is included below.

2.7.4.1 IFC PS1 Assessment and Management of Environmental and Social Risks and Impacts

PS1 outlines the requirements for social and environmental performance management throughout the life of a project. This is achieved through an integrated assessment to identify the environmental and social impacts, risks, and opportunities of the Project, effective engagement with affected local communities and other stakeholders, and the application of an Environmental and Social Management System (ESMS) to monitor and improve performance.

This PS applies to business activities with environmental and/or social risks and/or impacts. The level of environmental and social assessment and management is expected to be appropriate to the nature and scale of the project. Given the nature and scale of this Project, a comprehensive ESIA process is required to be undertaken, as documented through this ESIA Report. This impact assessment process has taken into consideration the requirements of PS1 through PS8, as well as, the requirements of the Russian Federation (see Section 2.4.4 for details of the Russian EIA Legislation).

As recommended in the IFC's Guidance Notes: Performance Standards on Environmental and Social Sustainability (Ref. 2.7), the following stages have been undertaken as part of this ESIA process:

- **Initial Screening of the Project** – this enabled the identification of Project components and activities; identification of environmental, socio-economic and cultural heritage receptors; the examination of relevant legislative and lender requirements; and, knowledge of the community values and uses associated with the receptors. An analysis of alternatives was also conducted during this stage to identify and evaluate alternative routes for the offshore pipeline (see **Chapter 4 Analysis of Alternatives**);

- **Environmental Issues Identification (ENVIID)** – this process enabled the comprehensive identification of the Project's potential interactions (beneficial and adverse) with environmental, socio-economic and cultural heritage receptors (see **Chapter 3 Impact Assessment Methodology**);
- **Scoping** – this stage identified the likely significant impacts that require further investigation and defined the final scope of the ESIA process by developing terms of reference for studies to assess Project impacts. Details of the Scoping Stage are reported in the South Stream Offshore Pipeline – Russian Sector: Scoping Report (Ref. 2.78);
- **Stakeholder Engagement** – stakeholder engagement has been undertaken throughout the development of the Project to ensure that all interested parties are aware and informed of the Project and that any potential issues are addressed appropriately (see **Chapter 6 Stakeholder Engagement**). South Stream Transport has developed a Stakeholder Engagement Plan (SEP) based on the principles and guidance presented in the IFC's PS1. The SEP also includes engagement activities necessary to meet Russian Federation requirements for the national EIA process. The SEP will be updated periodically throughout the Project lifecycle;
- **Baseline Studies** – the prevailing environmental and social conditions against which the potential impacts of the Project are assessed have been established. This allowed the identification of potentially sensitive receptors (such as ecosystems and local communities) and an evaluation of their level of sensitivity to the impacts. The results are presented on a discipline basis in Chapters 7 to 19 of this ESIA Report; and
- **Impact Significance Assessment** – this was an iterative process considering the following:
    - **Prediction**: What will happen to the environment as a consequence of this Project (i.e. defining Project activities and impacts)?
    - **Evaluation**: Will it have a beneficial or adverse effect? How big is the change expected to be? How important will it be to the affected receptors?
    - **Mitigation**: If the impact is of concern, can anything be done to avoid, minimise, or offset the impact? Or to enhance potential benefits?
    - **Residual Impact**: After mitigation, is the impact still of concern?

This process is further described in **Chapter 3 Impact Assessment Methodology** and the results are presented on a discipline basis in Chapters 7 to 19 of this ESIA Report.

- **Cumulative Impact Assessment** – identified the combined effects of the Project with other projects and activities that may, individually or in combination have a significant cumulative impact. Further details regarding the cumulative impacts can be found in **Chapter 20 Cumulative Impact Assessment**; and
- **Transboundary Impact Assessment** – an assessment was undertaken to identify whether any Project impacts were considered likely to extend across international borders

(e.g. air or water pollution impacts). Further details regarding the transboundary impacts can be found in **Chapter 21 Transboundary Impact Assessment**.

Chapter 3 Impact Assessment Methodology of this ESIA Report provides an overview of the process followed in compiling this ESIA Report and the methodology used to assess impact significance.

Disadvantaged and vulnerable individuals and groups have been identified in accordance with PS1. PS1 states that it is necessary to identify individuals and groups that may be directly and differentially or disproportionately affected by the Project because of their disadvantaged or vulnerable status e.g. by a disability, low income, an existing low level of access to key socio-economic or environmental resources or a low social status which limits their ability to adapt to change. These groups were considered to be a key focus for stakeholder engagement activities undertaken to ensure their concerns about the Project were considered in both Project design and the impact assessment phases. Further assessment and information on disadvantaged and vulnerable individuals and groups is provided in **Chapter 14 Socio-Economics**.

PS1 also stipulates that the Project proponent develop a formal environmental and social policy that reflects the principles captured in the PSs. The South Stream Transport Sustainability Policy is outlined in Section 2.2 and an HSSE-IMS is being developed in accordance with GIIP and in line with the requirements of ISO 14001:2004 (Environmental Management Systems) and OHSAS 18001:2007 (Health and Safety Management Systems). The overall approach to environmental and social management of the Project is summarised in **Chapter 22 Environmental and Social Management**.

2.7.4.2 IFC PS2: Labour and Working Conditions

PS2 establishes the need for workers' rights regarding income generation, employment creation, relationship management, commitment to staff, retention and staff benefits. It identifies and outlines the need to provide workers with a safe and healthy working environment. This PS is guided by international conventions, in particular those of the International Labour Organisation (ILO). Ultimately, the scope of application of this PS depends on the type of employment relationship between the Project and the worker e.g. it applies to workers directly engaged by the client (direct workers), as well as, workers engaged through third parties.

It is recognized that up to approximately 1,200 workers (including all sub-contracted parties and workers) may be engaged at any one time for the Project and, as such, compliance with PS2 is considered to be of relevance to the Project. Worker rights will be consistent with those of South Stream Transport, which is firmly committed to the protection of worker rights in compliance with the conventions listed in Table 2.1 and the relevant Russian statutory requirements.

In particular, the offshore pipelay works will utilise a large workforce (e.g. some vessels may contain over 700 workers at any one time). South Stream Transport is cognisant of the potential labour and working condition risks associated with confined employment and shift work conditions associated with offshore vessel operations. As part of the Project HSSE-IMS, regular audits of working conditions upon these vessels shall be undertaken.

Implementation of the necessary actions required by this PS will be managed through the Project ESMS. Further details on labour and working conditions, as well as occupational health, is included within **Chapter 14 Socio-Economics**. The overall approach to environmental and social management of the Project is summarised in **Chapter 22 Environmental and Social Management**.

2.7.4.3 IFC PS 3: Resource Efficiency and Pollution Prevention

PS3 defines an approach to pollution prevention and abatement in line with current internationally available technologies and good practice. It deals with ambient and cumulative considerations, resource conservation and energy efficiency, hazardous materials and waste management, pesticide use and management, and emergency preparedness and response provisions.

The Project will utilise resources which have the potential to generate pollution. The majority of resources that will be used and potential pollution events (e.g. waste spillage, noise, air pollutants, and greenhouse gases) will arise through the Project's Construction Phase. The main resource used during the Construction Phase will be steel for the pipeline. Throughout the Project Development Phase, efficiency of resource use has been considered and a range of minimum performance criteria and standards have been adopted. **Chapter 5 Project Description** details the range of design, construction and operational standards adopted for the Project.

For both the construction and operation phases, specific mitigation measures (encompassing both avoidance and minimisation measures) to address Project emissions (e.g. emissions associated with exhaust fumes of vessels) are described in the relevant technical chapters of this ESIA Report. In particular, Project resource efficiency measures are included in **Chapter 5 Project Description** and Project-related greenhouse gas (GHG) emissions are considered within **Chapter 9 Air Quality**.

In terms of waste, **Chapter 18 Waste Management** of this ESIA Report details how wastes will be managed throughout the Project, taking into consideration the need for resource use efficiencies. Specifically, the Project will adopt a waste management hierarchy. The waste hierarchy ranks waste management options according to what is best for the environment. In particular, the prevention, re-use and recycling of Project items where possible will help maximize resource use efficiency throughout the Project.

The overall approach to environmental management in line with these guidelines is summarised in **Chapter 22 Environmental and Social Management**.

2.7.4.4 IFC PS 4: Community Health, Safety and Security

PS4 outlines specific requirements for mitigating any potential for community exposure to risks and impacts arising from equipment and infrastructure accidents, releases of hazardous materials and communicable diseases.

The ESIA process has included extensive data gathering on the communities' social, economic and health conditions (as detailed in **Chapter 14 Socio-Economics** of this ESIA Report) as well as data on crime rates.

Project activities have been analysed to determine which aspects associated with the construction and operational phases of the Project could adversely impact communities.

Community health impacts have, for example, been assessed in relation to air emissions from the Project site, noise disturbance and interaction of communities with a large number of migrant workers.

Safety issues have been addressed both in relation to indirect hazards associated with the Project Construction Phase (increased traffic, presence of heavy machinery) and to the safety of the pipeline itself. Major Accident Hazards (MAHs) in relation to the local community during construction, installation and operation of the pipelines are addressed in **Chapter 19 Unplanned Events**. Detailed plans for dealing with the effects on the community of construction, installation and operation of the pipelines will be prepared and managed by South Stream Transport and the respective contractors through South Stream Transport's HSSE-IMS.

Security issues have been analysed in the context of the temporary interaction of relatively small rural communities with a large construction workforce.

2.7.4.5 IFC PS 5: Land Acquisition and Involuntary Resettlement

PS5 recognises that Project related land acquisition and restrictions could have adverse effects on communities or persons that use the land, and therefore, PS5 outlines objectives for avoiding or minimising involuntary physical resettlement as a consequence of development. Appropriate measures should be implemented to mitigate adverse impacts on displaced persons and host communities through appropriate compensation for resettlement or any economic displacement, such as loss of subsistence or commercial livelihood.

The Project will require either the acquisition of land or the leasing of land off of current owners for the onshore pipeline and landfall facilities. The potential impacts of the acquisition and leasing of land for the onshore pipeline and landfall facilities are addressed in **Chapter 14 Socio-Economics**.

No physical resettlement is anticipated; therefore, no Resettlement Action Plan is required.

2.7.4.6 IFC PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources

PS6 sets out an approach to protect and conserve biodiversity, including habitats, species and communities, ecosystem diversity, and genes and genomes, all of which have potential social, economic, cultural and scientific importance. It also sets out definitions of natural, modified and critical habitat types, stating that there should be no net loss of critical habitat as a result of the Project.

The Project has the potential to directly and indirectly impact natural and modified habitat types, both onshore and offshore (e.g. direct loss of habitat, temporary degradation of habitat, injury / harm to species etc.). These impacts have been assessed where necessary according to IFC Guidance for critical habitats. The potential impacts on marine and terrestrial ecology and the relevant identified mitigation measures to address these impacts are detailed in **Chapter 11 Terrestrial Ecology** and **Chapter 12 Marine Ecology**.

The Project may affect potential beneficiaries who may currently benefit from some ecosystem services. A discussion of the ecosystem services received and potential Project impacts upon these services is provided in **Chapter 14 Socio-Economics** of this ESIA Report and fully detailed in **Chapter 17 Ecosystem Services.**

2.7.4.7 IFC PS 7: Indigenous Peoples

PS7 recognises that indigenous peoples can be marginalised and vulnerable if their lands and resources are encroached upon by or significantly degraded by a Project. It recognises that their languages, cultures, religions, spiritual beliefs, and institutions may also be under threat.

Within PS7 the term 'Indigenous Peoples' is used in a generic sense to refer to a distinct social and cultural group possessing the following characteristics in varying degrees:

- *'Self-identification as members of a distinct indigenous cultural group and recognition of this identity by others;*
- *Collective attachment to geographically distinct habitats or ancestral territories in the project area and to the natural resources in these habitats and territories;*
- *Customary cultural, economic, social, or political institutions that are separate from those of the mainstream society or culture; or*
- *A distinct language or dialect, often different from the official language or languages of the country or region in which they reside.'*

The ethnical breakdown of the communities within the surrounding population of the Project has been studied along with the level of interaction and their cultural customs. Further information on these studies is detailed within **Chapter 14 Socio-Economics**. No truly indigenous communities will be affected by the Project, and PS7 is not considered directly applicable. However, pockets of minority nationals exist near Anapa (the strong Armenian community), and some of the principles of PS7 have been applied in regards to this community (see **Chapter 14 Socio-Economics**).

2.7.4.8 IFC PS 8: Cultural Heritage

PS8 aims to protect irreplaceable cultural heritage and to provide guidance for protecting cultural heritage throughout a project's lifecycle. PS8 states that for the purposes of this PS, cultural heritage refers to tangible forms of cultural heritage (e.g. property, sites, structures, or groups of structures with archaeological (prehistoric), paleontological, historical, cultural, artistic, and religious value), unique natural features or tangible objects that embody cultural values (e.g. sacred groves, rocks, lakes, and waterfalls), and certain instances of intangible forms of culture that are proposed to be used for commercial purposes (e.g. cultural knowledge, innovations, and practices of communities embodying traditional lifestyles).

A number of tangible cultural heritage receptors are currently known to be present within the landfall study area and it is therefore considered highly likely that additional objects of archaeological significance could be unearthed during onshore construction activities. Similarly, a number of confirmed cultural heritage objects have been identified offshore (including a shipwreck and a World War II airplane wing) and several potential objects have been identified through preliminary marine surveys. A full description of all identified cultural heritage items and places of significance is provided in **Chapter 16 Cultural Heritage**.

Impacts on onshore cultural heritage and archaeological objects may arise as a result of direct physical disturbance from construction activities (e.g. vegetation clearance, excavation works and pipeline laying). The significance of these impacts and corresponding mitigation measures to avoid and reduce the scale of impacts are discussed in **Chapter 16 Cultural Heritage**.

It is not anticipated that the Project will have an impact on intangible cultural heritage due to the location of the landfall section in areas with no specific notable or listed cultural traditions that could be affected by the Project. Nevertheless, potential impacts on the living cultural heritage and religious practices of communities are considered as part of this ESIA Report. Further details on both tangible and intangible cultural heritage receptors and the potential impacts associated with the Project are included in **Chapter 16 Cultural Heritage**.

Chapter 3: Impact Assessment Methodology

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3 Impact Assessment Methodology

3.1 Introduction

The impact assessment methodology used in this ESIA Report provides a basis to characterise the potential environmental and social impacts of the Project. The methodology is based on models commonly employed in impact assessment, and takes into consideration the International Finance Corporation (IFC) Performance Standards (PS).

Potential impacts arising from planned activities and unplanned events are assessed. Planned activities include routine and non-routine Project activities or events required for the Construction and Pre-Commissioning, Operational, or Decommissioning Phases of the Project; for example, the planned activity of pipe-laying might disrupt seabed sediments leading to an increase in water turbidity. Unplanned events are those not anticipated to occur during the normal course of Project activities; for example, the unlikely event of a vessel collision that may lead to a spill of fuel.

The impact assessment methodology for planned activities takes into consideration impact magnitude and receptor sensitivity. A matrix is also used to derive impact significance, for pre- and post-mitigation conditions.

The concept of likelihood is included in the methodology for unplanned events. The likelihood of the event occurring, and the likelihood of impacts arising are considered.

The assessment of discipline-specific impacts is presented in Chapters 8 to 18. Unplanned Events are addressed in **Chapter 19 Unplanned Events**, and Cumulative and Transboundary impacts are assessed in **Chapters 20 Cumulative Impact Assessment** and **Chapter 21 Transboundary Impact Assessment** respectively.

3.2 ESIA Process

The ESIA process is a systematic approach to identifying the environmental and social impacts of a project, and describing the mitigation, management and monitoring measures that will be implemented to address these impacts. Ultimately, it allows relevant organisations to make informed decisions about development proposals, and allows potentially affected stakeholders to participate in the process.

In order to ensure a robust and detailed impact assessment, the ESIA process has been structured over a series of progressive and iterative stages (Figure 3.1). Stakeholders, the Project team, and assessment team provided input to these stages during the ESIA process.

As part of the Project design process, measures to avoid or minimise impacts were identified and incorporated into the design. These are referred to as "design controls" and include physical design features and management measures. These design controls considered the IFC mitigation hierarchy as discussed in PS1. Section 3.3.10 of this report discusses this hierarchy and how it was applied to the Project's impact assessment in more detail. They are based on Good International Industry Practice (GIIP) and are intended to assist in the avoidance and control of unacceptable impacts. Specific design controls are described in greater detail in **Chapter 5 Project Description**. Where the outcome of the ESIA indicates that design controls are insufficient to manage an impact to an acceptable level, further measures have been identified. These measures have been termed "mitigation measures" and are described in respective chapters and detailed in Environmental and Social Management Plans (**Chapter 22 Environmental and Social Management**).

As shown in Figure 3.1, the ESIA process comprised the following stages:

- **Screening**: an initial identification of potential interactions between the Project and physical, ecological and human receptors (Section 3.2.1) indicating the level of impact assessment required;
- **ESIA Scoping**: outlines the perceived required scope of the ESIA to be undertaken, taking into consideration the nature of the Project, the results of the screening and applicable requirements. This stage included:
    - Environmental Issues Identification (ENVIID): a process of systematic identification of potential interactions between Project activities / events and known receptors (Section 3.2.2.1);
    - Desk-based studies: a review of existing environmental and social information, and gap analysis to identify additional baseline information required for the impact assessment. This included review of previous environmental and geotechnical survey data collected by Peter Gaz on behalf of Gazprom between 2008 and 2012 (Section 3.2.2.1);
    - Identification of potential physical, ecological, and human receptors that may be affected by the Project (Section 3.2.2.3);
    - Alternatives: assessment of Project technical alternatives at the Scoping Stage, including alternative routes and methods (Section 3.2.2.4); and
    - Stakeholder engagement: in November 2012, the South Stream Offshore Pipeline – Russian Sector: Scoping Report was published by South Stream Transport on the company website. Copies were also made available in local communities, and provided directly to some stakeholders. Interested and affected parties were invited through advertisement and direct invitation to participate in scoping meetings, held in Anapa and in Moscow during the week of 10-14 December 2012 (see **Chapter 6 Stakeholder Engagement** for further details). Feedback from the scoping meetings was taken into consideration in the ESIA process.
- **Baseline field surveys**: Following a gap analysis undertaken as part of the ESIA Scoping Stage, baseline field surveys were undertaken to complement existing information. The baseline environmental and social conditions against which the impact assessment was to be undertaken (Section 3.2.3) were described;
- **Impact assessment**: This stage included:
    - Building on the ENVIID conducted during the Scoping Stage to describe activities and potential impacts (Section 3.3.1);
    - Determining the nature of impact (Section 3.3.2), the expected magnitude of impact (section 3.3.3) and the sensitivity of receptors (Section 3.3.4);
    - Assessing the significance of potential impacts (Section 3.3.5) prior to planned mitigation;

- Considering unplanned events, i.e. those events which are not expected to happen during the Project but for which the risk of the event occurrence needs to be assessed (Section 3.3.6);
  - Considering the potential for Project impacts to combine with other impacts associated with existing or planned developments (cumulative impacts, Section 3.3.7) and the potential for Project impacts to extend across national boundaries (transboundary impacts, Section 3.3.8); and
  - Assessing the significance of residual impacts (section 3.3.10) taking into consideration proposed mitigation measures (Section 3.3.9).

- **Environmental and Social Management Plan**: This stage included the development of management plans and procedures as part of South Stream Transport's Health, Safety, Security and Environment Integrated Management System (HSSE-IMS), which captures all of the mitigation measures identified so that they can be practically applied as part of Project development (Section 3.3.11);

- **Stakeholder engagement**: Consultation with regulators and other stakeholders regarding the scope and content of the ESIA Report as well as aiding in the identification of potential Project impacts. Stakeholder engagement has and continues to run across the entire ESIA process (Section 3.4); and

- **ESIA report disclosure**: Release of the ESIA Report to the public so that they can provide opinion and comment on the report or the planned environmental and social management of the Project.

The process is summarised in Figure 3.1, and is described in further detail in following subsections.

3.2.1 Screening

Screening [1] was the first stage undertaken during the ESIA process to identify potential interactions between the Project and existing physical, ecological, and human receptors. Undertaking screening early in the ESIA process facilitated the incorporation of environmental and social considerations into the development of the Project design.

The Screening Stage included the following key steps:

- Identification of Project components and activities;

- Identification of likely physical, ecological and human receptors based on existing knowledge of the environmental and social baseline conditions and professional expertise;

- Examination of relevant national and international legislative requirements; and

- Development of a screening matrix to illustrate the potential interactions of Project activities with the physical, ecological and human receptors.

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[1] Screening in the context of this section refers to early stage of scoping prior to the preparation of the Scoping Report (Ref 3.1).

Decommissioning activities were not considered in detail during the Screening Stage due to limited information available at that time. The resultant screening matrix is presented in Table 3.1.

Figure 3.1 Overall ESIA Process

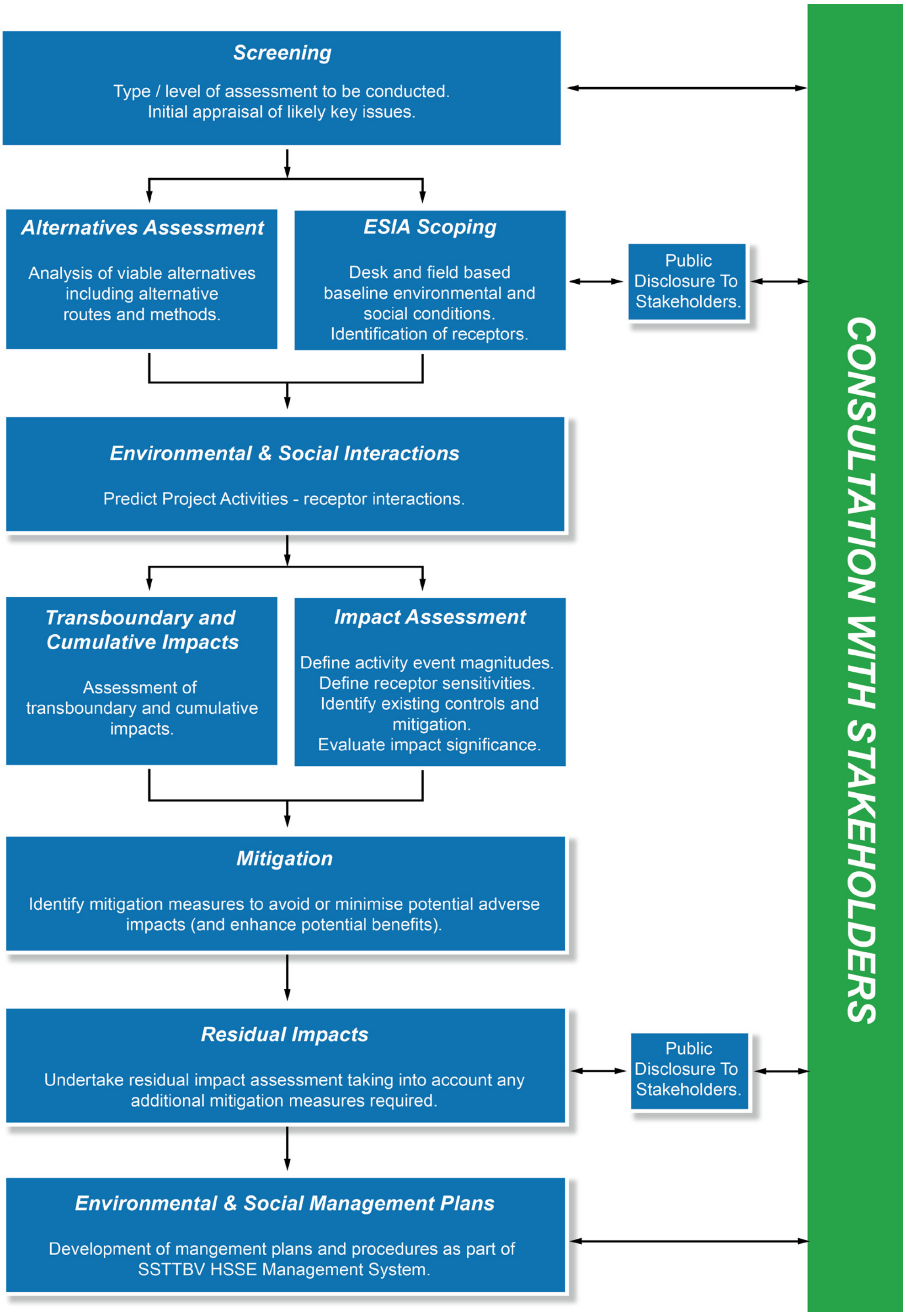


Table 3.1 Environmental and Social Screening Matrix

Impact Receptors	Project Activities		
	Construction Activities	**Commissioning Activities**	**Operational Activities**
Physical			
Water (Surface & Groundwater)	✓		
Water (Marine)	✓	✓	
Soils and Sediments	✓		
Landscape	✓	✓	✓
Climate / Air Quality	✓	✓	
Marine Ecology			
Marine Habitat (including plankton and benthic flora and fauna)	✓	✓	
Marine Mammals	✓	✓	
Shorebirds & Seabirds	✓	✓	
Marine Fish	✓	✓	
Terrestrial Ecology			
Birds	✓	✓	✓
Terrestrial Fauna	✓	✓	
Terrestrial Habitats (vegetation and ecosystems)	✓	✓	
Freshwater Fish	✓		
Human			
Local Communities	✓	✓	✓
Local / Regional Economy (including workers and businesses)	✓		✓
Land Users and Owners	✓		✓

Continued...

Impact Receptors	Project Activities		
	Construction Activities	Commissioning Activities	Operational Activities
Onshore Cultural Heritage	✓		
Offshore Cultural Heritage	✓		
Marine Users	✓	✓	✓

Complete.

3.2.2 ESIA Scoping

Following the Screening Stage, scoping was undertaken to provide further detail of potential environmental and social effects of the Project using additional engineering and baseline data. The Scoping Stage intended to facilitate impact identification in a consistent and robust manner.

3.2.2.1 Environmental Issues Identification (ENVIID) Register

Scoping included a systematic consideration of Project activities and their potential impact on physical, ecological and human receptors. An ENVIID was conducted to determine activities, receptors and impacts of all phases of the Project. This process, supported by interdisciplinary workshops (attended by Project engineers and environmental and social scientists), enabled a comprehensive identification of the Project's potential interactions (beneficial and adverse) with physical, ecological and human receptors. This information was recorded in an ENVIID Register that provided a reference for potential impacts requiring further investigation during the ESIA process.

3.2.2.2 Desk-Based Studies – Review of Existing Baseline Information

An important component of the Scoping Stage is the definition of existing baseline conditions (i.e. the prevailing environmental and social characteristics against which the potential impacts of the Project can be assessed). Baseline conditions were defined during the Scoping Stage through a review of existing environmental and social information.

A significant body of information was available in environmental and geotechnical survey data and reports prepared for the Project between 2008 and 2012 (Ref. 3.2). This information included the results of terrestrial and marine ecology, water quality, sediment and geology, soil and groundwater, cultural heritage and contamination surveys undertaken within the Project Area of Influence.

In addition to Project-specific information, scientific journals, reports by government agencies and by other groups, were reviewed for relevant baseline information.

Existing baseline information used for ESIA Scoping Stage also formed the core of baseline information in the impact assessment (Section 3.3). Where gaps were identified between baseline information available at the Scoping Stage and that required for the ESIA Report (e.g.

out of date, too narrow in scope, etc.), additional surveys or studies were undertaken to collect the required information.

3.2.2.3 Identifying Receptors

Receptors are environmental components, people and cultural heritage assets that may be affected, adversely or beneficially, by the Project. Potential receptors were identified through both desk and field-based studies, taking into consideration likely Project impacts. Based on the review of existing information, four high-level categories of Project receptors were identified:

- Physical (i.e. non-living environmental components, including air quality, water bodies, landscapes, terrestrial soils, marine sediments and geology);
- Marine ecology (i.e. marine habitat, flora and fauna);
- Terrestrial ecology (i.e. terrestrial habitat, flora and fauna); and
- Human (i.e. landowners and residents of local communities, local economy, marine users, cultural heritage).

Individual receptors within these groups were assessed as part of the impact assessment (Chapters 8 to 18) for their sensitivity to the potential impacts of the Project. Human receptors identified formed the basis of the stakeholder engagement activities undertaken (Section 3.4).

3.2.2.4 Analysis of Alternatives

An analysis was undertaken of technically and financially feasible alternatives that would allow the development of a new supply route that provides a safe and reliable means to export Russian gas to the countries of Central and South-Eastern Europe via the Black Sea.

The presentation of the Analysis of Alternatives followed a 'narrowing approach' involving a series of logical steps, starting with the high-level alternatives and progressively narrowing-in on more detailed alternatives. Using this commonly adopted approach the Analysis of Alternatives considers each of the following in series:

- South Stream Offshore Pipeline alternatives:
  - Alternative means of gas transportation; and
  - Offshore (macro) routing.
- The 'Zero' or 'No Project' alternative;
- Project alternatives:
  - Landfall site selection;
  - Shoreline crossing technique (open cut vs. microtunnelling);
  - Onshore routing; and
  - The offshore route optimisation.

The Analysis of Alternatives is described in **Chapter 4 Analysis of Alternatives**. Alternative mitigation and monitoring measures were also considered in the course of the assessment.

3.2.3 Additional Baseline Field Surveys and Studies

Field surveys and desk-based studies required to address identified gaps in baseline data were carried out during 2012 to 2013, and included:

- Air quality monitoring;
- Noise monitoring;
- Terrestrial ecology field surveys (habitat and species based surveys);
- Marine ecology surveys (habitat and species based surveys);
- Marine sediments and sea water quality sampling;
- Cultural heritage identification surveys;
- Beach-use surveys;
- Road traffic surveys; and
- Landscape and visual amenity characterisations.

The details of the surveys undertaken (timing, location, methods and results), together with information gathered through the desk-based studies, are presented in the relevant chapters of this ESIA Report.

3.3 Impact Assessment Framework

The process for assessing potential Project impacts is illustrated in Figure 3.2 and involved:

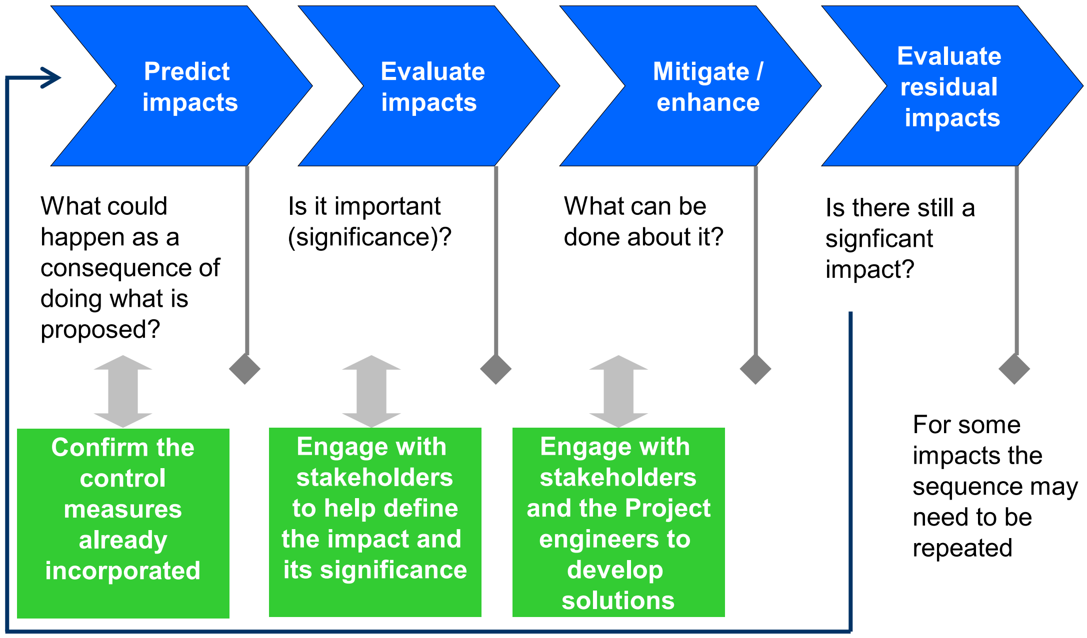
- **Prediction**: What will happen to the environment as a consequence of this Project (i.e. defining Project activities and impacts)?
- **Evaluation**: Will it have a beneficial or adverse effect? How big is the change expected to be? How important will it be to the affected receptors?
- **Mitigation**: If the impact is of concern, can anything be done to avoid, minimise, or offset the impact? Or to enhance potential benefits?
- **Residual Impact**: After mitigation, is the impact still of concern?

Impact significance was assessed with and without mitigation measures in place. The impact significance without mitigation measures was assessed with the design controls in place (Section 3.2). Impacts without mitigation measures in place are not representative of the Project's actual extent of impact, and are included to facilitate understanding of how and why mitigation measures were identified.

The residual impact is what remains following the application of mitigation and management measures, and is thus the final level of impact associated with the development of the Project. Residual impacts also serve as the focus of management and monitoring activities during Project implementation to verify that actual impacts are the same as those predicted in this ESIA Report.

For some types of impact, there are empirical, objective and established criteria for determining the potential impact significance (e.g. if a standard is breached or a protected area is damaged). However, in other cases assessment criteria are more subjective and require professional judgement to a greater degree. The criteria against which the significance of planned impacts was evaluated, for the purposes of this Project, has been described in terms of two components: impact magnitude (Section 3.3.3) and receptor sensitivity (Section 3.3.4). The assessment of unplanned impacts is described in Section 3.3.6.

Figure 3.2 Impact Identification and Assessment Process



3.3.1 Activities and Impacts

Building upon the ENVIID conducted during the Scoping Stage, Project activities and potential impacts upon physical, ecological and human receptors were further defined. For this purpose, the definition of a Project impact was adapted from ISO 14001:2004 (Ref 3.3) [2] as:

- *"Any change to the environment [or social receptors], whether adverse or beneficial, wholly or partially resulting from an organization's environmental [or social] aspects."*

Definitions of an 'activity' and a 'receptor' are not included within ISO 14001:2004, but for the purposes of this Project the following definitions are provided.

[2] Although not designed specifically for use in impact assessment certain terms and principles of this standard were adopted to assist with the impact identification / Scoping Stage.

A Project activity is considered to be:

- A physical action or presence of infrastructure associated with the operation of Project plant, equipment or vehicles, or the actions of Project employees.

A Project receptor is considered to be:

- Someone or something that could be influenced by the Project, including human health, water resources, air quality, ecological habitats or species, cultural heritage assets, and the wider environment.

An impact therefore represents the effect of an interaction of a Project activity with the physical, ecological and human receptor. Two examples of these relationships are provided in Figure 3.3.

Figure 3.3 Examples of Project Activity - Impact Pathways

Term	Example 1	Example 2
ACTIVITY	Use of diesel generator set	Generation of wastewater
RECEPTOR	Air quality and climate	Seawater quality
IMPACT	Deterioration of air quality, global warming	Environmental degradation, economic losses

Project activities were identified through a review of the Project Description (Chapter 5). Potential impacts were identified based on the details of Project activities and their potential interactions with the surrounding environment (and physical, ecological, and/or human receptors). This also required an understanding of the potential sources of impacts and impact pathways, and was supported by:

- An understanding of baseline conditions and potential receptors (Chapters 8 to 18);
- Spatial and temporal extent of the Project Area of Influence (Chapter 1);
- Information from stakeholders, including authorities, experts, and the public (Chapter 6); and
- Professional knowledge and experience of comparable projects or developments.

To some extent, the identification and understanding of Project activities and impacts was an iterative process conducted throughout the ESIA process as more Project and environmental and social baseline information became available.

The assessment of these environmental and social impacts has been structured according to the following technical disciplines:

- Terrestrial soil, water, and groundwater (Chapter 8);
- Air quality (Chapter 9);
- Terrestrial noise and vibration (Chapter 10);
- Terrestrial ecology (Chapter 11);
- Marine ecology (Chapter 12);
- Landscape and visual (Chapter 13);
- Socio-economics (Chapter 14);
- Community Health, Safety and Security (Chapter 15);
- Cultural heritage (Chapter 16);
- Ecosystem services (Chapter 17); and
- Waste (Chapter 18).

3.3.2 Impacts Nature and Type

Whether an impact is considered to be beneficial or adverse (impact nature), and the way in which it is related to the Project (impact type, e.g. direct, indirect) are relevant to the ESIA process. In particular, the degree to which an impact may be managed or modified by the mitigation measures is dependent upon the impact nature and type. Table 3.2 provides definitions.

Table 3.2 Impact Assessment Terminology

Term	Definition
Impact Nature	
Adverse Impact	An impact that is considered to represent an adverse change from the baseline condition or introduces a new undesirable factor.
Beneficial Impact	An impact that is considered to represent an improvement on the baseline condition or introduces a new desirable factor.

Continued…

Term	Definition
Impact Type	
Direct Impact	Impacts that result from a direct interaction between a Project activity and the receiving environment (e.g. between occupation of an area of seabed and the habitats which are lost).
Indirect Impact	Impacts that result from other activities that are encouraged to happen as a consequence of the Project (e.g. Project implementation promotes service industries in the region).
Secondary Impact	Impacts that follow on from the primary interactions between the Project and its environment as a result of subsequent interactions within the environment (e.g. loss of part of a habitat affects the viability of a species population over a wider area).
Cumulative Impact	Impacts that act together with other impacts, from other projects or unrelated activities, to affect the same environmental resource or receptor.

Complete.

In considering impacts related to this Project, both adverse and beneficial impacts have been identified. Where appropriate, the impact assessment chapters further identify impacts as direct, indirect or secondary impacts. Where appropriate, both impact nature and type definitions have been applied throughout the ESIA Report to provide clarity regarding the significance of the impacts. Cumulative impacts are discussed in Section 3.3.8 and **Chapter 20 Cumulative Impact Assessment.**

3.3.3 Impact Magnitude

The magnitude of an impact is a measure of change from baseline conditions. This measure of change can be described in terms of its:

- Extent: Spatial extent (e.g. area impacted) or population extent (e.g. proportion of the population / community affected) of an impact;
- Duration: How long the impact will interact with the receiving environment;
- Frequency: How often the impact will occur; and
- Reversibility: How long before impacts on receptors cease to be evident.

Thus, these characteristics collectively describe the nature, physical extent, and temporal condition of the impact.

To facilitate a structured description of impact magnitude, a qualitative category scale of negligible, low, moderate, and high was developed for each of the magnitude characteristics.

Criteria for each impact magnitude category (i.e. negligible, low, moderate and high ranking criteria) were developed as appropriate for each discipline, and are described in Chapters 8 to 18.

The determination of overall impact magnitude rating was determined on the basis of professional judgement and Good International Industry Practice (GIIP), considering all four characteristics collectively where relevant.

3.3.4 Receptor Sensitivity (Resilience and Value)

Receptor sensitivity is the degree to which a particular receptor is more or less susceptible to a given impact. Receptor sensitivity takes into consideration receptor resilience and value.

Receptor resilience (or conversely, vulnerability) describes the ability of the receptor to withstand adverse impacts. It takes into consideration not only activity-impact-receptor pathways, but also environmental characteristics of the receptor that might make it more or less resilient to change. As such, a receptor can be considered as existing within a spectrum of 'vulnerable' to 'resilient', with the former more likely to experience significant impacts as a result of a given change.

Receptor value takes into consideration its quality and its importance as represented, for example, by its conservation status, its cultural importance and / or its economic value. It recognises that, for a given magnitude impact, different receptors (either directly or indirectly) may be deemed to be of greater importance and as such the significance of the impact is greater than the impact magnitude alone.

Similar to the approach adopted for impact magnitude, a structured description of receptor sensitivity employed a qualitative category scale of negligible, low, moderate, and high for each of the sensitivity characteristics, resilience and value. Likewise, criteria for receptor sensitivity (i.e. negligible, low, moderate and high ranking criteria) were developed as appropriate for each discipline, and are described in Chapters 8 to 18.

3.3.5 Impact Significance

Impact magnitude and receptor sensitivity were used to assess impact significance according to the impact assessment matrix in Table 3.3, and the impact assessment definitions in Table 3.4.

Table 3.3 Impacts Significance Matrix

		Receptor Sensitivity (Vulnerability and Value)			
		Negligible	*Low*	*Moderate*	*High*
Impact Magnitude (Extent, Frequency, Reversibility, Duration)	*Negligible*	Not significant	Not significant	Not significant	Not significant/Low*
	Low	Not significant	*Low*	Low/Moderate†	Moderate
	Moderate	Not significant	Low/Moderate	Moderate	High
	High	Low	Moderate	High	High

* Allows technical discipline author to decide if impact significance is Not Significant or Low.
† Allows technical discipline author to decide if impact significance is Low or Moderate.

Table 3.4 Impact Significance Definitions

Adverse Impacts	**High**	**Significant.** Impacts with a "High" significance are likely to disrupt the function and value of the resource / receptor, and may have broader systemic consequences (e.g. ecosystem or social well-being). These impacts are a priority for mitigation in order to avoid or reduce the significance of the impact.
	Moderate	**Significant.** Impacts with a "Moderate" significance are likely to be noticeable and result in lasting changes to baseline conditions, which may cause hardship to or degradation of the resource / receptor, although the overall function and value of the resource / receptor is not disrupted. These impacts are a priority for mitigation in order to avoid or reduce the significance of the impact.
	Low	**Detectable but not significant.** Impacts with a "Low" significance are expected to be noticeable changes to baseline conditions, beyond natural variation, but are not expected to cause hardship, degradation, or impair the function and value of the resource / receptor. However, these impacts warrant the attention of decision-makers, and should be avoided or mitigated where practicable.
	Not Significant	**Not Significant.** Any impacts are expected to be indistinguishable from the baseline or within the natural level of variation. These impacts do not require mitigation and are not a concern of the decision-making process.

The above matrix and significance definitions have been used to assess adverse impacts of the Project. Although beneficial impacts of the Project are identified within this ESIA, beneficial impacts have not been assessed in terms of receptor sensitivity or impact magnitude. Rather, beneficial impacts have been described in qualitative terms and measures presented that South Stream Transport and other parties, where indicated, will employ to maximise benefits.

For adverse impacts, this methodology was applied to both pre- and post-mitigation scenarios for all impacts identified. The reasoning behind each evaluation is explained in the Chapters 8-18, depending on the relevant discipline, including a detailed discussion of the issues contributing to the determination of residual significance.

The impact assessment in each technical chapter includes an impact summary table for each phase of the Project (an example is presented in Table 3.5), including residual impact significance ratings for all impacts identified.

3.3.6 Waste

In contrast to the other environmental and social technical disciplines assessed within this ESIA, no pre-mitigation assessment of impact was undertaken for waste production, storage, management and disposal as this is considered part of the Project design as described in **Chapter 5 Project Description**. Rather, **Chapter 18 Waste Management** focuses upon identification of appropriate mitigation measures given the type and volume of wastes to be produced and identification of residual impact significance ratings. This methodology is described in further detail in **Chapter 18 Waste Management**.

3.3.7 Unplanned Events

Environmental and social impacts that might result from unplanned events (e.g. fuel spill, or wet buckle) are addressed in **Chapter 19 Unplanned Events**. In addition to impact magnitude and receptor sensitivity, the impact assessment methodology for unplanned events also considered the likelihood of occurrence of the event(s). This methodology is described in further detail in **Chapter 19 Unplanned Events**.

3.3.8 Cumulative Impacts

This ESIA adopts the IFC definition of cumulative impacts (Ref. 3.4): *"Cumulative impacts are those that result from the incremental impact of the Project when added to other existing, planned and reasonably predictable future projects and developments."*

The IFC has released a guidance note Cumulative Impact Assessment and Management – Guidance for the Private Sector in Emerging Markets in August 2013 (Ref. 3.5). The guidance note introduces a framework for identifying and assessing potentially significant cumulative impacts. The cumulative impact assessment (CIA) has been prepared taking into account the IFC draft guidance note.

A predominantly qualitative approach was taken in the identification and assessment of cumulative impacts during the construction and operations phases of the Project, taking into account geographic and scheduling overlaps with the Project. The methodology for the CIA is described in further detail in **Chapter 20 Cumulative Impact Assessment**.

Table 3.5 Assessment of Potential Impacts: Example Table

Activity	Potential Impact	Receptor(s)	Receptor Sensitivity	Impact Magnitude	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Plant operation at landfall construction sites	Noise disturbance to local residents and land-users	Local communities and land-users	High	Low	Moderate	• Schedule construction works to occur only during daylight hours • All plant and equipment to be regularly maintained in good working order	Low (based on Table 3.3 matrix)
Construction of RoW	Damage / loss of wildlife habitat	Terrestrial fauna	Moderate	Moderate	Moderate	• Minimise footprint of clearance	Low
Dredging of microtunnel exit pit	Seabed disturbance may lead to localised decrease in light and/or dissolved oxygen as a result of re-suspended material, thereby affecting planktonic organisms	Plankton	Moderate to Low	Low	Moderate to Low	• Routing to avoid most sensitive areas • Use of silt curtains as appropriate • Avoid overspill from dredgers • Use lowest impact trenching technology as conditions allow	Low

3.3.9 Transboundary Impacts

Transboundary impacts are defined as "*impacts that extend to multiple countries, beyond the host country of the project, but are not global in nature. Examples include air pollution extending to multiple countries, use or pollution of international waterways, and transboundary epidemic disease transmission*" (Ref. 3.4).

As the South Stream Offshore Pipeline spans multiple countries and is being constructed across a dynamic marine environment, there is the potential for some Project activities to generate transboundary impacts. Such impacts may arise from Project activities which traverse country boundaries, or impacts that originate within one country, but have the ability to extend across national borders.

For the purposes of the transboundary impact assessment included within this ESIA, the Russian national borders and the boundary of the Russian EEZ in the Black Sea define the transboundary impact boundaries. Any changes in baseline conditions extending across these boundaries would be considered to be a transboundary impact.

IFC Performance Standard (PS) 1 Assessment and Management of Environmental and Social Risks and Impacts (Ref. 3.6) recognises the need to consider transboundary impacts. The transboundary impact assessment (Chapter 21) has considered the potential for transboundary impacts to be generated by the Project as required by IFC PS1 Further details regarding potential transboundary impacts can be found in **Chapter 21 Transboundary Impact Assessment**.

3.3.10 Impact Mitigation

As part of the ESIA process, where the impact assessment identified impacts as potentially arising, mitigation measures were developed (including avoiding, management and monitoring actions). Where an adverse impact is identified, the next step is to find a way to avoid or minimise the impact. The process of identifying "design controls" and "mitigation measures" considered the mitigation hierarchy (Figure 3.4), as specified in IFC PS1, which is widely regarded as a best practise approach to managing risks.

For the Project, efforts were made to firstly avoid or prevent, then minimise or reduce adverse impacts, which were principally achieved through the application of "design controls" (Section 3.2). Avoidance, minimisation repair and/or restoration were considered during the application of "mitigation measures" to manage the risks of adverse impacts. Any remaining significant residual impacts were then addressed via consideration of measures including offsetting and compensation.

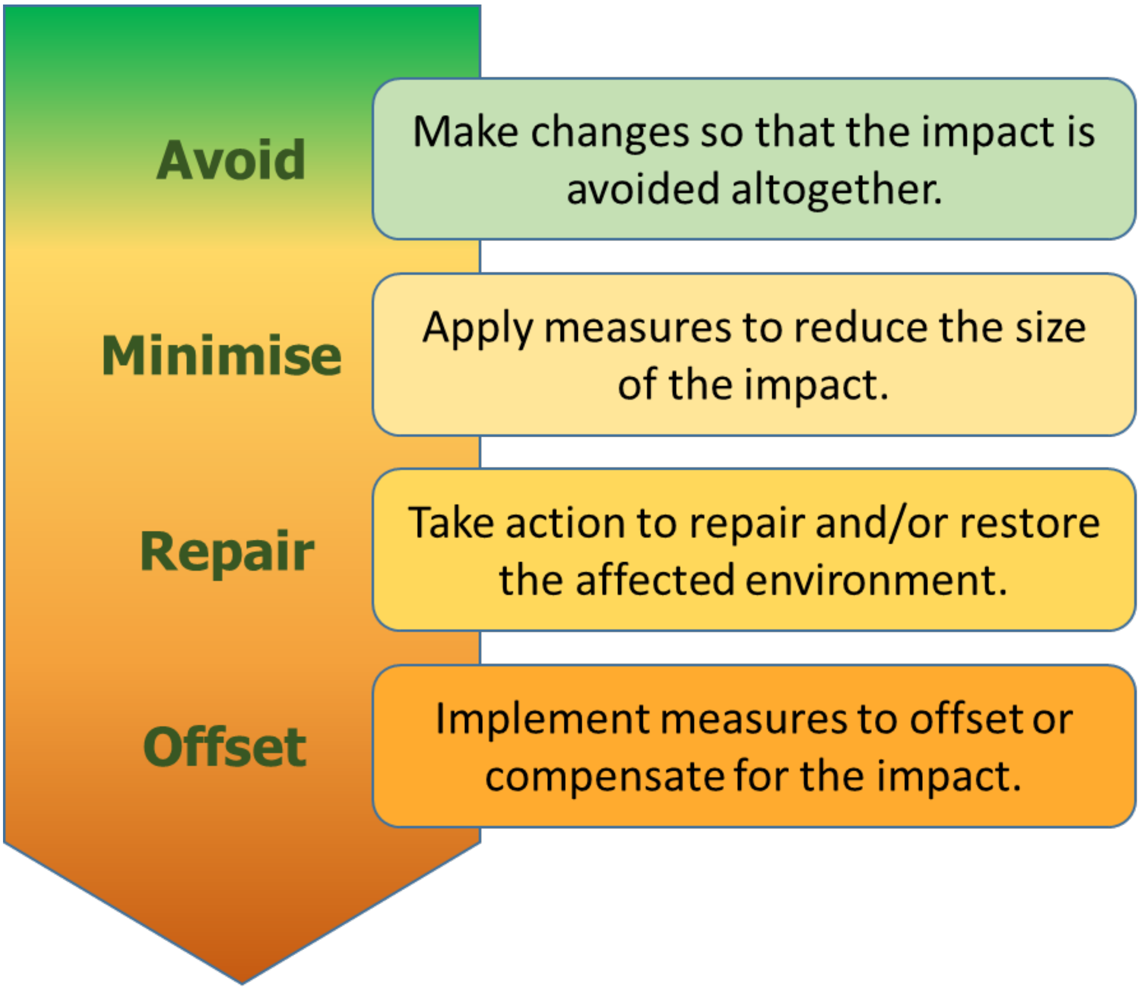
For biodiversity, the same hierarchy was applied to all stages of the impact assessment process, in order to achieve "no net loss" of biodiversity. The assessment of critical habitat for biodiversity was identified separately to the above impact assessment process, albeit using the same hierarchy, to achieve "net gain" of the biodiversity values for which the critical habitat was designated.

The mitigation hierarchy adopted for the Project is shown in Figure 3.4.

This process involved ESIA experts working with the Project team engineers to identify practicable and cost-effective approaches to mitigate impacts. These measures were agreed and integrated into the Project plan.

Specific mitigation measures are described in the relevant discipline chapters (Chapters 8 to 18).

Figure 3.4 Mitigation Hierarchy



3.3.11 Residual Impact Assessment

Once feasible mitigation measures were identified and agreed, the ESIA team reassessed the potential impacts, assuming the mitigation measures were effectively implemented as planned.

In general, impacts with "Not Significant" or "Low Significance" residual impact significance were not considered to be of concern to the development of the Project[3]. For adverse impacts of "Moderate" and "High" significance, an iterative process is undertaken to further investigate opportunities for mitigation, according to the hierarchy above. Where the significance cannot be further reduced, an explanation is provided of why further reduction is not practicable. Monitoring is required to confirm the measures used to mitigate adverse impacts are working properly and that the impact is not worse than predicted. Monitoring requirements are outlined in the respective assessment chapters.

3.3.12 Environmental and Social Management Plans

Environmental and Social Management Plans (ESMPs) have been developed to capture all mitigation and management measures and environmental and social commitments made within the ESIA Report. Adherence to these plans will be a condition of any Project construction and operation contracts awarded. It is noted that the ESMPs also incorporate environmental and social management commitments of Bulgaria and Turkey. How the ESMPs fit into this broader South Stream HSSE-IMS is described in **Chapter 22 Environmental and Social Management**.

3.4 Stakeholder Engagement

As part of the ESIA process, stakeholder engagement was and continues to be undertaken throughout the development of the Project to ensure that all interested parties are aware and informed of the Project and have an opportunity to provide input regarding potential Project impacts and mitigation measures. To date, consultations have been undertaken with:

- National authorities;
- Municipal and local authorities;
- Local communities;
- Marine area users;
- Local businesses;
- Non-governmental organisations (NGOs); and
- Academic and scientific organisations.

South Stream Transport has developed a Stakeholder Engagement Plan which identifies stakeholders and their interests, describes the consultation undertaken and that planned as part of the Project's ESIA process, and establishes a framework for stakeholder engagement activities to be undertaken as the Project progresses beyond the ESIA phase.

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[3] A more stringent approach was taken in the assessment of ecological receptors of high sensitivity, such as critical habitat, or species classified as having vulnerable or above conservation status. In this case, residual impact significance of Low and above was a concern to the further development of the Project.

The stakeholder consultation process has helped the ESIA to scope potential impacts and concerns identified by the public. As indicated in Figure 3.1, stakeholder consultation has been a part of the ESIA process from the initial screening phase, and will continue with the submission of this ESIA, and during Project implementation to ensure the management of impacts takes stakeholder's concerns into account.

Details of the stakeholder engagement process for the ESIA are discussed further in **Chapter 6 Stakeholder Engagement**.

This ESIA Report has been released to the public for review and comment. The purpose of this disclosure is:

- To help stakeholders understand the potential impacts, following the application of mitigation measures, that may arise as a result of the Project;
- To provide an opportunity for stakeholders to raise comments or concerns about the Project, and request any additional mitigation measures deemed appropriate; and
- To confirm to stakeholders that their opinions obtained through the stakeholder engagement process have been considered in both Project design and ESIA evaluation.

Further details about this disclosure are provided in **Chapter 2 Policy, Regulatory and Administrative Framework** and **Chapter 6 Stakeholder Engagement**.

3.5 Data Limitations

This ESIA Report has been based on design information available at the time of its preparation. Where necessary assumptions have been made and discussed in the relevant chapters. Consequently the ESIA has been undertaken on Project engineering design information at a Front End Engineering Design (FEED) level.

During the detailed design, Construction and Pre-commissioning, and Operational Phases of the Project, there may be a requirement to amend design elements or processes which results in a deviation from that presented in this Project Description. The Project has a management of change process to manage and track any such amendments, and to:

- Assess their potential consequences with respect to environmental and social impact; and
- In cases where a significant impact is likely to arise as a consequence of the amendment or change, to inform and consult with relevant parties on the nature of the impact and on proposed mitigation measures, where practical and appropriate.

All design changes will be added to a register of changes, which will summarise the change, the assessment, and the justification for South Stream Transport actions. The management of change process will be incorporated into the HSSE Management of Change Procedure, which is described in further detail in **Chapter 22 Environmental and Social Management**.

The Project design will continue to be refined to a final detailed design level, as informed by this ESIA. Any changes made to Project design following finalisation of this ESIA Report will be managed through the Management of Change Procedure (**Chapter 22, Environmental and**

Social Management), which includes the requirement to assess any potentially significant environmental and social impacts.

Comprehensive data have been used to inform this ESIA Report to enable sufficient confidence in the assessment conclusions. Notwithstanding the data set used, some gaps in baseline data necessitated some conservative assumptions as described in the relevant chapters and a precautionary approach to the mitigation measures adopted.

In this ESIA Report, predictions are made using accepted ESIA methods ranging from qualitative assessment and expert judgement to quantitative modelling. The technical discipline impact assessment sections in Chapters 8 to 18, detail specific relevant data and assumptions made.

References

Number	Reference
Ref 3.1	South Stream Transport B.V. Russian Sector Scoping Report (November 2012), available from: http://www.south-stream-offshore.com/media/documents/pdf/en/2012/11/ssttbv_south-stream-offshore-pipeline-russian-sector_30_en_20121115.pdf. Accessed on 18 June 2013.
Ref 3.2	Giprospetzgas (2011), Complex Engineering Surveys at the Phase 'Design Documentation' within the Framework of 'the South Stream' Gas Pipeline Marine Sector Project Implementation.
Ref 3.3	International Organization for Standardization (ISO) (2001), European Standard EN ISO 14001: 2004. Environmental management systems – Requirements with guidance for use. Accessed at: http://www.iso.org/iso/catalogue_detail?csnumber=31807. Accessed on 17 May 2013.
Ref. 3.4	International Finance Corporation (IFC) (2012), IFC Guidance Notes: Performance Standards on Environmental and Social Sustainability. Accessed at: http://www.ifc.org/wps/wcm/connect/e280ef804a0256609709ffd1a5d13d27/GN_English_2012_Full-Document.pdf?MOD=AJPERES&bcsi_scan_AB11CAA0E2721250=/Uuc1iQQbbCDfhp5zCA0mGTxe58/AQAAlCGIMA==&bcsi_scan_filename=GN_English_2012_Full-Document.pdf
Ref 3.5	IFC (2013), Good Practice Note: Cumulative Impact Assessment and Management – Guidance for the Private Sector in Emerging Markets (August 2013). http://www1.ifc.org/wps/wcm/connect/c8f524004a73daeca09afdf998895a12/IFC_Performance_Standards.pdf?MOD=AJPERES. Accessed on 20 September 2013.
Ref 3.6	IFC (2012), IFC Performance Standards on Environmental and Social Sustainability - Effective January 1, 2012Performance. Accessed at: http://www1.ifc.org/wps/wcm/connect/c8f524004a73daeca09afdf998895a12/IFC_Performance_Standards.pdf?MOD=AJPERES. Accessed on 17 May 2013.

Chapter 4: Analysis of Alternatives

URS-EIA-REP-204635

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4 Analysis of Alternatives

4.1 Introduction

The Project is the Russian Sector of the South Stream Offshore Pipeline, which is the offshore component of the South Stream Pipeline System. The objective of the South Stream Pipeline System is to develop a new gas supply route via the Black Sea that provides a safe and reliable means to export Russian gas to the countries of Central and South-Eastern Europe.

This chapter examines the technically and financially feasible alternatives to achieve the Project objective, which, consistent with the objective of the overall South Stream Pipeline System, is to form a key part of the new supply route via the Black Sea. These alternatives were considered during the Feasibility and Development Phases of the Project and have led to the validation of the Project as it is described in **Chapter 5 Project Description**.

Alternatives to the overall South Stream Pipeline System have not been considered within this ESIA Report, although reference is made to decisions made for the South Stream Offshore Pipeline and the wider South Stream Pipeline System. Such reference is made to provide context, particularly where decisions were made by third parties that directly influence the Project's design, recognising that the Project is an integral part of the wider South Stream Pipeline System.

Alternatives that were considered and assessed during the Feasibility Phase of the Project are referenced to the source documentation in the text. As indicated above, not all alternatives that are described in this chapter were considered and assessed during the Feasibility Phase. Some were examined later during the Development Phase, which includes the ESIA process. The need to carry out further appraisal of alternatives as part of the ESIA process stemmed from a need to confirm that all routing and technical decisions did in fact result in the least possible environmental and social impact, prior to finalising the design of the Project. These further appraisals do not have separate references and the results of the appraisals are presented in this chapter as part of the ESIA documentation.

The objective of this chapter is to outline how the Project represents an optimised design that is technically and financially feasible whilst minimising overall environmental and social impacts. The assessment of impacts that will arise as the result of the Project, along with the identification of appropriate mitigation measures, is contained in Chapters 7 to 21 of this ESIA Report.

This chapter is structured to start with consideration of high level strategic options (e.g. the zero alternative) and progressively focuses in on the more detailed Project-specific alternatives considered as part of the Front-End Engineering and Design (FEED) process (e.g. shore crossing options and route refinement options) (Ref. 4.1 to Ref. 4.3). Routing and siting alternatives have been analysed in the context of the engineering, environmental, socio-economic and cultural heritage optimisations that have been carried out during both the Feasibility and Development Phases of the Project.

It is noted that there is a requirement to provide flexibility to construction contractors in determining the most efficient and cost-effective construction methodologies whilst ensuring compliance with Project standards and Project commitments. Specifically, it is recognised that, at the time of writing this ESIA Report, data gathering and detailed design are on-going. As a result, some detailed aspects of the Project design may be subject to change but these will not materially alter the findings of the ESIA or any associated mitigation measures. In such cases, rather than being discussed within this chapter, **Chapter 5 Project Description** provides an outline of the potential construction alternatives.

4.2 Approach to Analysis of Alternatives

As recommended in the International Finance Corporation (IFC) Performance Standards Guidance Note 1: Assessment and Management of Environmental and Social Risks and Impacts (Ref. 4.4), the ESIA Report includes *"an examination of technically and financially feasible alternatives to the source of such impacts, and documentation of the rationale for selecting the particular course of action proposed."*

It is important to recognise that the South Stream Offshore Pipeline (and therefore the Project) is the offshore components of a larger South Stream Pipeline System. Consequently, the South Stream Offshore Pipeline and the Project (Russia Sector), which forms part of it, are significantly influenced by the route selection for the broader South Stream Pipeline System. Alternatives to the South Stream Offshore Pipeline as a whole are briefly discussed in this document (Sections 4.3 and 4.4) followed by the more detailed discussion of alternatives to the Project (Russian Sector).

Decisions taken by Gazprom prior to the establishment of South Stream Transport B.V. for the wider South Stream Pipeline System have significantly influenced the route selection (Ref. 4.1). Accordingly, this chapter briefly refers to the consideration of alternatives and decisions taken by Gazprom that have to a some extent predefined the Project design i.e. the general location of Russian landfall facilities and the routing of the offshore section of pipeline. Consequently the Analysis of Alternatives described in this chapter is structured to follow a 'narrowing approach' involving a series of logical steps, starting with the high-level alternatives (including those determined by third parties) followed by descriptions of more detailed alternatives (under South Stream Transport's control). Using this commonly adopted narrowing approach, the Analysis of Alternatives considers alternatives in the following sequence:

- The 'Zero' Alternative;
- South Stream Offshore Pipeline alternatives:
  - Alternative means of gas transportation; and
  - Offshore (macro) routing.
- Project alternatives:
  - Landfall site selection;
  - Shoreline crossing technique (open cut vs. microtunnelling);
  - Onshore routing; and
  - The offshore route optimisation.

4.3 Zero Alternative

The zero alternative for the purposes of this ESIA Report is the situation where the Project (i.e. the Russian Sector of the South Stream Offshore Pipeline) does not proceed. Under the zero alternative for the Project there are no adverse environmental or social impacts in Russia, on land or in Russian waters, as there is no construction or operation of the pipeline in Russia. Any such option would imply that the Project does not impinge on Russian territory, Russian waters, or the Russian EEZ.

The need for the South Stream Pipeline System and therefore the Project is driven by Europe's long-term demand for natural gas; further details are provided in **Chapter 1 Introduction**.

Should the Project not proceed, the entire South Stream Pipeline System with an offshore pipeline through the Black Sea would not proceed and the objective to provide a new supply route to the countries of Central and South-Eastern Europe via the Black Sea would not be met. This would in turn mean that diversifying existing supply routes to Central and South-Eastern Europe and providing additional supplies of natural gas to meet its growing energy demand would not be possible.

At the same time, the zero alternative would also mean that the Russian Federation would not benefit economically at the national level from the export of gas and at regional and local levels from sourcing employment, goods and services for the construction of the Project.

4.4 South Stream Offshore Pipeline Alternatives

4.4.1 Alternative Means of Gas Transportation

Based on the premise that gas will be exported via a new route across the Black Sea, consideration can be given to offshore transportation of gas by means other than pipeline systems. The main alternative to pipelines for transporting natural gas from Russia to Central and Southern European countries by sea is the liquefaction of natural gas at a Black Sea port in Russia and transportation of Liquefied Natural Gas (LNG) using LNG carriers to either:

- A port on the Western Black Sea coast (Bulgaria or Romania); or
- A port in southern Europe beyond the Turkish Straits.

The following factors were considered in the assessment of these alternatives:

1. Liquefaction and transportation of LNG to gas markets is usually undertaken for 'stranded gas' deposits where the source of gas is so distant and isolated from its markets as to make transportation by pipeline uneconomic;
2. Liquefaction would require the construction of a liquefaction plant on the Russian coastline. The onshore environmental impacts associated with the construction and operation of an LNG plant would be greater than those of a pipeline and associated compressor station;
3. This alternative would require the presence of an unloading jetty or offshore buoy and a regasification plant on the shores of a South European receiving country. In view of the

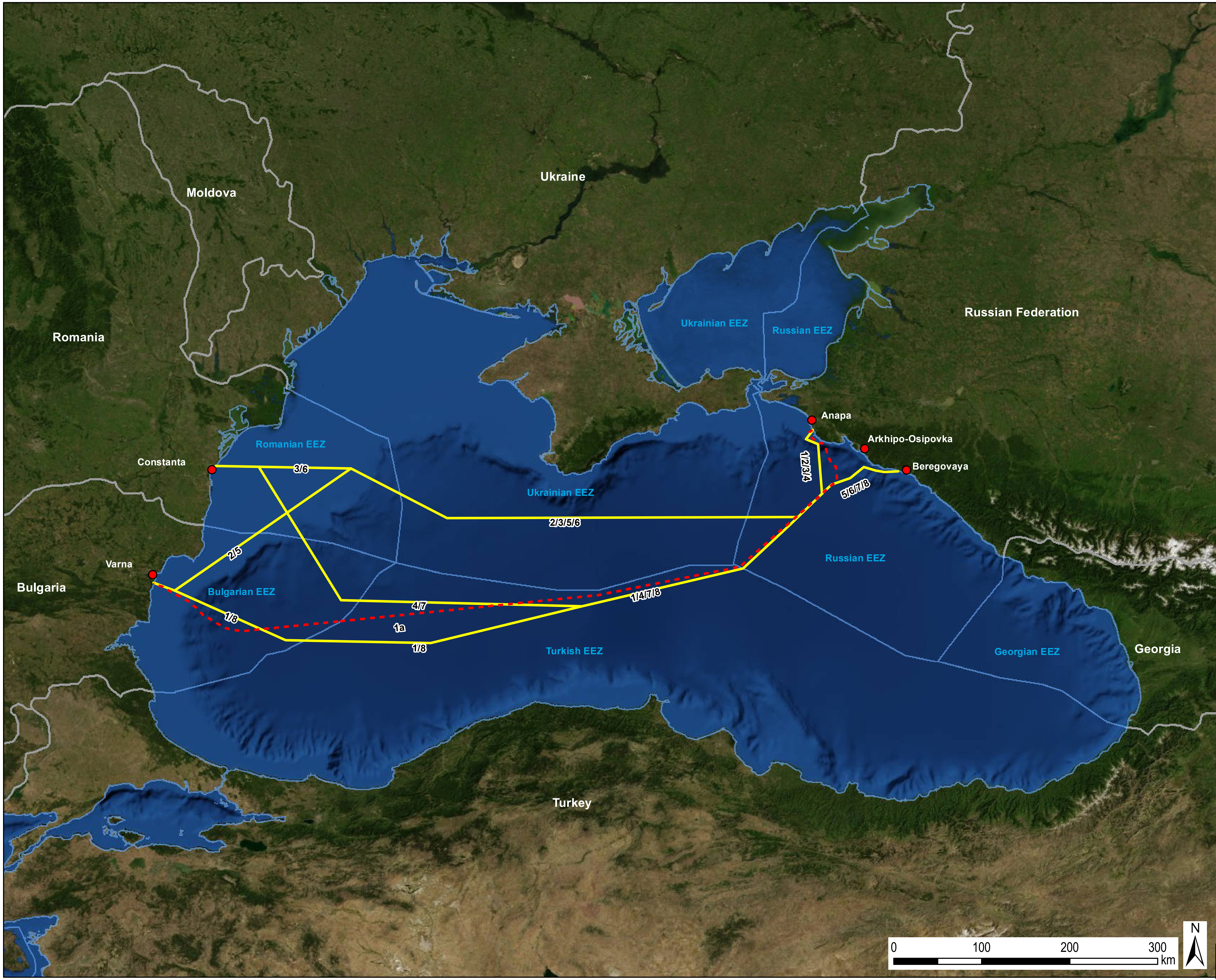
sensitivity and often designated protected status and recreational value of the Bulgarian and Romanian coastlines, it was considered undesirable to develop a large scale regasification plant on the coastal areas of Bulgaria or Romania. In order to avoid construction of a permanent regasification plant, export to an existing south European LNG regasification terminal could be considered; and

4. Transportation of LNG would require approximately 600 to 700 LNG carrier movements per year to export 63 bcm of natural gas per year. This would equate to approximately two full LNG carrier movements per day passing through the Turkish Straits, which include the densely populated areas adjacent to the Bosphorus Strait, Istanbul. In view of the hazardous nature of the cargo, the existing high density of maritime traffic through the Turkish Straits and the population density around the Bosphorus Strait, this number of vessels movements would introduce an additional and potentially unacceptable safety risk.

Based on the above, the LNG alternative is not considered further.

4.4.2 Offshore (Macro) Routing

Prior to selection of the site for the Russkaya Compressor Station (CS) to the south east of Anapa, eight potential offshore pipeline corridors were considered across the Black Sea; four offshore pipeline corridors from a shore crossing area near Beregovaya and four from a shore crossing area near Anapa, both located in the Russian Federation as shown in Figure 4.1.



LEGEND

Route alternatives

Option 1a

Exclusive Economic Zones

Offshore Pipeline Route Alternatives
Option 1 - Anapa to Varna (Turkish waters)
Option 1a - Anapa to Varna (Turkish waters)
Option 2 - Anapa to Varna (Ukrainian & Romanian waters)
Option 3 - Anapa to Constanta (Ukrainian waters)
Option 4 - Anapa to Constanta (Turkish & Bulgarian waters)

Discounted Offshore Pipeline Route Alternatives
Option 5 - Beregovaya to Varna (Ukrainian & Romanian waters)
Option 6 - Beregovaya to Constanta (Ukrainian waters)
Option 7 - Beregovaya to Constanta (Turkish & Bulgarian waters)
Option 8 - Beregovaya to Varna (Turkish waters)

Projection: Lambert Conformal Conic

Purpose of Issue: For ESIA Report

Client: South Stream Offshore Pipeline ENERGISING EUROPE

Project Title: SOUTH STREAM OFFSHORE PIPELINE

Drawing Title: OFFSHORE PIPELINE CORRIDOR OPTIONS

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File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA\Chapter 4 Analysis of Alternatives of the Russian ESIA\Figure 4.1 Offshore Pipeline Corridor Options.mxd

The comparative assessment of these two locations, carried out by Gazprom (Ref. 4.2) as summarised in Section 4.5.1, showed that the location chosen for the Russkaya CS (near Anapa) had lower environmental impacts compared to the Beregovaya location.

As a result of the selection of Anapa as the proposed shore crossing location, route options 5, 6, 7 and 8 were discarded from further consideration. The four options taken forward for assessment (Options 1, 2, 3 and 4) are summarised in Table 4.1.

Table 4.1 Offshore Pipeline Route Alternatives

Option	Shore Crossing Location (Russia)	Shore Crossing Location (S. Europe)	Transit EEZs	Route Length (km)
1	Anapa	Varna	Russian, Turkish and Bulgarian	940.3
2	Anapa	Varna	Russian, Ukrainian, Romanian and Bulgarian	928.4
3	Anapa	Constanta	Russian, Ukrainian and Romanian	933.2
4	Anapa	Constanta	Russian, Turkish, Bulgarian and Romanian	931.3

Of these four corridors, two cross the Turkish EEZ (Options 1 and 4) and two cross the Ukrainian EEZ (Options 2 and 3). Options 2 and 3 could not be surveyed within the timeframe required and were therefore discarded from further consideration. Further technical investigations were performed for Option 1, landing in Bulgaria and Option 4, landing in Romania (Ref. 4.3).

Various landfall site alternatives were considered on the Black Sea coast of southern Europe, in Bulgaria and Romania. This process identified two preferred shore crossing areas: one near the Bulgarian port of Varna and one near the Romanian port of Constanta.

After Bulgaria and Russia signed an Intergovernmental Agreement on South Stream, the remaining Romanian landfall alternative (Option 4) was no longer considered, leaving Option 1 as the preferred option. Following this decision, shore crossing sites in the vicinity of Varna on the Bulgarian Black Sea coast were further considered.

Option 1 was subsequently subject to route optimisation with consideration of a direct route across the Turkish EEZ rather than the deviation to the south. Option 1 was originally proposed to avoid the potential impacts of the southern edge of the Danube Delta sediment fan. Following further engineering investigation, it was concluded that due to the relatively low relief and inactive depositional nature of the outer submarine fan, the effects associated with deposition of sediment in the Danube fan system were minor. The direct line approach shown as Option 1a on Figure 4.1 was therefore adopted and subjected to further consideration of environmental and cultural heritage sensitivities (see **Chapter 12 Marine Ecology** and **Chapter 16 Cultural Heritage**).

4.5 Project Alternatives

4.5.1 Landfall Site Selection

Following the decision to construct an offshore pipeline system across the Black Sea, landfall sites on the Russian Black Sea coast and on the Black Sea coast of Southern Europe were selected.

The selection of the landfall site on the Russian Black Sea coast first took into account the requirement for a Compressor Station (CS) close to the coast[1]. A large CS is necessary to increase gas pressure and pump the gas across the Black Sea. As mentioned in **Chapter 1 Introduction**, the CS will be designed and installed as part of the project known as "Expansion of the UGS (United Gas Supply System) to provide gas to South Stream pipeline" that is being developed by Gazprom.

The land-take requirements and environmental and safety considerations associated with the CS are more significant than those associated with the offshore pipelines. The site for a large gas compressor station requires gentle topography, safe and feasible connections with the onshore and offshore pipeline system and adequate distances from populated areas and from areas with special designation (e.g. nature reserves). Not many locations satisfied all these requirements and only two potential locations were identified by Gazprom on the Russian shores of the Black Sea:

- A location approximately 10 km southeast of the town of Anapa (the Russkaya CS); and
- Beregovaya CS, located approximately 5 km east of the town of Arkhipo-Osipovka.

The Russkaya CS location is a green field site in a relatively isolated location whereas the Beregovaya location is adjacent to the existing CS of the Blue Stream Pipeline[2].

The two locations were identified by Gazprom (Ref. 4.2) on the basis of available land of suitable morphology, existing land use, presence of transport infrastructure, distance from residential areas and other environmental and social constraints. The concept of bundling potential environmental and social impacts and thus confining such impacts to one location, with potential positive and adverse cumulative effects, was considered for the Beregovaya location, given its proximity to the CS of the Blue Stream Pipeline.

---

[1] At this stage Gazprom divided pipeline into three distinct components: i) a pipeline system in Russia terminating at a Compressor Station (CS); ii) an offshore pipeline system (the South Stream Offshore Pipeline); and iii) an onshore distribution system in central and southern Europe. These three components became distinct projects with separate management companies, engineering and permitting history.

[2] The Blue Stream gas pipeline crosses the Black Sea delivering Russian natural gas to Turkey.

The comparative assessment of the two selected locations, carried out by Gazprom (Ref. 4.2), concluded that the location of the Russkaya CS had fewer environmental impacts compared to the Beregovaya location. This included lower impacts on air quality and noise, lower suspended solids in runoff, lower usage of petroleum products, lower impacts on marine biological resources and greater distances from protected areas (further details are provided in Appendix 20.1). Bundling impacts at Beregovaya was in this instance considered to be unacceptable because of the cumulative impacts associated with the contemporaneous operation of the two facilities. On this basis, the Russkaya CS site was selected and the decision was subsequently approved by Russian environmental agencies at both the Federal and Regional level during meetings held on the 22 to 29 September 2011.

As a result of the selection of the Russkaya CS site, the Anapa landfall was considered for further technical evaluation by Gazprom.

4.5.2 Shoreline Crossing

The selection of the shore crossing location was dictated by the requirement to keep the pipelines at a safe distance from residential and recreational areas (see Figure 4.2).

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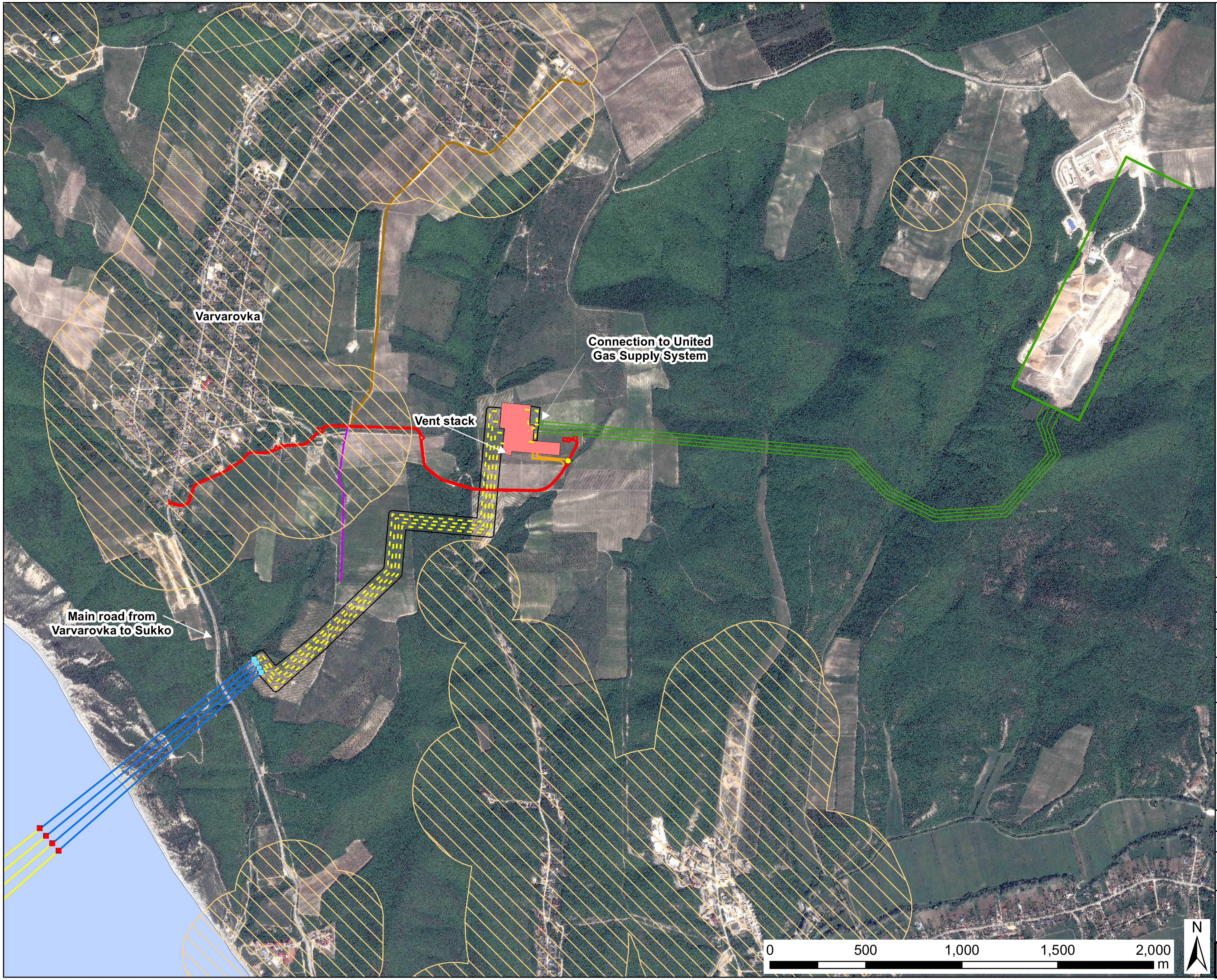

LEGEND

- 360m from residential receptors

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Landfall facilities
- Anode bed for cathodic protection of landfall section pipelines
- Proposed microtunnels
- Proposed offshore pipelines
- Right-of-Way
- Microtunnel entry shaft
- Microtunnel exit pit
- Permanent access road to be constructed by SSTTBV
- Temporary access road constructed by SSTTBV
- Varvarovka bypass road (used by Project during construction only)

United Gas Supply System

- United Gas Supply System pipelines
- Russkaya compressor station
- Permanent access road to be constructed by Gazprom Invest

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: For ESIA Report

Client: South Stream Offshore Pipeline — South Stream ENERGISING EUROPE

Project Title: SOUTH STREAM OFFSHORE PIPELINE

Drawing Title: ANAPA LANDFALL AND ONSHORE PIPELINE ROUTE

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Plot Date: 04 Mar 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA\Chapter 4 Analysis of Alternatives of the Russian ESIA\Figure 4.2 Anapa Landfall and Onshore Pipeline Route.mxd

Based on this requirement, the only feasible shore crossing corridor for a trenched crossing required the pipelines to cross the main road from Anapa and Varvarovka to Sukko, climb up a steep coastal ridge (17% gradient), cross a coastal path and finally descend a steeper slope (37% gradient) to reach the Black Sea shore. Figure 4.2 shows the route of the pipelines.

A preliminary engineering and environmental analysis (Ref. 4.3) of the shore crossing feasibility indicated that in addition to significant engineering challenges, due to the steepness of the slope (Figure 4.3), an open cut approach to the shore crossing would have resulted in additional environmental impacts, including the need to remove larger areas of sensitive natural habitats, which would result in habitat loss and fragmentation[3].

Figure 4.3 Russia Shore Crossing Coastline

Alternative trenchless shore crossing techniques were therefore assessed. The chosen technique is based on the construction of a tunnel[4] for each pipeline from a location to the east of the Anapa-Sukko road to the seabed, at a water depth of approximately 23 m and a distance of 400 m from the shore. This option includes the additional benefit of removing the need to carry

[3] Natural habitats present comprise notable plant species, such as Juniperus excelsa and Juniperus foetidissima listed as species of concern on local, regional and international Red Data Books.
[4] Trenchless alternatives included Horizontal Direction Drilling (HDD) and Microtunnelling. Microtunnelling was selected over HDD because it allows greater flexibility and reliability in differing sub strata.

out dredging and pipeline construction activities in the most sensitive section of the marine environment (0 to 20 m water depth).

Following the Analysis of Alternatives, microtunnelling was selected on the grounds that a steep angled open cut method would present significant engineering challenges. This trenchless alternative would also result in fewer environmental impacts.

4.5.3 Onshore Routing

The route of the onshore sections of the Offshore Pipeline Project shown in Figure 4.2 was chosen to maximise the use of modified vineyards thereby minimising impacts on natural habitat whilst also considering mandatory exclusions zones for safety purposes. The onshore route is further described in **Chapter 5 Project Description.**

4.5.4 Offshore Route Optimisation

The route selection process progressed with the optimisation of the offshore route across Russian waters in the three main oceanographic units of the Project:

- The continental slope;
- The continental shelf; and
- The abyssal plain.

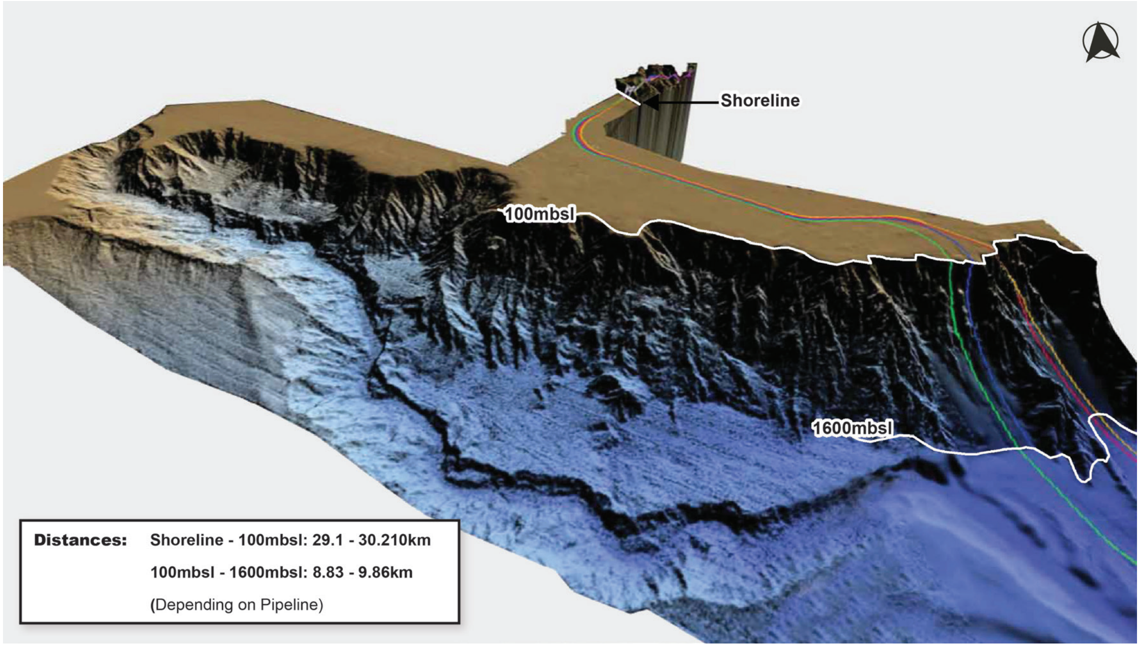
A corridor centred on a preliminary route alignment was surveyed between 2009 and 2011 to identify engineering and environmental constraints and marine archaeological features. The width of the corridor extended between 1.2 km and 2 km and up to 9 km in technically challenging areas such as the continental slope where the pipelines will be laid in separate canyons. Given the technical complexity associated with the identification of a continental slope crossing, this aspect was assessed first. After selecting a suitable continental slope crossing, the routes from the continental slope to the Anapa landfall (across the continental shelf and the shoreline) and the route across the abyssal plain to the border with the Turkish EEZ, were assessed.

4.5.4.1 Continental Slope Crossing

The continental slope is an unstable region where the depth of the sea rapidly changes and the seabed is generally characterised by unstable sediments, dynamic conditions (e.g. submarine slumps and sediment flows) and irregular morphology.

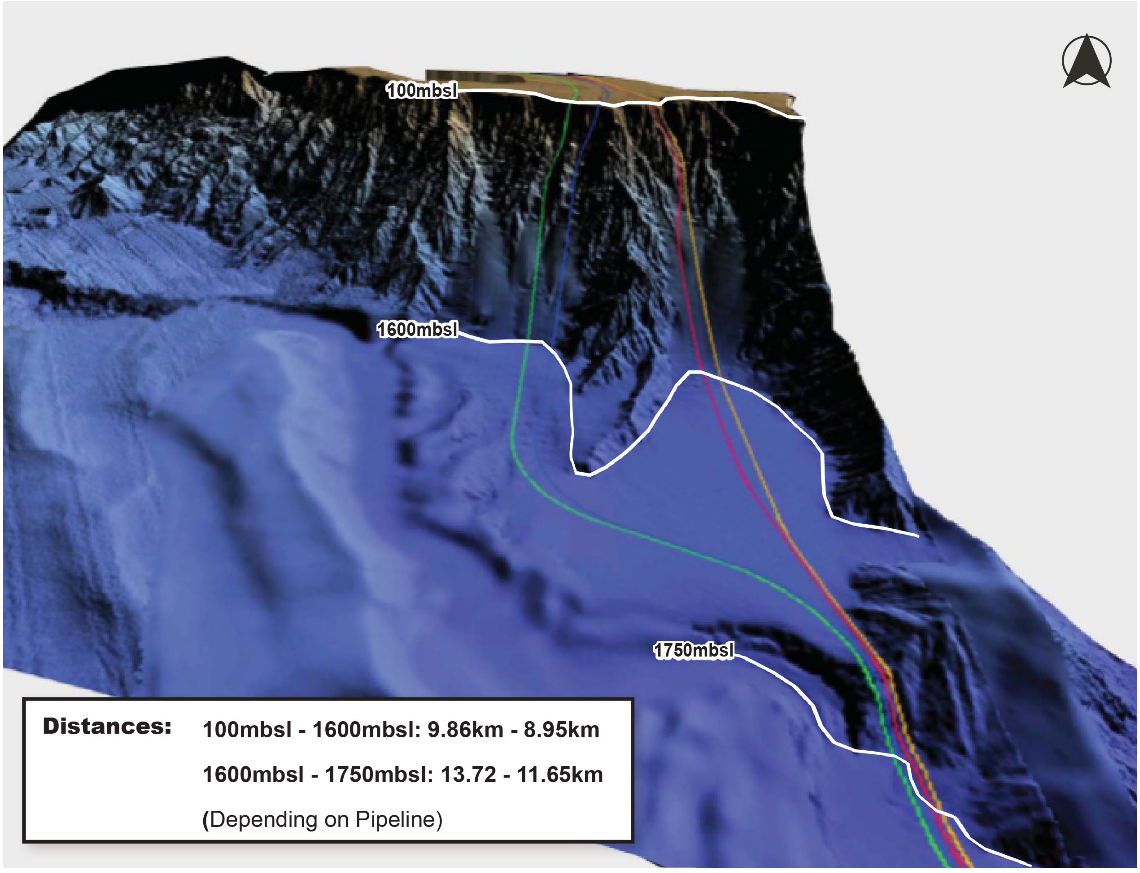
The continental slope near Anapa is characterised by an extensive network of canyons. The main canyon (known as the Anapa canyon) corresponds with the sediment transport path from the Sea of Azov to the Black Sea and is a relic feature of the estuaries of the Don and Kuban rivers. The Anapa canyon runs parallel to the Russian Black Sea coast. The northern slope of the Anapa canyon is steep and itself incised by smaller canyons. The floor of the canyon is further incised by a trough, which would have required a complex crossing. Throughout these morphological features of the seabed, sediment is unstable: massive sediment failures create turbid flows and submarine slumps, which could compromise the integrity of the pipeline. The rugged morphology associated with exposed rock outcrops and localised pockets of sediment also create stability and engineering challenges. For these reasons, extensive surveys were carried out to identify feasible crossing locations. Figure 4.4 shows the potential pipeline route through the Anapa Canyon.

Figure 4.4 Anapa Canyon Crossing



Two stable lateral canyons running down the continental slope were identified during the survey programme. On the basis of the width of the canyons, it was established that the best technical option included routing two pipelines in each canyon. Figure 4.5 shows the potential route of the four pipelines through these canyons diverging by up to approximately 4.8 km at the widest part.

Figure 4.5 Continental Slope Crossing



Having selected the preferred locations for crossing the continental slope, extensive geophysical and engineering surveys were carried out to identify both the safest routes across the continental slope and to determine if any environmental or cultural constraints were present along the preferred routes.

No significant environmental constraints that could influence the route selection were identified. The route selection process, therefore, progressed on the basis of technical feasibility and non-environmental sensitivities including a thorough review of the canyon's morphology and of the potential for the occurrence of geohazards and cultural heritage objects (CHO).

Three positively-identified CHOs are located on the continental slope. These three objects are not considered archaeological monuments, but are CHO ('science and technology objects') in accordance with Federal Law No.73-FZ dated June 25 2012. Furthermore, these objects were not in close proximity of the pipeline route and therefore did not influence the pipeline route selection. **Chapter 16 Cultural Heritage** provides further detail on these objects, their value and measures required to ensure their protection.

4.5.4.2 Continental Shelf Crossing

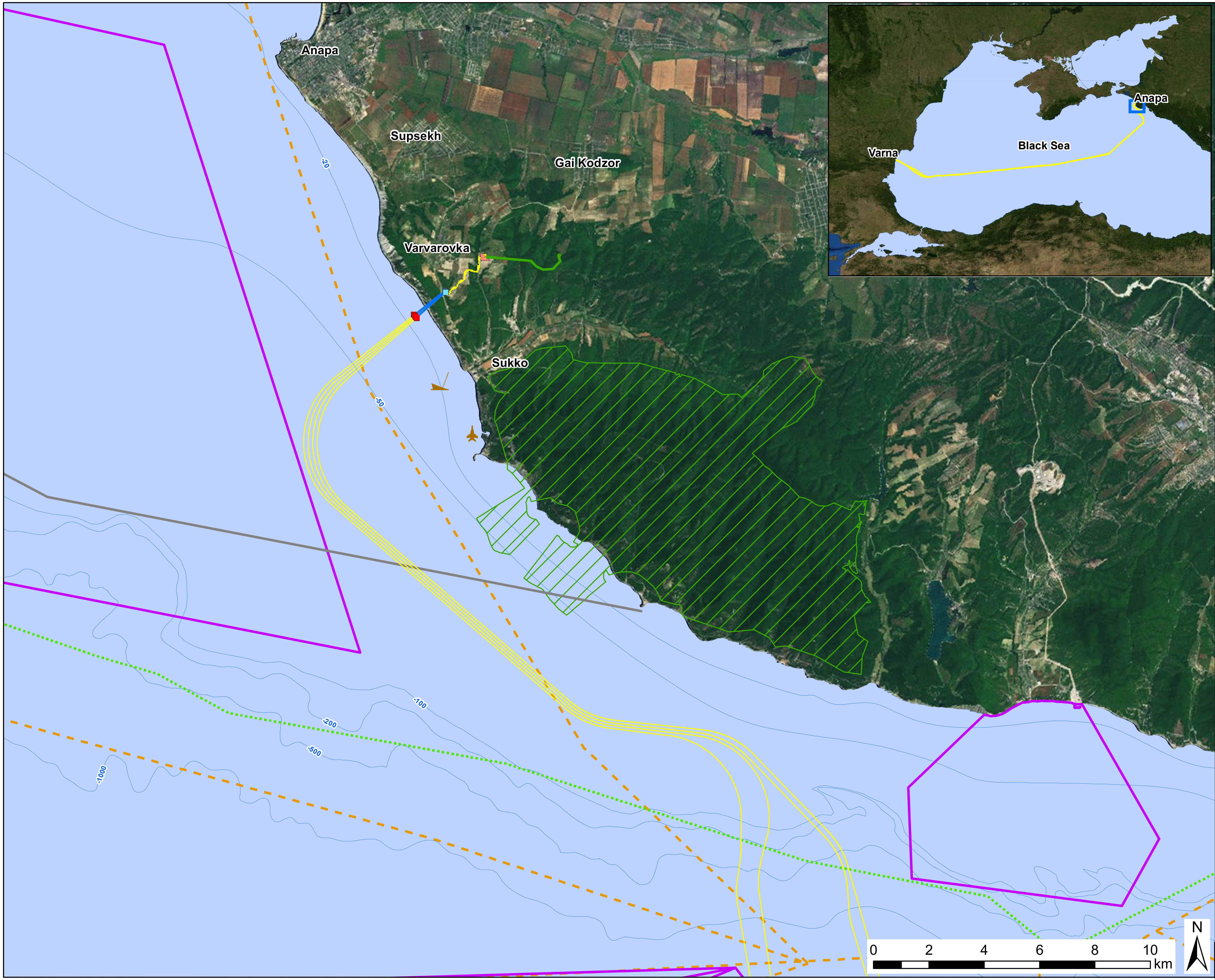
Currently known environmental, socio-economic and cultural heritage constraints on the continental shelf include environmental conservation areas in the shallow water environment (less than 20 m depth), military training areas, ammunition dumping grounds and shipping routes (Figure 4.6 and Figure 4.7). These areas were largely avoided during route selection.

Two further factors were considered in the assessment of alternative routes for crossing the Russian continental shelf:

1. The most sensitive marine habitats on the continental shelf are located at depths between 0 and 50 m; and
2. Below 30 m water depth, where conditions are stable, the risks from anchors and ships' hulls are minimal; and pipelines typically do not need to be buried. Consequently, trenching associated with the burial of pipeline is typically not required below 30 m water depth.

On the basis of the above considerations, the selected corridor runs parallel to the coast at a depth of more than 50 m for most of its length, therefore minimising any potential impacts on marine ecosystems from disturbance of water quality associated with dredging.

Marine habitat surveys were also carried out to validate the suitability of the chosen route (**Chapter 12 Marine Ecology**). These initial surveys, which have informed the assessment of impacts to the marine ecology, did not reveal any significant ecological sensitivities that warranted alteration of the route to minimise impacts.



LEGEND

Russian Sector of South Stream Offshore Pipeline

- Proposed Landfall section pipelines
- Landfall facilities
- Proposed microtunnels
- Proposed offshore pipelines
- Microtunnel entry shaft
- Microtunnel exit pit
- Sunken military airplane ("Me-109" - unconfirmed)
- Sunken scow "Gordipia"
- Anapskaya bank boundary
- Military training area
- Submarine cable
- Shipping lines and approaches
- State nature reserve "Utrish"

United Gas Supply System

- United Gas Supply System pipelines
- Isobaths

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: For Information

Client: South Stream Offshore Pipeline — ENERGISING EUROPE

Project Title: SOUTH STREAM OFFSHORE PIPELINE

Drawing Title: NEARSHORE CONSTRAINTS MAP

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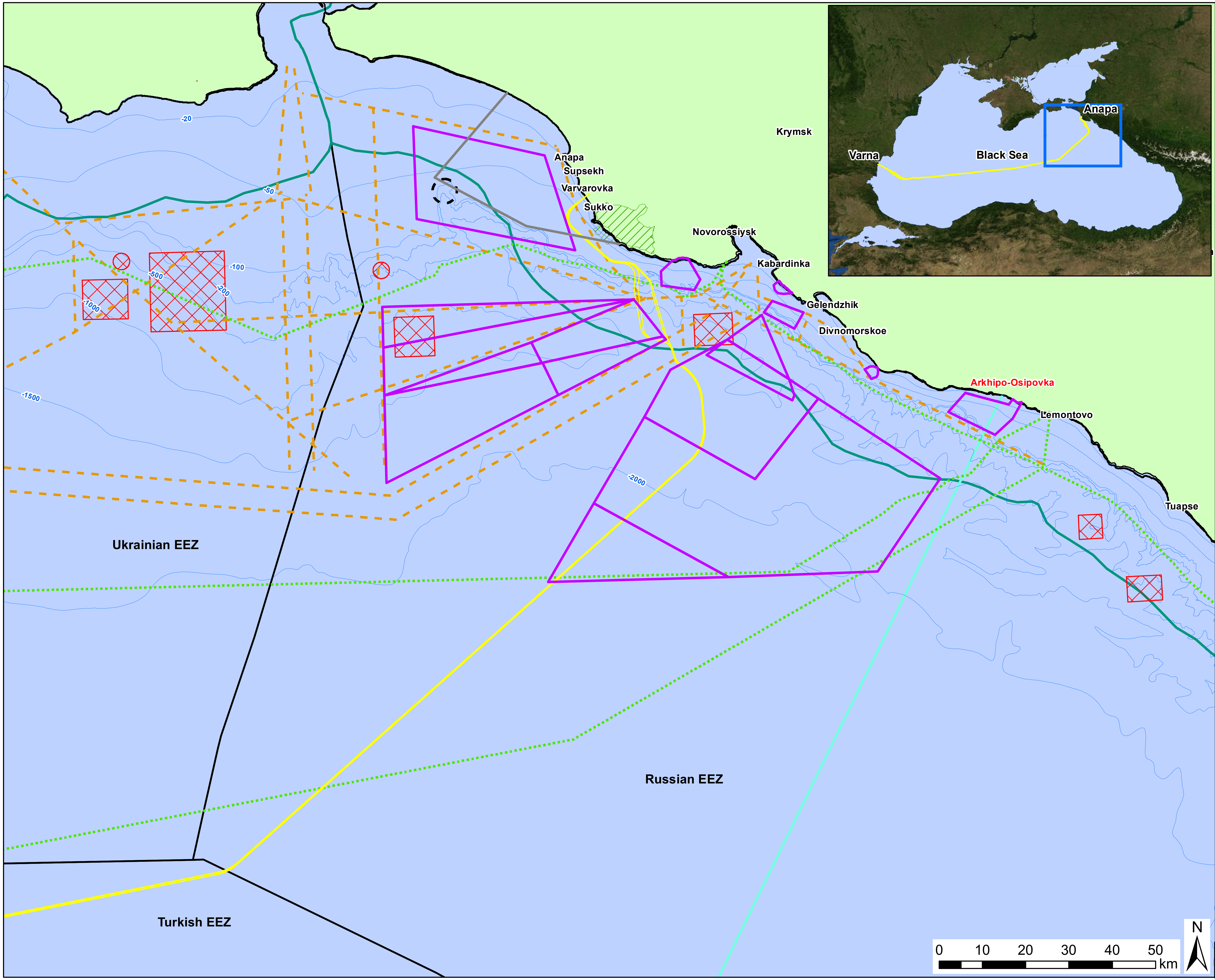

LEGEND

Russian Sector of South Stream Offshore Pipeline

- Proposed offshore pipelines
- Anapskaya bank boundary
- Submarine cable
- Shipping lines and approaches
- Blue Stream pipeline (indicative)
- Territorial waters boundary
- Military training area
- Spoil deposit area
- Explosives dumping ground
- State nature reserve "Utrish"
- Exclusive Economic Zone boundary
- Isobaths

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check / Date	Suffix

Purpose of Issue
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South Stream Offshore Pipeline — ENERGISING EUROPE

Project Title
SOUTH STREAM OFFSHORE PIPELINE

Drawing Title
OFFSHORE CONSTRAINTS MAP

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Figure 4.7

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4.5.4.3 Abyssal Plain Crossing

Following selection of the continental slope crossing, a preliminary corridor was identified to route the pipelines across the abyssal plain to the border with the Turkish EEZ.

No significant engineering or social constraints were identified on the abyssal plain. In addition, there was very limited information available on the environmental constraints (e.g. marine ecosystems). Therefore, a straight line route was initially adopted.

The final route alignment was subsequently selected on the basis of further geophysical, environmental and cultural heritage surveys. The entire corridor was mapped and the geological, bathymetric and cultural features were recorded for further analysis.

Specifically, a thorough review of the seabed features was carried out to determine the presence of features of biological importance such as microbial mats and CHOs. The findings of this review are included in Appendix 7.1 Abyssal Plain Report.

Whereas no significant features of biological importance were identified, four potential CHOs have been identified on the abyssal plain within 150 m of the pipeline route and seabed intervention works[5]. These potential CHOs were first identified in side-scan sonar images and have been earmarked for visual inspection via submersible ROV to determine their identity and potential cultural significance, prior to construction of the pipeline (Ref. 4.4). A conservative approach has been taken to ensure that the objects are not impacted and route adjustments will therefore be made during the detailed design phase of the Project to maintain the 150 m buffer between the pipelines and the objects, regardless of their designation as CHOs. **Chapter 16 Cultural Heritage** discusses these objects, their potential value and measures required to ensure their protection in more detail.

4.6 Summary

This chapter summarises the Analysis of Alternatives performed initially by Gazprom during early feasibility studies and then by South Stream Transport as part of the South Stream Offshore Project, Russian Sector. To some extent, the nature and location of the Project was determined by factors beyond the control of South Stream Transport, particularly in respect of the location of the landfall section, which was constrained by the selection and siting of the Russkaya Compressor Station. Nevertheless, the Analysis of Alternatives has adopted a typical narrowing approach, starting with high level alternatives such as means of transporting gas across the Black Sea, honing in on more detailed consideration of alternatives, such as consideration of detailed pipeline routing. The flow diagram below summarises the analysis of alternatives process, including the rationale for discarding certain alternatives.

---

[5] Seabed intervention works include all activities involving the disturbance of the seabed with the exception of pipe lay. For example, seabed intervention activities would include activities include rock placement to correct free span areas where the seabed is uneven, dredging, trenching, placement of support structures etc.

Figure 4.8 Summary Analysis of Alternatives (South Stream Offshore Project)

Options		Outcome and rationale
The 'no project' or Zero alternative (i.e. no transportation of gas via the Black Sea)	No Project vs Project – gas export via the Black Sea	Project Objective: as an integral part of the South Stream Offshore Pipeline to diversify supply routes for transportation of gas from Russia to Southern and Central Europe via the Black Sea, and to help meet projected increased demand for natural gas. If the Project does not proceed: • Impacts attributed to the Project would not occur, but other impacts associated with alternative transit routes would occur. • An opportunity to diversify gas supply routes will bemissed. • The risk of future gas supply interruptions and shortfalls in C&S Europe would be greater. **The 'No Project' option was dismissed**. Refer to Chapter 1 – the Project need.
Alternative means of gas transportation across the Black Sea	Offshore Pipeline vs LNG (LNG Plant, LNG carriers, regasification)	LNG could be exported to a new regasification facility in Romania, Bulgaria or beyond central and southern Europe, however: • Construction of unloading facilities and a regasification plant on the shore s of southern or central Europe is undesirable. • It is not the Project intent to export beyond central and southern Europe. • Transit through the Turkish Straits, for example to Italy, carries higher safety and environmental risks. **LNG dismissed on the grounds that a pipeline system was considered more safe and reliable avoiding the need for to construct a new regasification plant on the Black Sea coast/ship LNG through the Turkish Straits.**
Landfall – Russia (site selection)	Anapa (greenfield site referred to as Russkaya CS) vs Arkhipo-Osipovka (adjacent to the Blue Stream Beregovaya CS)	Driven by the need to have a large new build CS nearby – two sites identified by Gazprom were Anapa (Russkaya CS)and Arkhipo-Osipovka (close to Beregovaya CS) Studies performed by Gazprom concluded that a compressor station at the Anapa site would have less environmental impact. The cumulative impacts at Beregovaya were considered unacceptable. **Beregovaya was discarded due to concern over significant cumulative environmental impacts.**
Offshore routing (Macro alignment*)	Option 1 - Anapa-Varna via Turkey EEZ vs Option 2 - Anapa-Varna via Ukraine and Romania EEZ) Option 3 - Anapa-Constanta via Ukraine EEZ Option 4 - Anapa-Constanta via Turkey and Bulgaria EEZ	Option 2 and 3 were discarded because survey work would have resulted in schedule delays. Option 4, landing in Romania, was discarded after strategic transit agreements were made with Bulgarian entities. **Option 1 was the preferred alternative** selected for detailed route alignment studies after 1, 3 and 4 were discarded.
Shore crossing technique (Anapa, Russia)	Open cut trench vs Microtunnel	Open cut is typically less expensive, however open cut on a steep cliff face would be technically difficult and likely to result in environmental damage to a sensitive habitat. **Open cut discarded due to technical difficulties and risks to long term pipeline stability.**

References

Number	Reference
Ref. 4.1	Peter Gaz - A.V. Fedorenko Head of Safety and Environment Department et al., 2010. Social-Economical Feasibility Study for "South Stream" Gas Pipeline Project, Volume 17 - Environmental Impact Assessment. Russian Sector, Section 2 – Environmental Impacts Assessment on Alternative Options of Pipeline Route, Archive number: 6976.101.003.11.14.17.02-01(issued to replace 6976.101.003.11.14.17.02).
Ref. 4.2	Giprospetzgaz, 2010. Feasibility Study for the Offshore Section of the "South Stream" Project Pipeline, Volume 17 of the Environmental Impact Assessment (Russian Sector), Second Part of the Environmental Impact Assessment on Alternative Route Options for Pipeline (land area), Archive number: 6976.101.003.11.14.17.02-1 (replacement for 6976.101.003.11.14.17.02, St. Petersburg.
Ref. 4.3	Giprospetzgaz. 2010. Feasibility Study For Construction of South Stream Gas Pipeline, Volume 9: Route Evaluation. Part 3. Route Selection Manual. Archive No 6976.101.003.11.14.09.03-1 Instead of Archive No 6976.101.003.11.14.09.03
Ref. 4.4	Seascape Consultants Ltd. 2013. Interpretation of Seabed Survey Data for the South Stream Offshore Pipeline Project, Report No 2013/07.

Chapter 5: Project Description

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Table of Contents

Tables

Figures

5 Project Description

5.1 Introduction

This chapter of the Environmental and Social Impact Assessment (ESIA) Report describes the technical components of the Project and forms the basis for the assessment of impacts undertaken in the technical studies found in Chapters 8 to 21 of this ESIA Report. The physical aspects of the Project are set out in terms of the Construction, Pre-Commissioning, Operational, and Decommissioning Phases of the Project.

As described in Section 1.2 of **Chapter 1 Introduction**, the Project is the Russian Sector of the South Stream Offshore Pipeline, which itself, is the offshore component of the South Stream Pipeline System that will deliver natural gas from Russia to the countries of central and south-eastern Europe.

The Project commences at a pipeline tie-in (where two pipeline ends are welded together) approximately 100 m upstream of the landfall facilities, which connects the Project pipelines to the project known as "Expansion of the United Gas Supply System" that is being developed by Gazprom Invest. The landfall facilities will be connected to the Russkaya Compressor Station (CS) via four 3.2 kilometres (km) long onshore pipelines. The Russkaya CS, and the four connecting pipelines (upstream of the aforementioned tie-in location), are being developed by Gazprom Invest and are not part of the Project. The tie-ins to the "Expansion of the United Gas Supply System" are located approximately 10 km south of the town of Anapa, in the Krasnodar Krai (or region). See Section 5.2.1 for illustrative figures.

From the landfall facilities, the Project pipelines will extend in a generally south-westerly direction for approximately 2.4 km to four microtunnel entry shafts. The pipelines will continue in a south-westerly direction through microtunnels for approximately 1.4 km where they will emerge from the tunnels approximately 400 m offshore. Microtunnelling has been selected for the shore crossing predominantly due to the technical difficulties associated with the crossing of the high cliffs at the shore crossing location. Due to the steepness of the slope and the presence of rock, open-cut installation of the onshore pipeline across the sea cliffs is not feasible. The pipelines will then extend through Russian Territorial Waters and the Russian Exclusive Economic Zone (EEZ) for approximately 225 km in a generally south and south-westerly direction to the EEZ boundary of Russia and Turkey (the downstream boundary of the Project). From here, the South Stream Offshore Pipeline will continue across the Black Sea, via the Turkey and Bulgaria EEZ towards Varna in Bulgaria where it will make landfall.

The proposed route of the Pipeline was selected following an extensive analysis of alternatives as described in **Chapter 4 Analysis of Alternatives**. Final pipeline route alignments may be further optimised during the detailed design phase; however any such changes are not anticipated to result in changes to the impact assessments presented in technical Chapters 8-21 of this ESIA Report. Should any major changes to the pipeline routing be required, which may affect the results of the ESIA, the management of change process described in Section 5.11 will be followed.

As part of the Project design process, measures to avoid or minimise impacts were identified and incorporated into the design. These are referred to as design controls and include physical design features and management measures. They are based on Good International Industry Practice (GIIP) and are intended to avoid or control unacceptable impacts. Specific design controls are described in this Project Description. Their role in controlling impacts on environmental, social and cultural heritage impacts is further discussed in **Chapter 3 Impact Assessment Methodology**. Where the outcome of the ESIA indicates that design controls are insufficient to manage an impact to an acceptable level, further measures have been identified. These measures have been termed "mitigation measures" and are described in respective chapters and detailed in Environmental and Social Management Plans.

5.2 Project Components

The permanent Project components comprise of the following main elements:

- Four 32-inch (813 millimetre (mm)) diameter buried onshore steel pipelines approximately 100 metres (m) long from the tie-in to the "Expansion of the United Gas Supply System" to the landfall facilities;
- Four 32-inch (813 mm) diameter buried onshore steel pipelines approximately 2.4 km long from the landfall facilities to the microtunnel entry shafts;
- Four 2.5 m diameter, 1.4 km long microtunnels each housing one 32 inch (813 mm) steel pipeline from the microtunnel entry shafts to the offshore microtunnel exit pits;
- Four 32-inch (813 mm) diameter subsea steel pipelines, approximately 225 km in length, from the microtunnel exit pits to the border of the Russian and Turkish EEZ;
- Fenced landfall facilities (approximately 4.85 hectares (ha) in area), which will primarily consist of:
    - Metrology equipment;
    - Four Pipeline Inspection Gauge (PIG) trap facilities (one per pipeline);
    - Eight Emergency Shutdown (ESD) valves (two per pipeline);
    - Eight block valves (two per pipeline);
    - Other valve systems including ball line valves, and temperature control valves (TCV);
    - A gas heating system;
    - Four 24-inch (610 mm) diameter steel pipelines, each approximately 106 m long;
    - Pre-fabricated containers to provide office and storage space, sanitary facilities and house electrical and instrumentation (E&I) equipment;
    - A 21 m high vent stack and associated piping;
    - Isolations joints;
    - Two 10 kilovolt (kV) buried power cables connecting to the Russkaya CS;
    - Two buried fibre optic communication cables connecting to the Russkaya CS;
    - Rainwater drainage system;
- An area of cut and fill slopes (approximately 4.83 ha in area) surrounding the landfall facilities;
- Access road and car parking;

- Cathodic protection system, including an onshore anode bed;
- A permanent Right of Way (RoW) approximately 95 m wide above the landfall section trenched onshore pipelines;
- Exclusion zones extending to 410 m from the outermost landfall section pipelines and landfall facilities for the protection of public health and infrastructure; and
- A 0.5 km exclusion zone (either side of the centreline of the outermost pipelines - except for a section on the Russian continental slope where the pipelines diverge into two groups of two), extending from the seabed to the surface of the sea, and from the microtunnel exit pits to the Russian and Turkish EEZ boundary.

Further details on the permanent Project components are provided in Sections 5.2.4 and 5.2.5 and information on the Operational Phase safety exclusion zones are provided in Section 5.6.6 and 5.6.7. Information on the temporary facilities required for the construction of the permanent Project components is provided in Section 5.3.4.1.

5.2.1 Project Area

The Project Area (defined in Section 1.2.1 and illustrated in Figure 1.5) is subdivided into the following sections: landfall, nearshore and offshore, primarily in relation to the different construction activities employed in each section. The landfall, nearshore and offshore sections of the Project Area are shown in Figure 5.1 and Figure 5.2 respectively and are described below. Note that the Project Area sections are associated with the construction activities and have no ecological meaning.

5.2.1.1 Landfall Section

The landfall section of the Project Area, including the landfall facilities, is approximately 4 km in length. Within this section the pipelines will be buried for the first 100 m upstream of the landfall facilities and for 2.4 km downstream of the landfall facilities using open-cut construction techniques. For safety reasons the buried landfall section pipelines will have a minimum soil cover of 1.5 m. For the remaining 1.4 km each pipeline will be housed in a microtunnel which will terminate approximately 400 m from the coast in water depth of approximately 23 m. The permanent onshore landfall facilities (approximately 142 m wide) are also included within the landfall section.

The area of the landfall section is primarily defined by the maximum operational safety exclusion zone of 410 m width surrounding the Pipeline and the landfall facilities. While the entirety of this area may not experience physical impacts, there will be restrictions on future land use and development within the exclusion zone. Within this area, a 95 m operational pipeline RoW will be permanently established above the pipelines. Outside of the operational safety exclusion zone, the landfall section of the Project Area also includes a temporary construction access road, a bypass road that will be constructed for permanent use, but only used by the Project during the Construction Phase and potential temporary transfer site (if required by contractor). The temporary road will link the microtunnel construction site to a permanent access road being constructed by Gazprom Invest as part of the "Expansion of the United Gas Supply System".

The bypass road will link the Varvarovka – Gai Kodzor public road to Gazprom Invests' permanent access road, in order to provide an access road to the landfall facilities construction site. Refer to Section 5.3.3 and Figure 5.8 for further information on the permanent and temporary access roads required to support the Project.

5.2.1.2 Nearshore Section

The nearshore section of the Project Area commences at the exit point of the microtunnels, located approximately 400 m from the coast at a water depth of approximately 23 m and extends approximately 425 m out to a water depth of 30 m where an above water tie-in will be made following the completion of pre-commissioning activities of the landfall and nearshore section pipelines. From the microtunnel exit point the pipelines will be buried in trenches to a depth of approximately 2.5 - 3 m for a distance of approximately 170 m. From here, out to the edge of the nearshore section (30 m water depth), the pipelines will be coated in concrete and laid directly on the seabed. Concrete coating is to provide protection from third party activities and stability from sea currents. The pipelines are pre-coated before delivery to South Stream Transport.

5.2.1.3 Offshore Section

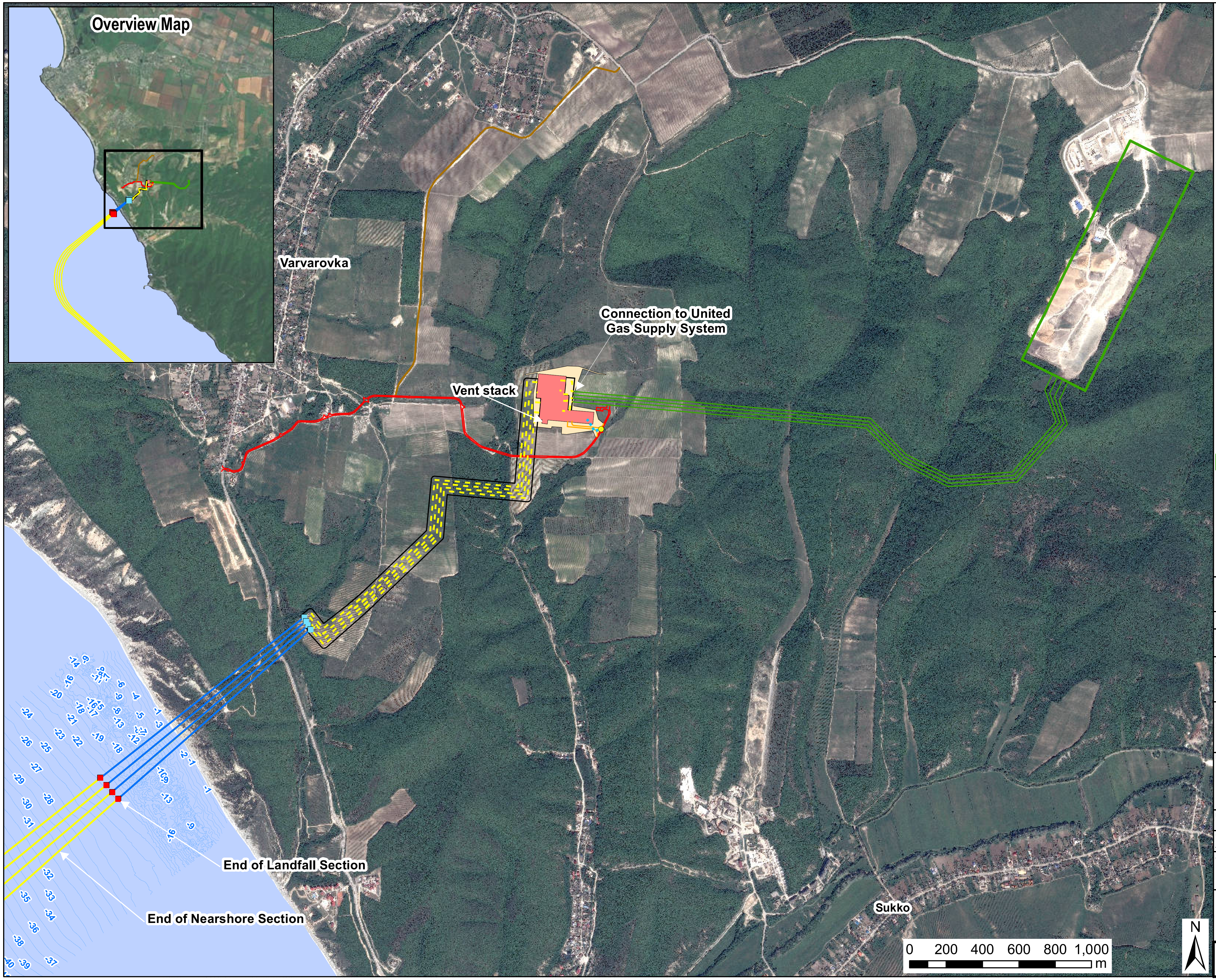
The offshore section of the Project Area extends from the edge of nearshore section at 30 m water depth (where an above water tie-in will be made) to the border of the Russian and Turkish EEZs in the Black Sea, passing through approximately 225 km of Russian waters, of which 50 km lie within Russian territorial waters and 175 km lie in the Russian EEZ. In the offshore section, the pipelines will be laid directly on the seabed. In the offshore section, the pipelines will be coated in concrete out to a water depth of approximately 88 m.

5.2.2 Associated Facilities

As described in **Chapter 1 Introduction**, the Project will rely on other facilities that are not under the direct control of South Stream Transport and typically located outside of the Project Area. In line with the OECD Common Approaches[1] definition for associated facilities these include *"facilities that are not a component of the project but that would not be constructed or expanded if the project did not exist and on whose existence the viability of the project depends; such facilities may be funded, owned, managed, constructed and operated by the buyer and/or project sponsor or separately from the project."* (Ref. 5.1). The Project associated facilities are consistent with this definition and include:

- The Russkaya Compressor Station (CS) located immediately upstream of the Project in Russia being developed and managed by Gazprom Invest; and
- Designated existing quarries for sourcing material / aggregates, where those existing quarries would require significant expansion for the sole purpose of supplying the Project.

[1] OECD Common Approaches are the primary Environmental and Social Standards applicable to the Project. Further details are provided in **Chapter 2 Policy Regulatory and Administrative Framework**.



LEGEND

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Landfall facilities
- Anode ground bed for cathodic protection of pipelines (indicative)
- Proposed microtunnels
- Proposed offshore pipelines
- Microtunnel entry shaft
- Microtunnel exit pit
- Right-of-Way
- Cut and fill side slopes
- Anode ground bed connection to landfall facilities (indicative)
- Permanent access road to be constructed by SSTTBV
- Varvarovka bypass road (used by Project during construction only)

United Gas Supply System

- United Gas Supply System pipelines
- Russkaya compressor station
- Permanent access road to be constructed by Gazprom Invest
- Isobaths

Projection: Lambert Conformal Conic

Revision Details	By Check	Check Date	Suffix

Purpose of Issue: For Information

Client: South Stream Offshore Pipeline — Energising Europe

Project Title: SOUTH STREAM OFFSHORE PIPELINE

Drawing Title: LANDFALL AND NEARSHORE SECTIONS PIPELINE ROUTE

Drawn	Checked	Approved	Date
DH	RW	MW	28 Feb 2014

URS Internal Project No.	Scale @ A3
46369082	1:20,000

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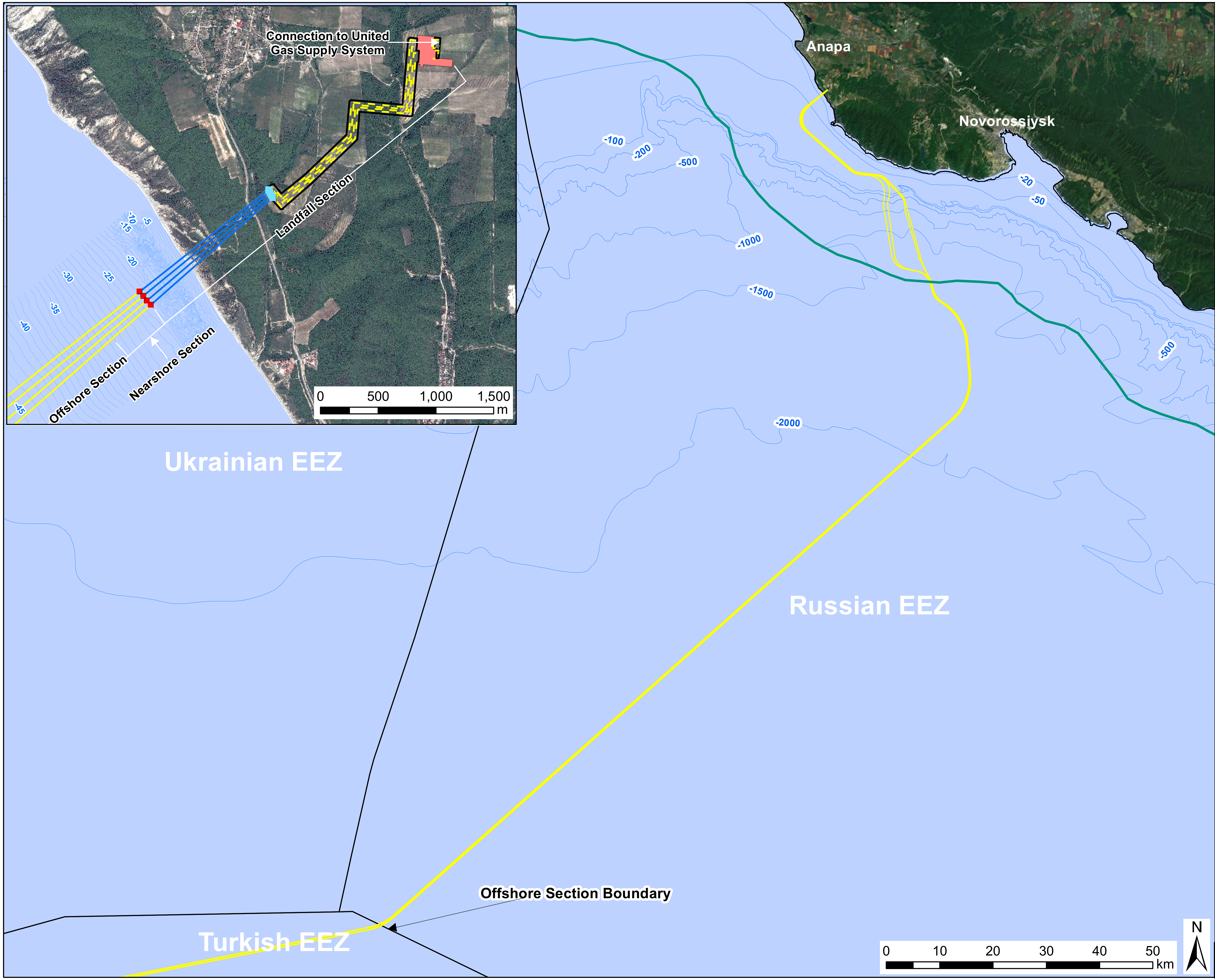
Drawing Number: Figure 5.1

Rev



LEGEND

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Landfall facilities
- Proposed microtunnels
- Proposed offshore pipelines
- Right-of-Way
- Microtunnel entry shaft
- Microtunnel exit pit
- Russian Territorial Waters boundary
- Exclusive Economic Zone boundary
- Isobaths

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: For Information

Client: South Stream Offshore Pipeline — Stream ENERGISING EUROPE

Project Title: SOUTH STREAM OFFSHORE PIPELINE

Drawing Title: OFFSHORE SECTION PIPELINE ROUTE

Drawn	Checked	Approved	Date
DH	RW	MW	18 Feb 2014

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Drawing Number: Figure 5.2 | Rev:

Plot Date: 18 Feb 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 5 Project Description\Figure 5-2 Offshore Section Pipeline Route.mxd

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There are existing Ports in Bulgaria that will be upgraded as part of the Project in order that they can be used as Marshalling Yards for the Project. Use of the Marshalling Yards is described further in Section 5.3.2.1.

5.2.3 The Russkaya Compressor Station

As described in **Chapter 1 Introduction**, the landfall facilities will be connected to the Russkaya CS via four 3.2 km onshore pipelines (Figure 5.1). The four 3.2 km connecting pipelines, and the Russkaya CS are not part of the Project, but will be designed and installed as part of a separate project known as the "Expansion of the United Gas Supply System", which is being constructed by Gazprom Invest. However, the CS provides the pressure necessary to drive gas through the Project pipelines across the Black Sea, and therefore it is considered to be an associated facility. The main elements of the Russkaya CS and its construction and operation are summarised briefly in this Section. The CS is described in more detail in Appendix 20.1.

According to the Russkaya EIA (Ref. 5.2), the Russkaya CS includes approximately 50 ha of permanent landtake for the CS facilities, and comprises the following main elements:

- Input pipelines and gas inlet unit that will connect the main gas pipeline with the gas treatment unit;
- Gas treatment unit that will treat gas by removing contaminants, such as solids, water and hydrocarbon condensate;
- Compressor works, that will comprise the gas pumping units (GPUs) with individual gas air cooling units;
- Gas flow-rate metering unit that will measure the commercial gas flow-rate and determine the chemical composition of the transported gas;
- Supporting facilities and utilities, such as access roads, a gas processing unit for internal power needs, power stations, a boiler unit for heat supply, water supply and treatment facilities, wastewater drainage and treatment facilities; and
- Materials and equipment depot (MED) to provide for storage of materials and equipment. The MED will include an entry area with changing rooms, heated warehouse, cooled warehouse, open storage area, automatic diesel power station, diesel storage tank and local treatment facilities for rainwater.

5.2.3.1 Inlet Unit

The inlet unit will connect the Russkaya CS to the upstream gas pipeline. A control unit will provide for safe operation of CS inlet unit and pipelines, protecting them from pressure fluctuations.

5.2.3.2 Gas Treatment Unit

The gas treatment unit will remove solids, water and hydrocarbon condensate in order to prevent contamination and erosion of the CS equipment and pipelines. Products of treatment will be transported for recycling / disposal at licensed facilities.

5.2.3.3 Gas Compressor Works

The compressor works will comprise 32 megawatt (MW) unit capacity gas pumping units (GPUs) equipped with full pressure turbo-compressors (Ref. 5.2). During Stage 1, the works will consist of seven GPUs. This will be expanded during Stage 2 to consist 14 GPUs which will increase the maximum total capacity to 448 MW, and the maximum processing capacity to 63 billion m^3/year (Ref. 5.3). Gas will be compressed at the CS for 24 hours a day, 7 days a week. The schedule for these two stages is summarised in Section 5.2.3.8.

5.2.3.4 Access Roads

A permanent access road will be constructed by Gazprom Invest to the Russkaya CS site. It is understood that this access road will have a permanent width of approximately 25 m (including shoulders) and will be hard surfaced. The construction corridor width for the road will be approximately 41 m wide. Temporary access roads will be constructed to the construction site and site accommodation, with temporary road surfacing of precast concrete slabs (Ref. 5.2).

5.2.3.5 Power Supply

The main power supply to the Russkaya CS will be a natural gas power plant, consisting of seven 1.5 MW gas turbines (five in duty, one reserve, one repair). An emergency automatic diesel power station will be used as a reserve source of power in case of a power cut (Ref. 5.2).

5.2.3.6 Water Demand and Supply

Construction

During construction, 7 m^3 per day of water will be required for production and engineering needs (Ref. 5.2). Water will be delivered from the existing water supply systems of nearby settlements and stored in a tanker.

Pre-Commissioning

The total demand for water for hydrotesting is estimated to be 3,000 m^3 (Ref. 5.2). To accumulate this volume, a temporary earthen insulated settling pit will be constructed near the Russkaya CS site. Water will be delivered to the site from existing supply systems in nearby settlements via trucks (Ref. 5.2).

Operation

During operations at the Russkaya CS it is estimated that approximately 152 m^3 per day of water will be required for use in the CS plant, household and potable needs, and for watering the area (Ref. 5.2). Water will not be used in the main technical processes at the CS.

5.2.3.7 Landfill and Waste Facilities

According to the Russkaya EIA (Ref. 5.2), contracts will be signed with licensed organisations for waste recycling, disposal, and reprocessing prior to the commencement of construction and operation of the Russkaya CS.

Construction

Construction waste will comprise solid refuse waste, vegetation and mineral soil surplus, stumps and cutting debris, and will be transported to approved sites. The total amount of construction waste generated is predicted to be approximately 502,484.5 tons (Ref. 5.2).

Operation

All industrial and domestic wastes produced during CS operation will be incinerated at the station site or transferred to licensed facilities. The annual amount of waste generated at the site is predicted to be approximately 164.6 tons (Ref. 5.2).

5.2.3.8 Construction Phase

Indicative Construction Schedule

The main construction period for Stage 1 of the Russkaya CS is estimated to be 34 months, from early 2013 until approximately October 2015. Stage 2 of the construction is estimated at 34 months, with completion in 2018 (Ref. 5.2).

Construction Works

Construction Materials

During the preparatory period, quarry soil will be transported to site via trucks and used to install temporary platforms and roads, and to maintain roads used during the construction phase (Ref. 5.2). Industrial equipment, pipes, soil, construction cargo, and labourers will all be transported to site by vehicles.

5.2.3.9 Pre-Commissioning, Commissioning and Operation

The Pre-Commissioning phase will involve testing the pipelines for durability and checking for leaks using the hydraulic method.

Process discharge of gas will be performed during the commissioning stage.

During operation, gas will be transported through the Russkaya CS via the following sequence: supply, treatment, compression, cooling and metering. Operational procedures centre on monitoring and maintenance of the CS facilities.

5.2.4 Pipeline Routing, Spacing and Operational Exclusion Zones

In general the four pipelines shall be laid parallel to each other in such a fashion that minimises the overall pipeline length and extent of the onshore RoW and offshore exclusion zones. However, detailed design engineering may require some final deviations to the design should any changes be required they are anticipated to be minor and are not anticipated to alter the results of this ESIA Report. Should any major changes to the pipeline routing be required, which may affect the results of the ESIA Report, the management of change process described in Section 5.11 will be followed.

In the landfall section of the Project Area, the distance between the pipelines in open-cut trenches is approximately 19 m. However, the spacing between the pipelines housed in the microtunnels increases from 26 m at the entry shafts to approximately 50 m at the exit pits located approximately 400 m from the coast. Throughout the nearshore and offshore sections, the pipeline spacing will range between 50 and 4,300 m (where the pipelines diverge down two canyons on the continental slope) measured from the centreline of the pipelines, although in general they are approximately 100 m apart.

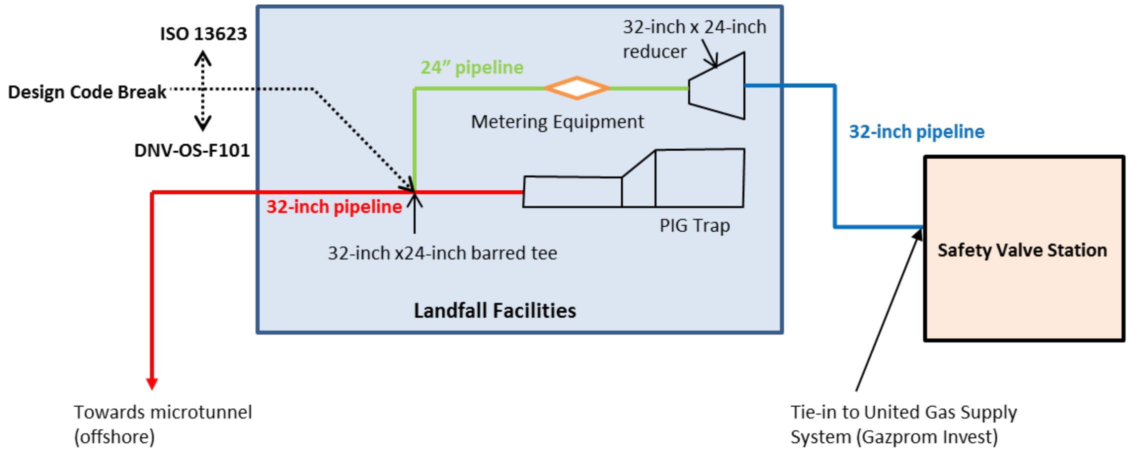
Operational Phase exclusion zones and permanent land take is required to ensure the safety of the landfall section pipelines. The permanent RoW will be approximately 95 m wide (19 m either side of the centreline of the two outside pipelines and 19 m between the centreline of each pipeline). In addition to the permanent RoW there will be three Safety Exclusion Zones for the protection of public health and infrastructure, which go out to a maximum distance of 410 m from the outermost pipelines and landfall facilities. Further information on permanent land use and onshore exclusion zones are provided in Section 5.6.6.

During the Operational Phase of the Project an exclusion zone of 0.5 km either side of the outermost pipelines will be put in place above the offshore and nearshore section pipelines for the entire length of the pipelines within the Russian EEZ (except for a section on the Russian continental slope where the pipelines diverge into two groups of two). This will restrict activities that may damage the pipelines. Further information on the offshore exclusion zones is provided in Section 5.6.7.

5.2.5 Permanent Landfall Facilities

The landfall facilities will occupy an area of approximately 4.85 hectares (ha). The areas of cut and fill side slopes surrounding the landfall facilities are approximately 4.83 ha. The location of the landfall facilities is shown in Figure 5.2 and the indicative layout of the equipment is shown in Figure 5.3 and Figure 5.4.

Figure 5.3 Landfall Facilities 32-Inch and 24-Inch Pipelines Design Break



Within the landfall facilities there will be pipe and equipment installed both above and below ground as illustrated in Figure 5.5.

The main components of the landfall facilities are the metrology equipment for monitoring the operations at the landfall facilities (gas temperatures, pressures etc.), PIG traps, electrical heating system, a venting system for pipeline depressurisation and customised pre-fabricated containers, that will serve various purposes including providing office space, sanitary facilities and housing E&I equipment to monitor the operating conditions of the pipelines. The final number and dimensions of the containers will be confirmed during the detailed design phase. However, this is not anticipated to affect the result of the impact assessments reported in Chapters 8-21 of this ESIA Report.

The landfall facilities will also include a number of valve systems including ESD valves, block valves, ball line valves, temperature control valves (TCV) and flow control valves (FCV).

Within the landfall facilities, each 32-inch pipeline will pass through a reducer (32-inch x 24-inch) which decreases the pipeline diameter to 24-inch, leading to a 32-inch x 24-inch barred tee (a type of T-shaped pipe fitting) upstream of the PIG traps. The 24-inch pipeline is required in order to connect to the metrology equipment. From the barred tee, the 32-inch pipeline diverges. In one direction the pipeline leads to a PIG trap and in the other direction the pipeline continues downstream through the landfall facilities as can be seen in Figure 5.4. A schematic of this process is shown in Figure 5.3.

The landfall facilities will be provided with power by buried cables which will run from the Russkaya CS to the landfall facilities. A fire and gas detection system will also be installed at the landfall facilities. The landfall facilities will be unmanned, except during maintenance activities, and will be controlled from a Central Control Room (CCR) and a Back Up Control Room (BUCR) located in Amsterdam.

The main elements of the landfall facilities are described in the following sections and permanent access routes to the landfall facilities are described in Section 5.3.3. Further information on permanent land take requirements for the Pipeline is provided in Section 5.6.6.

5.2.5.1 Monitoring Equipment

The E&I equipment required to monitor the operation of the South Stream Offshore Pipeline will be housed in customised pre-fabricated containers located with the landfall facilities. The monitoring equipment will continuously measure the gas composition (including water and hydrocarbon dew point), temperature, flow rate and pressure of the gas being transported. It is anticipated that approximately five containers may be required to house the necessary E&I equipment.

5.2.5.2 Emergency Shutdown Valves

Consistent with GIIP, the landfall facilities in Russia will have local ESD valves installed for each pipeline. An ESD valve is a hydraulic actuated and spring return valve designed to stop the flow of a hazardous substance (i.e. the gas) upon the detection of a potentially dangerous event or non-standard operating conditions. The ESD valves will quickly enable the offshore section pipeline to be isolated from the landfall facilities in case of a rupture or leak. This minimises risk of possible harm to people, equipment or the environment. The ESD valves will be located in below ground concrete pits and are designed to operate in the event of plant malfunction or fire. The location of the inlet and outlet ESD valves are shown in Figure 5.4.

5.2.5.3 Block Valves

Each pipeline within the landfall facilities will be equipped with block valves. The block valves enable a segment of the pipeline to be isolated for maintenance work. Block valves are not as quickly operated (opened / closed) as the ESD valves described above, which are used in response to an emergency situation.

5.2.5.4 Pipeline Inspection Gauge Trap Facilities

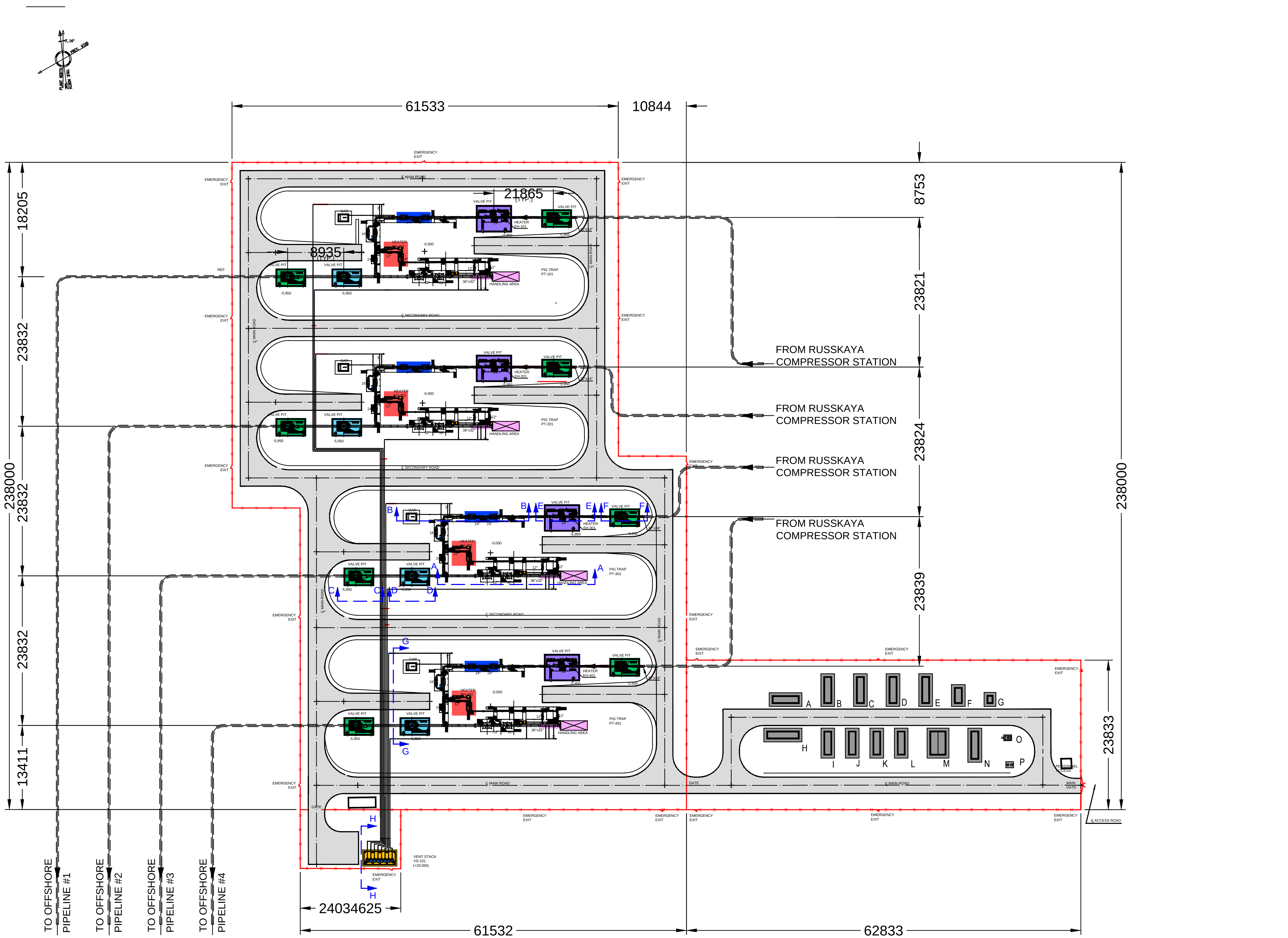
A bidirectional PIG trap will be constructed for each 32-inch pipeline. PIG traps are used for inserting PIGs into a pipeline then launching, receiving, and finally removing them without flow interruption. The PIG trap will be used to send and receive PIGs during pre-commissioning tests and to receive PIGs during maintenance activities in the Operational Phase. PIGs are used for activities such as checking for defects (gauging), cleaning, drying and inspection of the inside of the pipeline.

5.2.5.5 Gas Heating System

A gas heating system will be employed to heat the gas to maintain the temperature of the gas above the minimum design requirements of -10°C. This heating system will not be required on a continuous basis and will only be employed during start-up operations following a planned or emergency shutdown event and at certain gas throughput quantities. It is estimated that the heaters will be required to operate for between one and three days during start-up operations depending on the size of heater used and length of shutdown period.

5.2.5.6 Vent System

The venting system is designed for venting the gaseous inventory of the pipework within the landfall facilities to the atmosphere (to depressurise) via eight 3-inch vent pipes in cases of planned shutdown of the pipelines. Each of the vent pipes will be mounted to a single 21 m high vent stack. For safety purposes, the location of the vent stack structure is chosen such that the prevailing wind blows gas away from the landfall facilities. Consequently the vent stack will be located approximately 70 m from the nearest pipework within the landfall facilities. Flow of gas to the vent stack is controlled by blow down valves (BDV). The BDV is a fail-safe actuated valve with downstream piping leading to a local vent pipe. During normal operations, the vent stack will not emit any gas. Venting will only take place during planned maintenance or shutdown activities that may require gas within certain areas of the landfall facilities to be released to atmosphere. The vent stack will be fitted with appropriately designed silencers to reduce the noise associated with the venting process. There will be no flaring from the vent stack.



RUSSIAN SECTOR OF THE SOUTH STREAM OFFSHORE PIPELINE

LEGEND:

GAR =	GAS ANALYZING ROOM
	SECURITY FENCING
	CONCRETE VALVE PIT. CONTAINS: - EMERGENCY SHUT DOWN VALVE - ELECTRICAL CASTLINE HEATER - TEMPERATURE CONTROL VALVE
	EMERGENCY SHUTDOWN VALVE (IN CONCRETE PIT)
	BLOCK VALVE (IN CONCRETE PIT)
	GAS HEATING BYPASS SYSTEM. CONTAINS: - ELECTRICAL CASTLINE HEATER - TEMPERATURE CONTROL VALVE
	METROLOGY EQUIPMENT
	PIPELINE INSPECTION GAUGE (PIG) TRAP
	VENT STACK
	PRE-FABRICATED CONTAINERS AND PORTAKABINS
A.	COMMON ELECTRICAL AND INSTRUMENTATION ROOM
B.	ELECTRICAL AND INSTRUMENTATION ROOM PIPELINE 1
C.	ELECTRICAL AND INSTRUMENTATION ROOM PIPELINE 2
D.	ELECTRICAL AND INSTRUMENTATION ROOM PIPELINE 3
E.	ELECTRICAL AND INSTRUMENTATION ROOM PIPELINE 4
F.	MEASURING ROOM
G.	CP CONTAINER
H.	COMMON LOCAL CONTROL ROOM
I.	MEETING / STAFF ROOM
J.	MEETING / STAFF ROOM
K.	OPERATORS ROOM
L.	STORAGE FOR SPARE PARTS
M.	TRANSFORMERS
N.	DIESEL GENERATOR
O.	DIESEL STORAGE TANK (9 m³)
P.	DIESEL DISCHARGE TANK (1 m³)
	ROADS

NOTES

1. ALL DIMENSIONS ARE IN mm.
2. VALVE PITS ARE PROVIDED FOR ISOLATION AND ESD-VALVES.
3. PIPELINE CONSTRUCTION SEQUENCE: #1, #2, #3, #4.

Projection: Lambert Conformal Conic

Revision Details	By / Check	Date	Suffix

Purpose of issue: For Information

Client: South Stream Offshore Pipeline — ENERGISING EUROPE

Project Title: SOUTH STREAM OFFSHORE PIPELINE

Drawing Title: Indicative Landfall Facilities Layout

Designed	Drawn	Checked	Approved	Date
RW	OAS	MJW		20/11/13

URS Internal Project No. 46369078

Scale @ A3 1:1500

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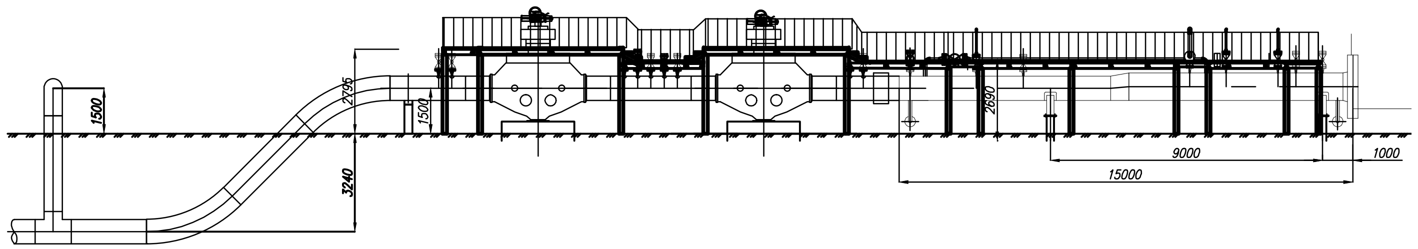

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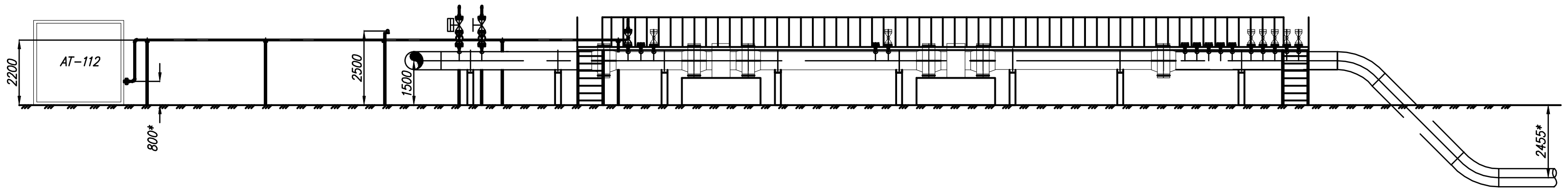

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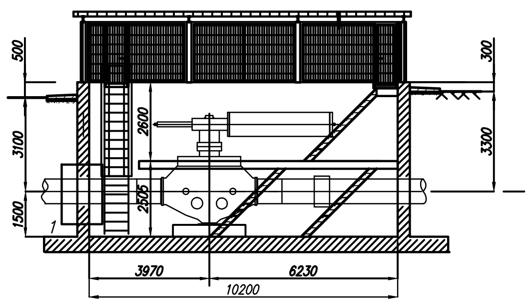

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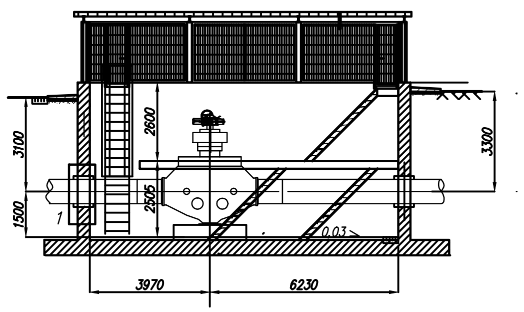

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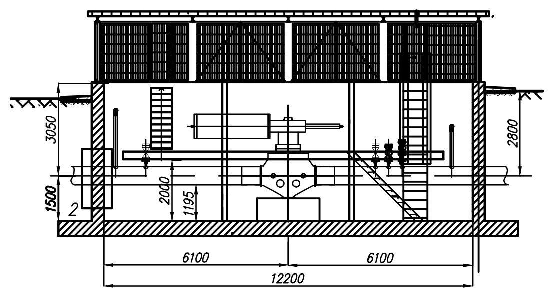

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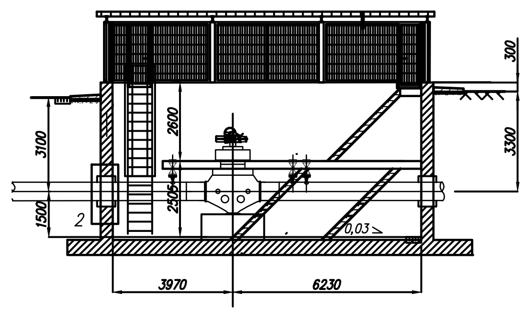

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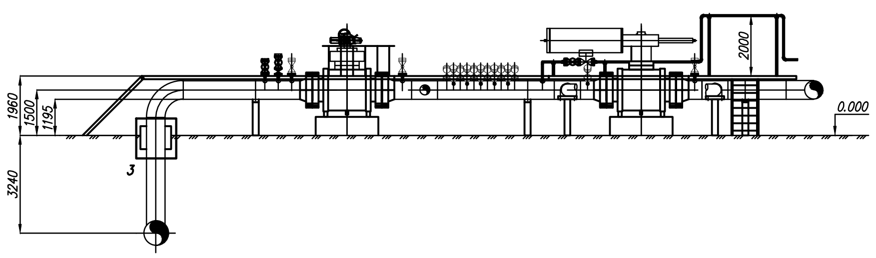

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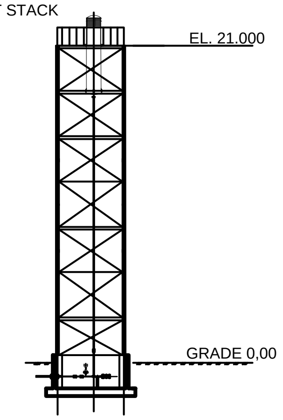

SECTION H-H
Scale 1:500

RUSSIAN SECTOR OF THE SOUTH STREAM OFFSHORE PIPELINE

NOTES
1. ALL DIMENSIONS ARE IN mm.
2. VALVE PITS ARE PROVIDED FOR ISOLATION AND ESD-VALVES.

Projection: Lambert Conformal Conic

Revision Details	By / Check	Date	Suffix

Purpose of issue
For Information

Client
South Stream Offshore Pipeline — ENERGISING EUROPE

Project Title
SOUTH STREAM OFFSHORE PIPELINE

Drawing Title
Indicative Landfall Facilities Elevations

Designed	Drawn	Checked	Approved	Date
RW	OAS	MJW		19/03/14

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46369078	As Shown

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Drawing Number	Rev
Figure 5.5	

5.2.5.7 Auxiliary Facilities

Fire and Gas Detection System

The purpose of the Fire and Gas (F&G) detection system is to protect and alert personnel and assets from the consequences of a fire and/or gas release. The F&G detection system is a safeguarding system which acts completely autonomously from other safety systems. The landfall facilities F&G detection system will include a number of strategically placed gas, flame and smoke detectors. The containers housing the E&I equipment will also be fitted with gas, flame and smoke detection systems as appropriate.

In an emergency case the landfall facilities will be isolated from the offshore pipeline and Russkaya CS in Russia and the Receiving Terminal in Bulgaria. There is no requirement for emergency venting (i.e. venting is not part of the ESD logic). However, provisions exist to enable a manual depressurisation of the landfall facilities, if required.

Provisions for active firefighting activities exposing personnel are not foreseen for fire protection of the equipment within the landfall facilities as water based extinguishing systems are not considered an effective measure to extinguish or even mitigate the effects of gas fires on gas containing equipment. Main piping will be installed underground as much as possible and ESD valves will be installed in pits to minimise exposure to fire and explosion events, and therefore minimise the potential for escalation. The containers housing the E&I equipment will be provided with automated gaseous extinguishing systems in accordance with applicable fire protection codes and standards. As the rooms in the containers will be occasionally occupied by electrical/instrumentation personnel, signs and warning systems shall be in place to ensure personnel do not enter or get trapped in the rooms when the system is activated upon fire detection. The containers Heating Ventilation Air Conditioning (HVAC) system will be provided with fire dampers, to be closed prior to activation of the extinguishing system. This will ensure the effectiveness of the extinguishing system and prevent migration of inert gas to other areas.

During a gas venting event (for example during a process shut down for maintenance) there is a risk that the gas cloud could ignite at the vent stack. If this occurs, the gas supply to the vent stack will be stopped.

Security Systems

The perimeter of the landfall facilities will be secured by chain-link fencing. An intrusion detection system with Closed-Circuit Television (CCTV) and presence detection will also be installed at the landfall facilities. The CCTV and presence detection will be monitored from the CCR. The CCR will also have a constant and secure communication link with operational staff located at the Russkaya CS (operated by Gazprom Invest) who will be alerted to an incident if necessary.

A Security Plan is currently being developed by South Stream Transport as part of the Health, Safety, Security and Environmental Integrated Management System (HSSE-IMS). The Security Plan will define the detailed management and security measures to be employed for the Project. Further information on the management plans that will be produced for the Project is provided in **Chapter 22 Environmental and Social Management.**

5.2.5.8 Utilities

Electrical Power Supply

During operation, the landfall facilities will be provided with 400 kW of electrical power, provided via two 10 kV buried cables which will run from the Russkaya CS to the landfall facilities. Transformers will be provided within the landfall facilities to adjust the electricity supply as required for the operation of systems and equipment.

In addition, emergency power supply provisions are provided at the landfall facilities to support critical electrical systems following the loss of normal power supplies. It will be supplied by an emergency power generator and batteries (uninterruptible power supply). The emergency power generator is a diesel generator with integrated diesel storage for several days of power supply.

Emergency power is provided so that essential safety systems can still function and maintain safe conditions following the loss of normal power supplies. These systems are primarily those associated with control and monitoring, emergency shutdown, F&G detection systems and communication.

Water

There is no process water demand at the landfall facilities and there will be no service water connection to a mains supply. Potable water for domestic consumption will be provided through a drinking water dispenser or bottled water that will be brought in when required for personnel. Water is not required for firefighting.

Wastewater

No sewerage connection is required for the landfall facilities as chemical toilets will be used. Proprietary service will be contracted for toilet emptying for disposal off-site, and maintenance of chemical toilets. The only water collected during the Operational Phase will be rain water run-off from hardstanding areas.

The run-off will be guided via engineered sloped surfaces and a system of drainage channels which will flow towards the south-eastern corner of the landfall facilities. The collected water will be filtered by sand traps and pass through an oil-water separator before being discharged into the nearby gully, Graphova Gap, which is a tributary of the Sukko River.

Systems and equipment using liquid fuels or chemicals, for example the emergency back-up diesel generator, will be provided with impermeable bunding to contain any leaks/spills as an integral part of the design. Any rainwater drainage from these areas will be directed through an oil-water separator prior to being discharged.

Any waste water arising from operational maintenance activities (e.g. pigging of pipelines) will be collected on site in tanks and transported from site by an appropriately licensed waste hauler to an appropriate waste treatment site in accordance with current waste management regulations.

Waste

No waste will be produced at the landfall facilities during normal operating conditions as the landfall facilities will be unmanned. Low volumes of waste will be generated during maintenance activities (for example during pigging of the pipelines). This will be collected and taken-off site and disposed of at an appropriately licensed waste treatment site in accordance with current waste management regulations. A description of potential waste streams generated during the Operational Phase is provided in **Chapter 18 Waste Management.**

5.2.5.9 Telecommunication System

The landfall facilities will be equipped with a Telecommunication System (TCS). The TCS will be designed to operate under normal conditions with minimum operator actions required. As the distance between the landfall facilities in Bulgaria and the landfall facilities in Russia is in excess of 900 km, and the location of the CCR and BUCR in Amsterdam is also a significant distance from the landfall facilities, a dedicated South Stream Offshore Pipeline telecommunication network infrastructure (e.g. use of fibre optic cables) is not considered feasible.

It is proposed that a service with high availability in combination with high bandwidth is used. Thus a broadband internet connection (Digital Subscriber Line (DSL)) will be used as the primary transmission technique and data path for the TCS. A satellite connection (Very Small Aperture Terminal (VSAT)) will provide a backup transmission technique. The TCS will automatically switch back and forth between data paths, based on failure and recovery from failure of data paths. The landfall facilities will also be equipped with an Ultra High Frequency (UHF) radio system to enable two-way indoor and outdoor communication at the landfall facilities where no fixed telephone system is available. The mobile network (Global System for Mobile Communications (GSM)) will be used to supplement the telephone network but is not part of the TCS due to limited bandwidth.

Telecommunication links between the Project and the "Expansion of the United Gas Supply System" will be made via two buried fibre optic cables connecting the landfall facilities and Russkaya CS. The connection between the fibre optic cables installed by South Stream Transport and Gazprom Invest will be made at the Telemechanic Valve Station being developed by Gazprom Invest approximately 300 m upstream from the landfall facilities. The fibre optic cables will allow bi-directional information exchange to take place between the landfall facilities and Russkaya CS and wider South Stream Offshore Pipeline facilities such as the CCR in Amsterdam. Information to be exchanged includes safeguarding signals (e.g. if a shutdown is taking place), process control data (e.g. changes in flow rates, valves opening/closing) and security information (e.g. a security alert as a result of a security breach).

5.2.6 Design Philosophy

The South Stream Offshore Pipeline (including the Project) has a design life of 50 years. The overall design philosophy is to ensure that the South Stream Offshore Pipeline is in compliance with internationally recognised standards for the design, material use, fabrication, installation, testing, commissioning, operation and maintenance of pipeline systems. Furthermore, the design aims to minimise impacts to the environment and communities.

5.2.6.1 Pipeline System Design Codes and Standards

The Project will be undertaken in compliance with national and internationally recognised standards for the design, material use, fabrication, installation, testing, commissioning, operation and maintenance of pipeline systems. The Project will comply with Russian Federation national legislation, spatial planning (detailed development plans), investment design, construction permit and other related permits.

The Project will be designed in accordance with recognised and respected pipeline industry standards.

In addition, a Project Specific Design Code (PSDC) will be prepared for the Project, which is intended to reconcile the design with Russian requirements. The PSDC for the Project will be developed during the detailed design stage and will be primarily based on DNV-OS-F101 (2010).

DNV will certify that the offshore gas pipeline is compliant with its internationally-recognised offshore design code Offshore Standard DNV-OS-F101, which is harmonised with ISO 13623:2009 and other relevant ISO standards. This design code has been used for 65% of offshore pipelines worldwide, including Blue Stream, which connects Russia with Turkey across the Black Sea, and Nord Stream, which is the only high pressure offshore pipeline constructed in the Baltic Sea.

5.2.6.2 Pipeline Design Parameters and Gas Properties

System Export Capacity

When fully operational the Project will have a design export capacity of 63 Billion Cubic Meters (BCM) per year. Each of the four pipelines will have an export capacity of 15.75 BCM and a daily flow rate of approximately 47.9 Million Standard Cubic Metres (MMSCM) per day.

The entire South Stream Offshore Pipeline, including the Russian sector, will have a design pressure of 300 bar, although the expected maximum operating pressure is anticipated to be approximately 284 bar. The operating pressure of the South Stream Offshore Pipeline will vary across its length, particularly in relation to friction inside the pipelines and ambient temperature conditions surrounding the pipelines. The operating temperature of the gas will be approximately 50°C at the upstream end of the Project pipelines and will gradually fall as the gas moves further offshore through the pipeline. By the time the gas makes landfall in Bulgaria the arrival operating pressure will have fallen to between 65 and 87 bar (if the South Stream Offshore Pipeline is operating at maximum flow rate).

The operating temperature of the gas on arrival in Bulgaria will normally be approximately -5°C. However, during extreme winter conditions there is potential for the gas temperature to fall to -8°C and as such, the pipelines have been designed to a minimum temperature of -10°C.

The South Stream Offshore Pipeline operating data is summarised in Table 5.1.

Table 5.1 Summary of System Pressures and Temperatures

Parameter	Value
Design Pressure (in Russia)	300 bar at +180 m reference elevation
Maximum operating pressure (inlet)	284.5 bar
Minimum operating delivery pressure (in Bulgaria)	65 bar at +100 m reference elevation
Maximum operating delivery pressure (in Bulgaria)	87 bar at +100 m reference elevation
Design Temperature - minimum / maximum	
- main 32-inch pipeline - landfall facilities 32-inch pipeline - main landfall facilities piping - bypass heaters / piping - venting piping - vent stack	-10°C / + 55°C -30°C / + 55°C -40°C / + 55°C -40°C / + 93°C -120°C / + 55°C -150°C / + 55°C
Operating Temperature - maximum (compressor outlet in Russia) - minimum (requirement at landfall in Bulgaria)	 50°C -5°C (normal) - 8°C (in extreme winter conditions)

Safety protection facilities will be provided so that the pipelines at the landfall facilities in Russia will not be subject to temperatures higher than the maximum design temperature. This is described in more detail in Section 5.6.1.

Gas Composition and Properties

The gas to be transported by the South Stream Offshore Pipeline will be treated to a dry condition (i.e. having a water and hydrocarbon dewpoint of -22°C at 65 bar). Dry gas means water, liquefiable hydrocarbons and other impurities have been removed from the gas to make it suitable for sale to gas customers. The gas will consist of approximately 97 mol% [2] of methane and the maximum carbon dioxide (CO_2) content will be 0.41 mol%. The gas density is anticipated to vary between approximately 60 and 250 kilograms per cubic metre (kg/m^3).

[2] Mol% describes the percentage of moles (or molecules) within a given mixture.

Table 5.2 provides a summary of the likely composition of the gas. These gas properties apply as design values only and the properties of the processed natural gas provided to the South Stream Offshore Pipeline may vary slightly from those identified in the table. However, any changes will be very small deviations around the design natural gas parameters and will not result in changes to the size and design of the main Project components.

Table 5.2 Gas Composition

Component	Mole %	Component	Mole %
Methane	97.5389	n-pentane	0.0171
Nitrogen (N_2)	0.9305	Hexane	0.0205
CO_2	0.4101	Heptane	0.0033
Ethane	0.8800	Octane	0.0004
Propane	0.1399	Nonane	0.0001
i-butane	0.0150	Water	0.0014
n-butane	0.0249	Methanol	0.0005
i-pentane	0.0171	Hydrogen sulphide (H_2S)	0.0003

5.2.6.3 Pipeline Design Data

Pipeline Overview

The pipelines will be constructed of steel line pipes made of 12 m long sections, which will be welded together. The pipe sections will be coated both inside and outside prior to delivery to the marshalling yards. The internal coating will be an epoxy paint which improves internal cleanliness and the operational gas flow rate, whilst the external coating will be made of three-layer-polypropylene (3LPP) to protect the pipelines from corrosion.

Shallow water sections of the subsea pipelines (for water depths of less than approximately 88 m, including buried pipelines) will be additionally coated with reinforced concrete to increase their weight to improve stability against sea currents and provide additional protection from external damage due to third party activities. The concrete coated pipelines will be delivered to the marshalling yards pre-coated ready for installation. In addition, the pipelines will be protected against corrosion by a cathodic protection system consisting of sacrificial anodes for the nearshore and offshore sections and an Impressed Current Cathodic Protection (ICCP) system for the landfall section.

Pipe Dimensional Data

The steel pipe properties and dimensional data of the 32-inch pipes to be used for the South Stream Offshore Pipeline (including the Project) are summarised in Table 5.3 and Table 5.4, respectively.

Table 5.3 Steel Properties of 32-inch Pipes

Parameter	32-inch Pipe
Steel density	7,850 kg/m^3
Young's Modulus	207 megapascal (MPa)
Poisson's ratio	0.3
Material grade (per DNV-OS-F101)	SAWL 450
Specified Minimum Yield Stress, SMYS	450 MPa
Yield stress to be used in design	447 MPa

Table 5.4 Pipeline Dimensional Data of 32-inch Pipes

Parameter	32-inch Pipe
Pipe nominal outside diameter	812.8 mm
Pipe nominal inside diameter	734.8 mm
Wall thickness	39 mm
Internal or external corrosion allowance	0 mm
Wall thickness fabrication tolerance	±1 mm

The pipe used for the landfall, nearshore and offshore sections will have the same dimensions and steel properties, with the exception of a short section within the landfall facilities. Within the landfall facilities, 24-inch (609.6 mm) outside diameter steel pipes will transport the gas from a 32-inch x 24-inch reducer to a 32-inch x 24-inch barred tee as described in Section 5.2.5 and illustrated in Figure 5.5.

5.2.6.4 Buckle Arrestors

Buckle arrestors (pipe reinforcement) are used in the pipeline to avoid buckle propagation in the event of local buckling by placing arrestors at regular intervals and/or in susceptible areas along the length of the pipeline. The buckle arrestors will be welded into the pipelines in those areas that are susceptible to collapse, local buckling or propagation buckling.

Buckle arrestors are manufactured from the same steel grade as the pipes and basically act as a reinforcing ring placed around the outside of the pipe.

An integral ring buckle arrestor is considered to be the most effective type of arrestor for deep water pipeline projects. As such, an integral ring buckle arrestor approximately 4.1 m long with wall thickness of 74 mm (tapering down to 39 mm) is proposed. Buckle arrestors will be required in water depths in excess of approximately 650 m and it is proposed that a buckle arrestor spacing of 2,000 m is used. As the exact spacing of arrestors will depend on the pipe-lay installation methodology, the final spacing of the arrestors will be determined in consultation with the appointed installation contractor.

5.2.6.5 Welding

The line pipe sections will be welded together to form the four pipelines. Welding consumables (e.g. electrodes, wires and fluxes) that are similar and compatible to the composition of the line-pipe material will be used. The weld properties will have a minimum steel grade equal to that of the pipe. No other materials will be added during welding.

Each weld will be subject to visual inspection and non-destructive examination (NDE) to ensure the weld meets the required specification. The weld specification will be agreed with the installation contractor prior to construction and supported by an Engineering Critical Assessment. The weld specification will be produced to complement the NDE procedures.

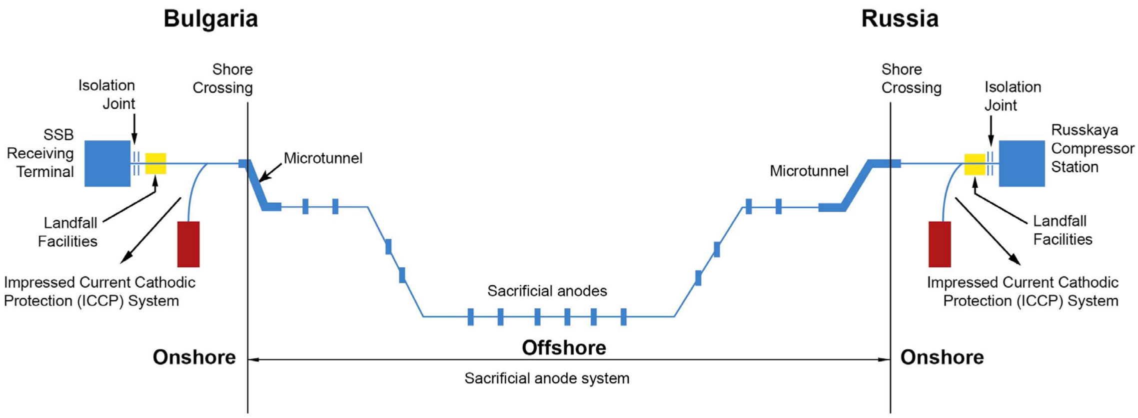
Critical processes such as welding will be inspected by the contractor’s quality assurance crew, and thereafter inspected by representatives of the certification company and South Stream Transport.

Corrosion Protection, Internal and External Coatings Corrosion Protection System

The corrosion protection system of the pipelines is important to ensure pipeline integrity during installation and during its operational life. The principle of cathodic protection is to prevent anodic sites occurring on the structure under protection by allowing the anodic reactions to occur on specially designed and installed anodes.

An indicative schematic diagram of the onshore and offshore corrosion protection system is shown in Figure 5.6.

Figure 5.6 Schematic Layout of the Cathodic Protection System



Cathodic Protection

Landfall Section Pipelines

An ICCP system will be installed to provide cathodic protection of the landfall section pipelines. With an ICCP system the current flow is "impressed" or forced by a power supply. The power source will deliver a direct current (DC) through the groundbed to provide the cathodic protection.

Nearshore and Offshore Section Pipelines

To ensure the integrity of the nearshore and offshore (subsea) pipelines over their operational life, secondary anticorrosion protection will be provided by sacrificial anodes. The cathodic protection design of the offshore pipeline is performed in accordance with the recommended practice design code DNV-RP-F103.

Applying the recommended practice design code (DNV-RP-F103) for the selected zinc anodes, results in the following anode requirement per pipeline in Russian waters as provided in Table 5.5. This assumes a maximum spacing of up to 300 m between anodes.

Table 5.5 Estimated Number of Anodes Required per Offshore Pipeline (in Russian Waters)

Number of Anodes	Total Anode Mass (kg)
736	301,998

5.2.7 Resource Efficiency

Resource efficiency measures are included in the Construction Management Plans which will form part of South Stream Transport's Environmental and Social Management Plan (ESMP). Examples of such measures in Russia include:

- Minimisation of plant, equipment and vehicle noise and air emissions;
- Contractor shall ensure that all vehicle engines are turned off when the vehicle is not in use. Where possible, equipment with engines shall not be left running at night;
- Minimisation of the volume of water generated by trench dewatering, the contractor shall minimise the time that trenches and pits are open;
- The contractor shall actively seek and implement opportunities to avoid, minimise, reuse or recycle waste materials;
- Surplus excavated spoil shall be used for landscaping purposes within the construction corridor or will be used for site engineering or restoration purposes at a local landfill site, or as inert backfill at identified quarries;
- Appropriate vessels will be chosen and maintained correctly; and
- Systematic monitoring of the condition and the adjustment of the fuel systems of ship equipment to ensure efficient use of fuel.

5.3 Construction Phase

This section describes the activities that will take place during construction of the Project. Activities are described for each section of the Project: offshore, nearshore and landfall.

5.3.1 Indicative Construction Schedule

The overall South Stream Offshore Pipeline phases and timeline is provided in **Chapter 1 Introduction**, and the construction schedule for the Project is summarised in Figure 5.7. The schedule presented in Figure 5.7 is the base case estimate that has been used for the planning of the Construction Phase and Pre-Commissioning Phase of the Project. Construction is scheduled to begin in 2014, with first gas from Pipeline #1 scheduled for late 2015, and all four pipelines fully operational by the end of 2017.

As with all large construction projects, there may be some changes made to the schedule during the Construction and Pre-Commissioning Phase as a result of unforeseen delays such as weather conditions, logistics problems, geological conditions/seabed intervention issues or administrative procedures with national Governments. Should there be any major change to the construction schedule, which may affect the results of the ESIA Report the management of change process described in Section 5.11 will be followed.

Each of the pipelines in the landfall section from the landfall facilities to the microtunnel entry shaft will be installed consecutively in a single construction period to minimise the length of disturbance. Restoration of the landfall and nearshore sections will not commence until successful pre-commissioning tests of these sections have been concluded.

Figure 5.7 Indicative Construction Schedule (all four pipelines)

		2013	2014				2015				2016				2017			
	Operations	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Landfall Section	Landfall Section Pipelines & Microtunnel - site establishment, offices and access road preparation and mobilisation of equipment		■	■	■													
	Landfall Section Pipeline Construction				■	■	■											
	Landfall Facilities - site establishment, offices and access road preparation and mobilisation of equipment			■														
	Landfall Facilities Enabling / Early Civil Works			■	■	■	■	■	■									
	Landfall Facilities Pipework & Instrumentation Installation							■	■	■								
	Excavation of Microtunnel Entry Shaft				■	■	■	■	■	■								
	Construction of Microtunnel					■	■	■	■	■	■							
	Installation of Pipeline in Microtunnel (pull-in from pipe-lay vessel)						■	■	■	■	■							
	Grouting of Microtunnel						■	■	■	■	■	■						
	Tie-in to Expansion of the United Gas Supply System (Gazprom Invest)								■	■	■							
	Land Clean-Up & Installation of Pipeline Markers					■	■	■	■	■	■	■						
Nearshore Section	Mobilise Shallow Water Pipe-Lay Vessel to Microtunnel Exit Pit and Survey Area							■	■	■	■							
	Dredging of Microtunnel Exit Pit and Transition Trench & recovery of TBM						■	■	■	■	■							
	Installation of Pipeline in Microtunnel (pull-in from pipe-lay vessel)						■		■	■	■							
	Pipe-Lay from 26m to 30 m WD						■		■	■	■							
	Backfilling of Microtunnel Exit Pit and Transition Trench						■		■	■	■							
Offshore Section	Pre-lay Rock Dumping and Cable Crossings				■					■		■		■				
	Pipeline Route Pre-lay Survey (max of 45 days in advance of pipe-lay)					■				■		■		■				
	S-Lay Pipe-lay - 30m to 600 m WD					■				■	■	■	■	■				
	J-Lay Pipe-lay - 600 m WD to Russia / Turkey EEZ Boundary					■	■			■		■		■				
	Above Water Pipeline Tie-in at 30 m WD							■		■		■		■				
	Post-Lay Seabed Intervention (including surveys)						■	■	■	■			■	■	■	■	■	■
	Pre-Commissioning of Landfall & Nearshore Pipelines						■	■	■	■	■	■						
	Pre-Commissioning of Landfall Facilities							■	■	■								
	Pre-Commissioning of South Stream Offshore Pipeline (Russia to Bulgaria)								■	■			■	■	■	■	■	■
	Commissioning Of South Stream Offshore Pipeline (Russia to Bulgaria)									■				■		■		■
	South Stream Offshore Pipeline Russia to Bulgaria) Operational									■				■		■		■

The construction schedule presented in Figure 5.7 assumes the deep water part of the pipeline (water depth greater than 600 m) is laid by J-Lay method. However, S-Lay methods could also be used. Further information on J-Lay and S-Lay pipe-lay methods is provided in Section 5.3.5.5 and 5.3.6.4. The use of J-Lay provides a more conservative approach in terms of scheduling, as the J-Lay pipe-lay rate is typically slower than the S-Lay method.

The construction schedule assumes the installation of two or more of the pipelines in the deep water section (water depth >600 m) will overlap. To achieve this strategy, multiple pipe-lay vessels must be utilised during the course of the installation. Following this phasing concept, pipeline #1 and pipeline #2 are installed using the first pipe-lay vessel. Approximately midway through the pipe-lay of pipeline #2, a second pipe-lay vessel then commences with pipeline #3. Once the first pipe-lay vessel completes pipeline #2, it then commences with the pipe-lay of pipeline #4.

Installation of one pipeline (pipeline #3) is removed from the critical path installation sequence thus reducing the completion time of the offshore pipe-lay process by approximately one year. The use of a second pipe-lay vessel to perform simultaneous work can be introduced at various other points in the schedule to achieve the same results.

5.3.2 Logistics and Material Supply

The Project will require the procurement of materials, equipment and labour from locations in Russia, the EU and outside the EU. Established road, rail and sea transportation routes will be utilised during the Project. Preference will be given to source equipment (such as plant and construction vehicles) and materials which meet the required project specifications from Russia wherever possible. The pipe to be used for the installation of the Project pipelines is anticipated to come from pipe mills located in Europe, Russia, Japan, and/or India.

At the time of preparing this ESIA Report it is anticipated that all of the pipe required to construct the Project will arrive at marshalling yards in Bulgaria via sea.

5.3.2.1 Marshalling Yards in Bulgaria

Large scale pipeline construction work requires considerable support from onshore support facilities, known as marshalling yards, for the delivery, storage and load out of pipe, plant and equipment. The marshalling yards will also provide support facilities, which will provide general storage for supply of consumables to the offshore fleet, and managerial support for South Stream Transport and its contractors.

Marshalling yards for the Project will be located at the ports of Varna East, Varna West and Burgas in Bulgaria. The impacts of the development and use of these marshalling yards are assessed in the Bulgarian ESIA. The Project is committed to using these marshalling yards for construction of pipelines 1 and 2, including construction of the landfall (onshore) components in Russia and in Bulgaria. Once future construction contracts for pipelines 3 and 4 are signed, it will be known if the marshalling yards will remain in Bulgaria, or be moved to Russia. If the latter, then the management of change process, as described in Section 5.11, will be invoked and an impact assessment prepared if required.

5.3.2.2 Ports

Although it is anticipated that there will be no marshalling yards located on the Russian coast, it is likely that the contractor will use the Port of Novorossiysk for some of the activities listed below during the Construction Phase of the Project:

- Temporary storage of pipe;
- Load out of pipe to the landfall section construction spread via road transport;
- Receipt, temporary storage and load out of plant, equipment and supplies to the landfall section construction spread;
- Receipt of wastes from vessels generated during construction of the nearshore and offshore section construction spreads prior to onward transport to suitably licensed waste handling facilities;
- Base for the supply vessels necessary to deliver construction materials;
- Re-fuelling and maintenance of construction vessels and bilge-water disposal; and
- Base for crew-change vessels travelling to the nearshore and offshore construction spread.

Although the use of other Russian ports is possible, only Novorossiysk has been included in the assessment as it was not known at the time this ESIA report was prepared which other ports could be used, or which activities could be involved. If there is a need to examine the impacts of activities taking place at an alternative port, they will be considered by the management of change process described in Section 5.11.

5.3.3 Onshore Access Routes

5.3.3.1 Transport Routes from Novorossiysk Port

Pipe sections and other materials that are required for the installation of the landfall section of the Project will be delivered from the port of Novorossiysk to the landfall section construction sites by road. The proposed road delivery route from Novorossiysk will utilise the M25, as summarised below.

The delivery route from Novorossiysk will utilise the M25 and the Rassvet to Gai Kodzor Road. Construction traffic will then use a temporary road being constructed by Gazprom Invest to bypass Gai Kodzor before joining the Gai Kodzor to Varvarovka road briefly, and then turning off onto a new Varvarovka bypass road being constructed by South Stream Transport for use during the Construction Phase of the Project.

Permanent Access Roads

From the Varvarovka to Sukko Road, a new permanent access road (shown in red in Figure 5.8) will be constructed by Gazprom Invest, to support the development of the "Expansion of the United Gas Supply System".

This permanent access road will be approximately 2.7 km in length, and only the last spur (of approximately 200 m shown in orange in Figure 5.8) will be constructed by South Stream

Transport. This road will be utilised throughout the Operational Phase of the Project to provide access to the landfall facilities and pipeline RoWs.

A 2.6 km bypass road (referred to as the Varvarovka bypass road, shown in brown in Figure 5.8) will be constructed by South Stream Transport to bypass the town of Varvarovka and prevent construction traffic from passing through those residential settlements during the Construction Phase of the Project. Although the Project will make only temporary use of it, the road will be a permanent structure as local residents / motorists will continue to use it after construction is complete.

Temporary Access Roads

Temporary access roads will also be required during the Construction and Pre-Commissioning Phase of the Project.

Temporary Bypass Road

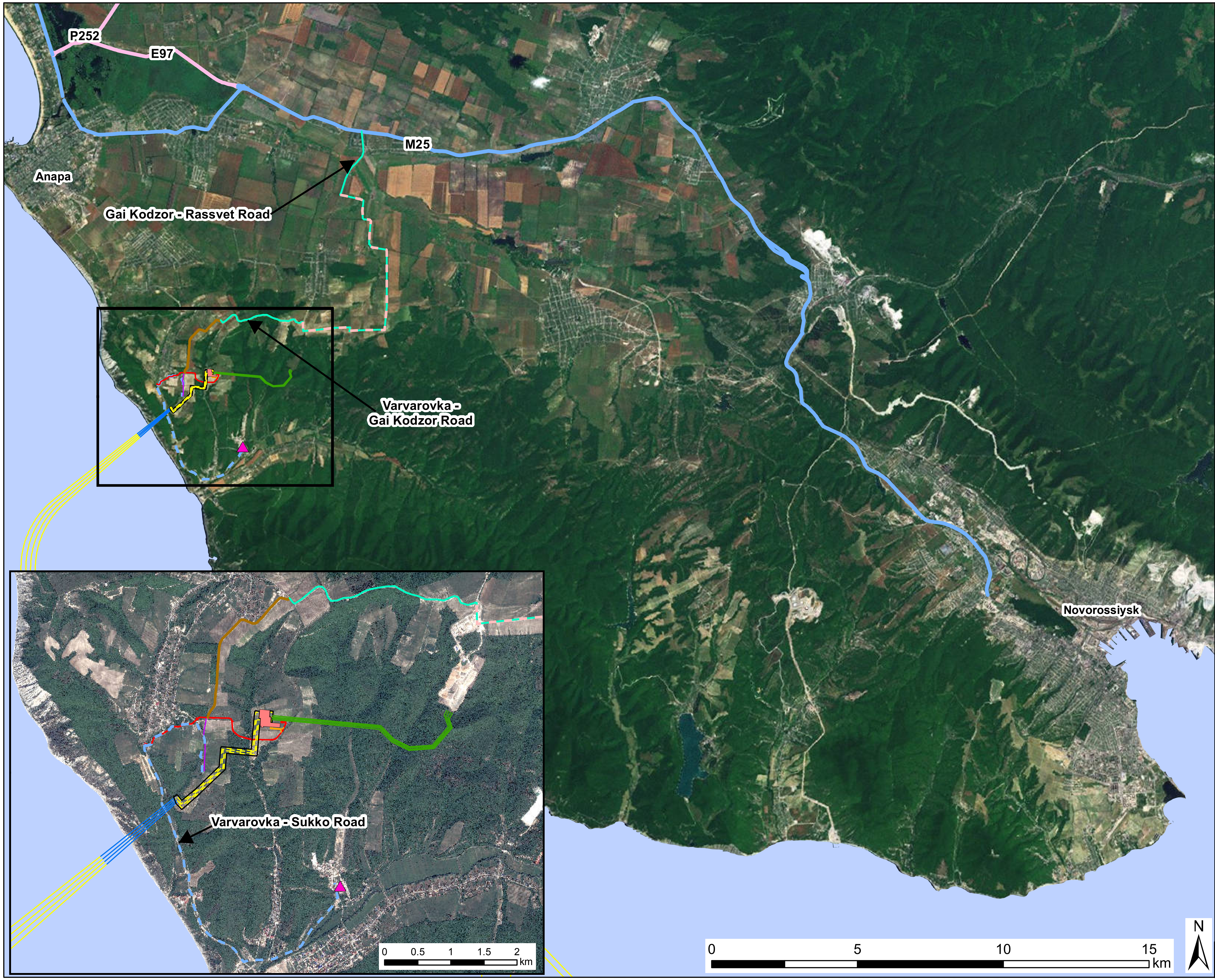
A temporary bypass road (shown by dashed pink lines in Figure 5.8) has been constructed by Gazprom Invest to avoid their construction traffic passing through residential settlements in Gai Kodzor. Although this bypass road is part of the "Expansion of the United Gas Supply System", South Stream Transport will use the same temporary bypass road for construction of the Project.

Other Temporary Access Roads

A 0.8 km temporary access road (shown in purple in Figure 5.8) will be installed by South Stream Transport from the point where the Varvarovka bypass road meets the permanent access road being constructed by Gazprom Invest, and will travel south to the temporary Pipeline String Preparation Area (Site B). A temporary access road will also be established within the construction corridor shown in (Figure 5.8) to allow the movement of heavy equipment and materials. The temporary access roads will be removed following the completion of the Construction Phase. Access along the permanent RoW for inspection and maintenance activities will be via a minor track which will be accessible by 4x4 vehicles only. Further information on the construction of the access road and construction corridor road is provided in Section 5.3.4.2.

5.3.3.2 Freshwater Supply

Freshwater is required for the microtunnel construction process (approximately 37,000 m^3 in total) and the hydrotesting of the landfall facilities (approximately 500 m^3). In addition there will be an average usage of approximate 10 m^3 of water per day for general construction activities (domestic usages, dust suppression, wheel washing etc.) at the landfall section construction sites.



LEGEND

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Landfall facilities
- Proposed microtunnels
- Proposed offshore pipelines
- Right-of-Way

Access Roads

- Proposed delivery route
- Permanent access road to be constructed by SSTTBV
- Temporary access road constructed by SSTTBV
- Varvarovka bypass road (used by Project during construction only)
- Gazprom Invest temporary bypass road to be utilised by SSTTBV
- Route from freshwater supply well
- Ministry of Defence freshwater well

United Gas Supply System

- United Gas Supply System pipelines
- Permanent access road to be constructed by Gazprom Invest
- Federal road
- Regional road

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: For Information

Client: South Stream Offshore Pipeline — South Stream ENERGISING EUROPE

Project Title: SOUTH STREAM OFFSHORE PIPELINE

Drawing Title: TRANSPORT ROUTE TO LANDFALL SECTION

Drawn	Checked	Approved	Date
AH	RW	MW	11 Apr 2014

URS Internal Project No.: 46369082 | Scale @ A3: 1:125,000

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Drawing Number: Figure 5.8 | Rev:

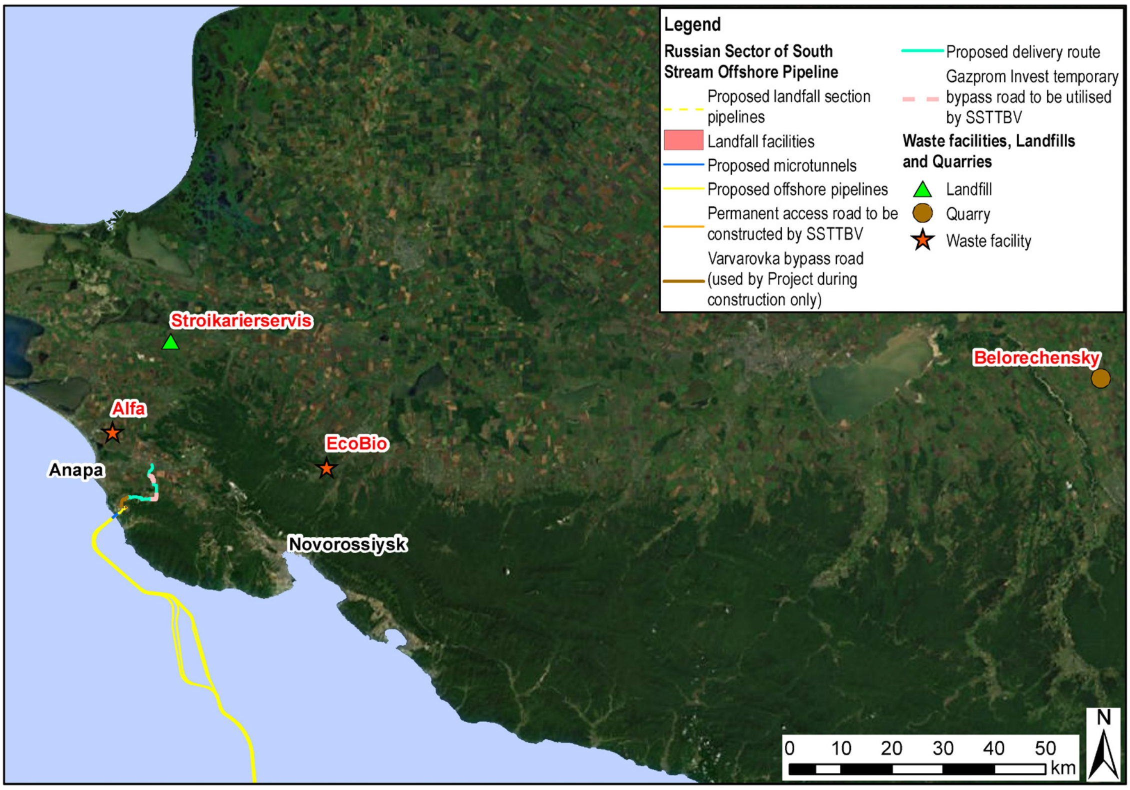
Plot Date: 11 Apr 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 5 Project Description\Figure 5-8 Transport Route to Landfall Section.mxd

Water will be obtained from an existing well located on the northern side of Sukko. The route from the northern edge of Sukko to the landfall section is shown in Figure 5.8. However, water cannot be sourced from here between May and September (inclusive). Therefore, a large volume of water (up to 10,800 m^3) may need to be stored within the landfall section construction sites during this period. Further information on water use and storage requirements is provided in Section 5.3.4.1.

5.3.3.3 Landfill, Waste Facility and Quarry Locations

Potential waste facilities, landfill sites and quarries to support the construction of the Project have been identified (see Figure 5.9). However, it should be noted that no agreements with these sites has been put in place and alternative sites may be identified during the detailed design phase of the Project. When suitable sites are confirmed, the potential impacts of traffic travelling between these sites and the landfall section construction site will be managed through the Russian Landfall Construction Management Plan (CMP), which will form part of South Stream Transport's ESMP. The CMP will contain activity-specific requirements, to be met by both South Stream Transport and the appointed contractors (and sub-contractors). Further information on the Russian Landfall CMP and South Stream Transport's ESMP are described in **Chapter 22 Environmental and Social Management**.

Figure 5.9 Locations of Potential Waste Facilities, Landfill Sites and Quarries



5.3.4 Construction of Landfall Section

The landfall section is approximately 4 km in length. Within this section, the pipelines will be buried using both open-cut and trenchless construction techniques and will pass through the landfall facilities. The pipelines will be buried using open-cut techniques for approximately 100 m from the connection to the "Expansion of the United Gas Supply System" to the landfall facilities and for approximately 2.4 km from the landfall facilities to the microtunnel entry shafts. Due to the presence of a steep sea cliff at the shore crossing, for the remaining 1.4 km the pipelines will be housed in microtunnels (2.5 m in diameter), which will terminate approximately 400 m from the coast in a water depth of approximately 23 m. The equipment within the landfall facilities is listed in Section 5.2 and illustrated in Figure 5.4.

Prior to construction, the appointed contractor will perform a pre-entry survey, including topographic and photographic records at all construction sites, and will prepare a Record of Condition in agreement with landowners, tenants and South Stream Transport. This record will be used as the standard against which the quality of the restoration work will be judged at any time during the construction works and upon completion of the works. Restoration of the land required for the temporary facilities during the Construction and Pre-Commissioning Phase is estimated to take approximately 17 months.

5.3.4.1 Temporary Facilities

A number of onshore temporary facilities will be required throughout the Construction and Pre-Commissioning Phase for the storage of pipe, equipment, materials, spoil storage areas, parking space and mess and welfare facilities for workers. Pipe will be temporarily stacked within the construction sites prior to transport to the construction spread for installation. A summary of the estimated areas of land required for these temporary facilities is shown in Table 5.6 and illustrated in Figure 5.10. It should be noted that these are the maximum extents of land anticipated as being required. During construction, the actual footprint of these areas will be reviewed by the contractors and South Stream Transport to ascertain if the footprints can be reduced to minimise the areas of land clearance required. Further information on the microtunnel construction site is provided in Section 5.3.4.5. The majority of this land will be rehabilitated following completion of construction.

Table 5.6 Estimated Area Requirements for Onshore Temporary Facilities

Temporary Site	Area (ha)
Landfall Section Pipeline Construction Corridor	27.43*
Microtunnel Construction Site (Site A)	8.76†
Pipeline String Preparation Area (Site B)	4.61
Landfall Pipeline Construction Site (Site C)	2.24

Continued…

Temporary Site	Area (ha)
Temporary Storage Area (Site D)	0.50
Landfall Facilities Construction Site and Pre-Commissioning/Commissioning Spread (Site E)	5.19
Access Road Construction Areas (including temporary access roads in their entirety)	8.54
Potential Transfer Site (only if required by the contractor)	5.38

* 21.72 ha of the Permanent RoW is located within the Landfall Section Pipeline Construction Corridor, therefore the temporary landtake requirement outside the RoW is 5.71 ha.
† 4.93 ha of Site A is located within the Landfall Section Pipeline Construction Corridor, therefore the temporary landtake outside the Landfall Section Pipeline Construction Corridor is 3.83 ha.

Complete.

The Microtunnel Construction Site (Site A), Pipeline String Preparation Area (Site B), Landfall Pipeline Construction Site (Site C), the Landfall Facilities Construction Site and Pre-Commissioning/Commissioning Spread (Site E), and the optional Transfer Site will have approximately 50% of their surface area to be reinforced with small stones/rock to prepare areas of hardstanding. This land will be re-instated following completion of construction.

A Transfer Site (shown indicatively in Figure 5.10) may be required as a temporary laydown area for equipment and materials required for the Project between the construction sites and the public highway. It may also be used to temporarily store soils excavated for the Project that cannot be re-used on site before they are taken away for disposal. Deliveries of materials and equipment to the temporary facilities will be made via the temporary and permanent access roads described in Section 5.3.3 and shown in Figure 5.8.

The layout of equipment within each construction site will be subject to the preference of the appointed contractor. However, it is anticipated that a number of pre-fabricated cabins and/or containers will be required to provide office space, mess and welfare facilities etc. in the Microtunnel Construction Site (Site A), the Landfall Pipeline Construction Site (Site C) and the Landfall Facilities Construction Site and Pre-Commissioning/Commissioning Spread (Site E). Pipe will be temporarily stacked within the Landfall Pipeline Construction Site (Site C), and potentially at the optional Transfer Site, prior to transport to the construction spread for installation. Due to the source of freshwater near Sukko being unavailable for supply during May to September (inclusive), a large volume of water (up to 10,000 m^3) may need to be stored in large water tanks. This water is required for the microtunnelling process, but it is assumed that it would be stored in the Pipeline String Preparation Area (Site B), so that it is adjacent to the Microtunnel Construction Site (Site A). Approximately 1,000 m^3 ^{m}ay also need to be stored at the Landfall Facilities Construction Site and Pre-Commissioning/Commissioning Spread (Site E). This water is required for general construction activities at the various onshore construction sites. The exact location and dimensions of the storage tanks will be finalised during the detailed design and will be agreed between the Contractor, South Stream Transport and the relevant Local Authorities.

It is anticipated that during March and April 2014 seven months' supply of water (approximately 1,400 m^3) will be delivered to site for general construction activities. Between October 2014 and April 2015 (inclusive), approximately 28,500 m^3 of water will be delivered to the Pipeline String

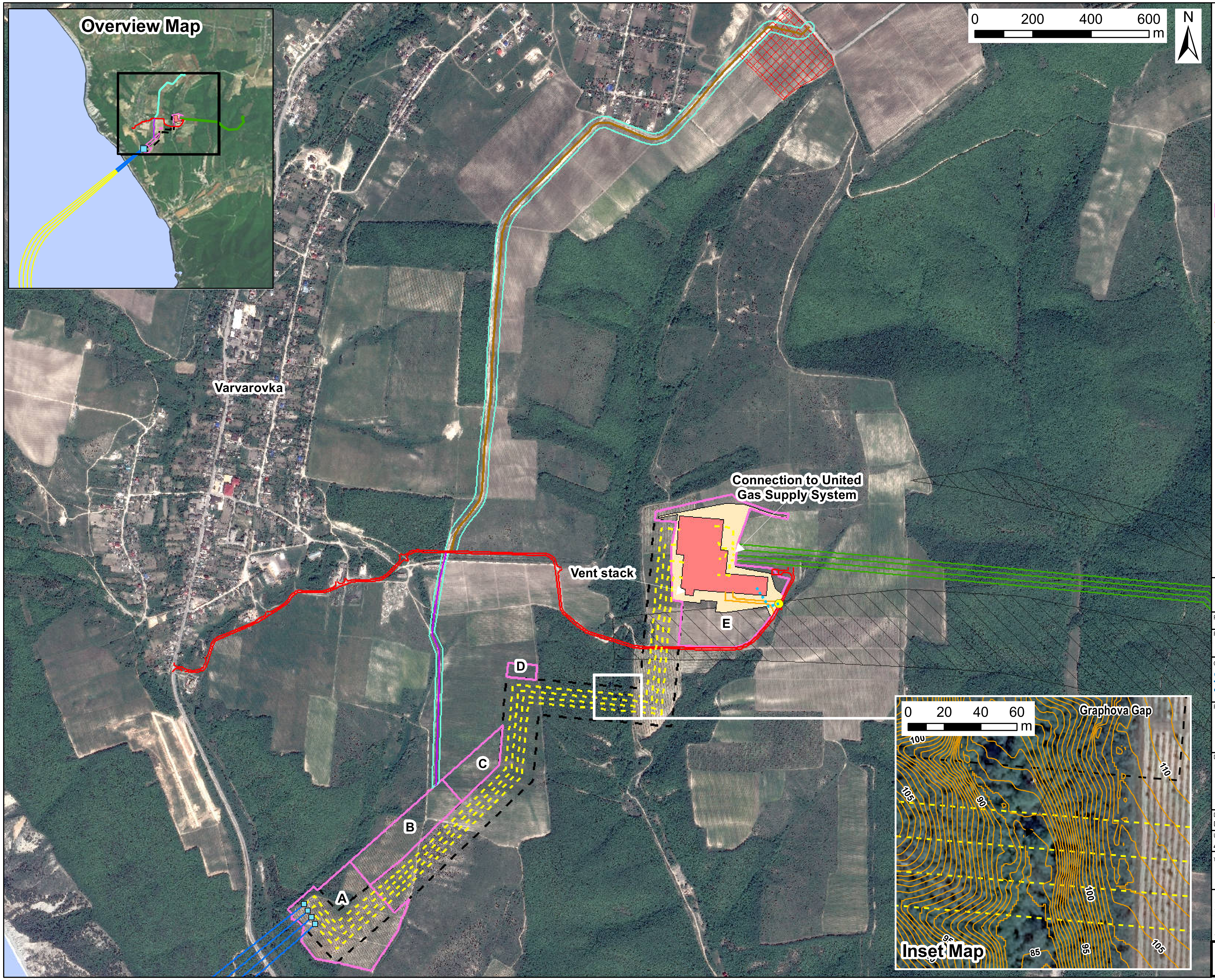
Preparation Area (Site B) and 2,900 m^3 (2,400 m^3 for general construction activities and 500 m^3 for hydrotesting) to the Landfall Facilities Construction Site and Pre-Commissioning/ Commissioning Spread (Site E). Between October 2015 and mid-February 2016 (inclusive) a further 8,500 m^3 will be delivered to the Pipeline String Preparation Area (Site B) and 900 m^3 will be delivered to the Landfall Facilities Construction Site and Pre-Commissioning/Commissioning Spread (Site E). It is considered that the amounts of water required at the construction sites after mid-February 2016 will be sufficiently low that associated truck movements will be negligible and do not need to be considered. The only activity after this date is site reinstatement. The estimated truck movements to bring freshwater to the site have been included in Table 5.13 These numbers are also specified in **Appendix 9.1 Traffic and Transport Study**.

A temporary construction corridor will be required along the length of the landfall section pipelines route from the tie-in location with the project "Expansion of the United Gas Supply System" to the landfall facilities, and from the landfall facilities to the microtunnel entry shaft.

It should be noted that some of the permanent facilities described in Section 5.6.6 and shown in Table 5.4 are located within the footprint of the boundary of the temporary facilities shown in Table 5.7. This includes the permanent RoW which is located within the construction corridor.

A temporary security fence will be installed around the perimeter of the temporary facilities, and the landfall facilities site during construction to prevent the entry of unauthorised persons. Signs will be erected to raise awareness of the hazards. Fencing may also be provided where necessary to prevent the entry of animals. Further information on requirements for fencing along the construction corridor is provided in Section 5.3.4.5 and fencing in relation to the prevention of injury to animals is provided in **Chapter 11 Terrestrial Ecology**.

All open-cut pipeline construction activities will be undertaken within a temporary construction corridor. The construction corridor will nominally be 120 m wide. A typical cross-section of the construction corridor is shown in Figure 5.11.



LEGEND

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Landfall facilities
- Anode ground bed for cathodic protection of pipelines
- Proposed microtunnels
- Microtunnel entry shaft
- Construction corridor
- Cut and fill side slopes
- Temporary construction area for road construction
- Construction sites
- Anode ground bed connection to landfall facilities
- Permanent access road to be constructed by SSTTBV
- Temporary access road constructed by SSTTBV
- Varvarovka bypass road (used by Project during construction only)
- Optional transfer site

A - Microtunnel construction site
B - Pipeline string preparation area
C - Landfall section pipelines construction site
D - Temporary storage area
E - Construction site for landfall facilities and offshore pre-commissioning and commissioning spread and site preparation

United Gas Supply System

- United Gas Supply System pipelines
- Permanent access road to be constructed by Gazprom Invest
- Marfovsky fault (indicative location)

Projection: Lambert Conformal Conic

Revision Details	By	Check	Check Date	Suffix

Purpose of Issue
For Information

Client
South Stream Offshore Pipeline — ENERGISING EUROPE

Project Title
SOUTH STREAM OFFSHORE PIPELINE

Drawing Title
LOCATION OF TEMPORARY FACILITIES

Drawn	Checked	Approved	Date
DH	RW	MW	18 Feb 2014

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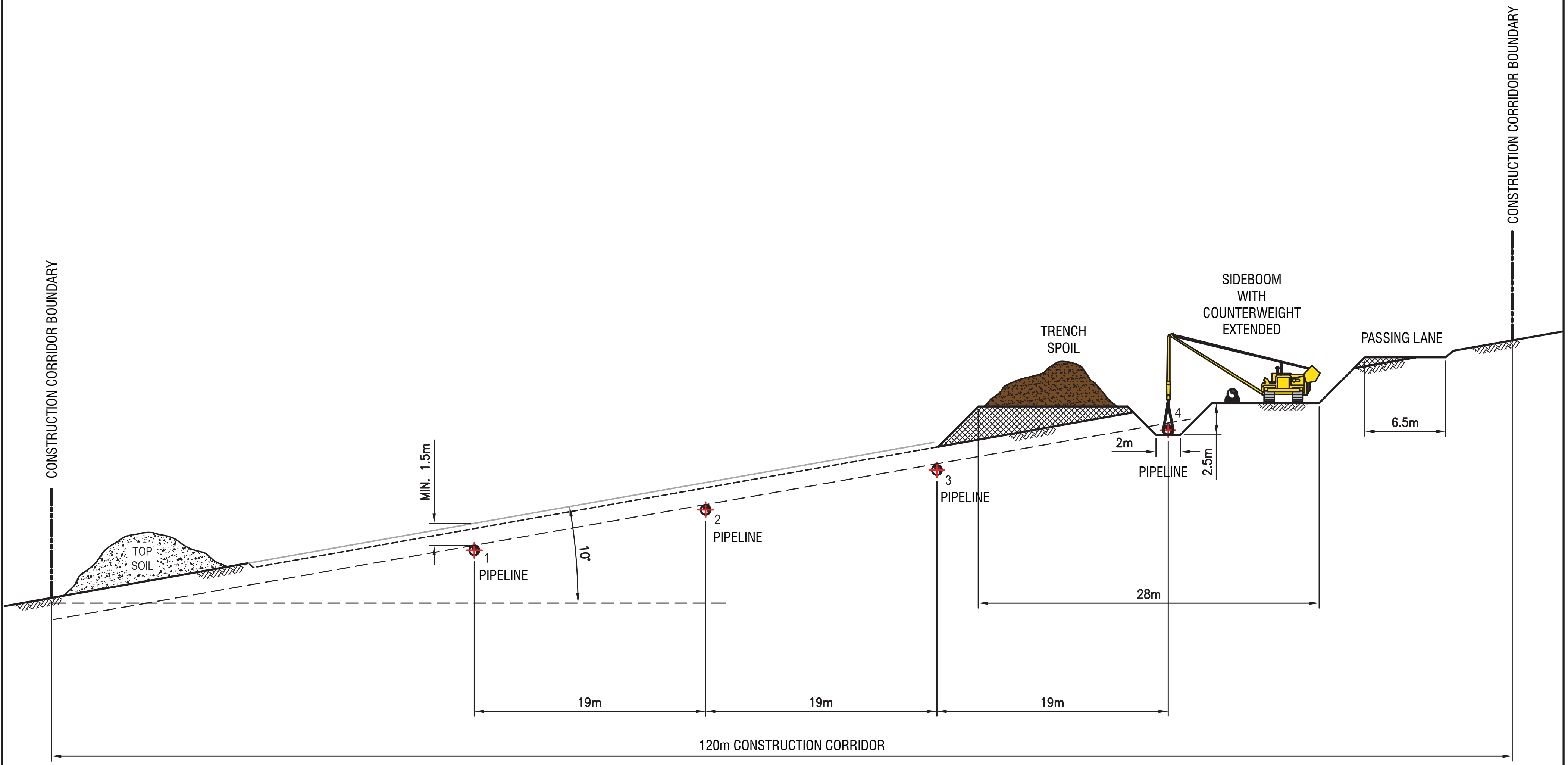
Drawing Number	Rev
Figure 5.10	

Plot Date: 18 Feb 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 5 Project Description\Figure 5-10 Location of Temporary Facilities.mxd

Figure 5.11 Typical Construction Corridor



5.3.4.2 Construction of Permanent and Temporary Access Roads

The Project will require the construction of the following roads, as shown in Figure 5.10 to provide access to all aspects of the Project during construction of the pipelines, microtunnels and landfall facilities:

- Approximately 200 m of permanent access road that will branch off the permanent access road being constructed by Gazprom Invest (shown in red in Figure 5.10) to meet the southern edge of the landfall facilities (shown in orange in Figure 5.10). This road will have a running surface approximately 7 m wide with 1.5 m wide shoulders on either side of the road, and will require an additional 3.5 m either side of the road edge during construction of the road only. This entire road will be contained within the area designated for cut and fill slopes, therefore the road does not add to the total permanent or temporary land take of the Project;
- Approximately 0.8 km of temporary access road from the permanent access road being constructed by Gazprom Invest to the temporary Pipeline String Preparation Area (Site B) (shown in purple in Figure 5.10). This road will have a running surface approximately 7 m wide with 1.5 m wide shoulders on either side of the road, and will require an additional 3.5 m either side of the road edge during construction;
- Approximately 2.6 km of access road (shown in brown in Figure 5.10 from the Gai Kodzor - Varvarovka Road to the permanent access road being constructed by Gazprom Invest. This permanent road is referred to as the Varvarovka bypass road and will be used by the Project during the Construction Phase only. This road will have a running surface approximately 8 m wide and 1 m wide shoulders on either side of the road. Due to the road being constructed on a slope, it is assumed that this road will require construction areas ranging from approximately 5 - 14 m at the road edges in some sections during construction to form safe slopes and the construction of retaining walls where required; and

Approximately 2.5 km of temporary access road (shown in Figure 5.10) within the temporary construction areas and along the construction corridor, which runs from the landfall facilities to the microtunnel construction site. This road will have a running surface approximately 4 - 5 m wide.

Road Construction Techniques

Where possible, a ‘cut-track’ design will be used for the construction of the permanent access road and temporary access roads, in which the topsoil will be stripped to expose a suitable rock or sub-soil horizon on which to build the track. The upper soil horizon will be suitably stored on the site for later reinstatement, as appropriate. Where practicable, a geotextile material such as a geogrid (grid-like mesh formed of plastics which provide ground stabilisation and reduce aggregate requirements) will then be placed to provide separation between the fill material and the founding strata. The road will then be built up on the geogrid by laying and compacting crushed rock. The actual depth will be dependent on ground conditions and topography and confirmed during the detailed design stage.

The temporary Varvarovka Bypass Road will be constructed on a hill slope and will require cuts and fills of soils in various sections of the road to form a suitable road surface. The road will also require a number of engineered slopes and retaining walls to ensure the integrity of the road is protected during its use throughout the Construction Phase.

In areas of very poor soil conditions, (i.e. boggy or wet ground) along the route of the temporary access road within the construction corridor, topsoil stripping may be omitted in favour of the geotextile material being laid directly over the ground. Alternatively, there may be sections which are constructed with timber crane / bog mats which can be easily removed following the completion of the construction process. Timber crane / bog mats provide stable access over boggy and wet ground conditions, reducing permanent damage to existing surfaces by spreading heavy loading, increasing stability and minimising hard surface damage.

As far as possible, the access roads will be constructed of material from locally sourced imported graded stone and geotextiles. The source of this material is yet to be confirmed but a potential suitable quarry source has been identified (see Figure 5.9).

However, it should be noted that no supply agreement with this source has been put in place and alternative sources may be identified during the detailed design phase of the Project. When a suitable source is confirmed, the potential impacts of traffic travelling between the quarry and the landfall section construction site will be managed through the Russian Landfall CMP, which will form part of South Stream Transport's ESMP. The CMP will contain activity-specific requirements, to be met by both South Stream Transport and the appointed contractors (and sub-contractors). Further information on the Russian Landfall CMP and South Stream Transport's ESMP are described in **Chapter 22 Environmental and Social Management**.

The materials imported from quarries will be chemically checked to ensure their inertness and to prevent any potential adverse effect on groundwater. The permanent access road leading to the landfall facilities will be finished with an asphalt concrete or tarmac surface approximately 80 mm thick.

For the purposes of the ESIA it has been assumed that the entire length of the temporary access road from the junction with the permanent access road to the temporary Pipeline String Preparation Area (Site B) and the temporary road within the construction corridor will be constructed with rock, although some sections may use timber crane/bog mats.

Road Drainage

The general approach to road drainage is described below, along with measures specific to the Varvarovka Bypass Road.

Road edge drains will be led away by ditches into drainage swales (a shaped and sloped depression in the soil surface) via settlement lagoons and small ponds away from the road edges so that runoff is controlled to prevent sediment entering local surface waters. Swales are shallow channels that are used to collect and/or move water and also remove pollution from it (see **Chapter 8 Soils, Groundwater and Surface Waters**). They can be covered by grass or other vegetation and have shallow side slopes. Swales allow the water to infiltrate into the ground resulting in less water run-off. The road will have adequate cross-fall to allow rainwater to be shed and, where gradients are present, lateral drains will intercept flow along the road. A drainage ditch may be formed on the upslope side of the road where required to collect runoff from the upper slopes, dependent on detailed drainage design.

Cross pipes will be laid as required to permit good road drainage and introduced where the position of the road may cause ponding to one side. As far as possible, these will coincide with naturally occurring drainage channels. Where the road slopes downhill, 'waterbars' will be placed to divert the flow into naturally occurring channels. The key function of a waterbar is to divert running surface water off a sloping road surface to prevent the road surface from being scoured by the water flow and becoming rough and gullied and unsuitable for construction traffic.

Due to the steepness of the slope on which the Varvarovka bypass road will be constructed, this road will include some additional rainwater drainage features to those described above to ensure safe driving conditions during rainfall. The drainage features for this road consists mainly of ditches situated at the bottom of the road embankment (road edge) or at the head of surrounding slopes to collect water coming from the road itself and/or surrounding areas. In addition, in cut sections of the road a concrete lined ditch will be located at each side of the road to collect the water coming from the road surface and surrounding slopes. Where retaining walls are provided, to avoid water (from the surrounding slopes) flowing down the wall into the road, a concrete channel will be formed above the wall to collect the water. To avoid scouring of the concrete lined ditch, due to high flow velocity of water in areas of slopes greater than 5%, the lined concrete ditches will be provided with features to slow down the conveyed water.

Road Crossings

The permanent access road to the landfall facilities and temporary access road within the construction corridor will cross the unnamed tributary of the Sukko River which is located in the Graphova Gap (illustrated in Figure 5.10). This unnamed tributary has no or low flow during the summer months and more significant flow during the winter months.

A road crossing of the Graphova Gap within the construction corridor is necessary to allow the movement of construction vehicles and equipment. This crossing will remain in place to allow 4x4 vehicles to access along the permanent RoW during the operational phase of the project to allow for inspections of the pipelines. The design of the crossing will be finalised during the detailed design stage and will ensure that water flow is not impeded.

At the time of preparing this ESIA Report, the actual location of the temporary access road within the construction corridor is unknown and will be subject to the detailed design of the appointed installation contractor and approvals from South Stream Transport and/or the Russian Federation regulatory authorities.

During construction of the landfall section, the movements of construction vehicles will be restricted to the temporary construction yards, the construction corridor and the access roads constructed as part of the Project.

Landfall Section Construction Plant, Vehicles and Equipment

Table 5.7 presents a preliminary list of typical construction equipment that may be used during the construction of the landfall facilities and the installation of the open-cut pipelines.

Table 5.7 Numbers of Plant / Equipment Expected for Construction of the Open-Cut Pipelines and Landfall Facilities

Construction Equipment			Number of Plant / Equipment per Phase				
Equipment	**Power Rating**	**Activity dB Laeq,T @ 10 m**	**Site Preparation (inc. access roads and equipment mobilisation)**	**Landfall Facilities (4 pipelines)**	**Trench Excavation (4 pipelines)**	**Pipeline Installation (4 pipelines)**	**Demobilisation/ Reinstatement**
Bulldozer	250 kW - 35 t	86	4	2	1	1	1
Grader	87 kW	77	2	1	1	1	1
Tracked Excavator	102 kW - 22 t	78	4	2	4	2	2
Tipper Lorry	75 kW - 25 t	85	6	2	2	1	2
Shovel	74 kW - 19 t	76	2	1	2	1	2
Tracked Side Boom	230 kW - 50 t	77	0	0	0	6	0
Tracked Crawler Crane	250 kW -120 t	75	0	2	0	1	0
Welding Machines	20 kW - 0.6 t	65	0	0	0	10	0
Pipe Bending Machine	129 kW - 25 t	66	0	0	0	1	0
Generators	250 kW	98	2	4	2	4	2

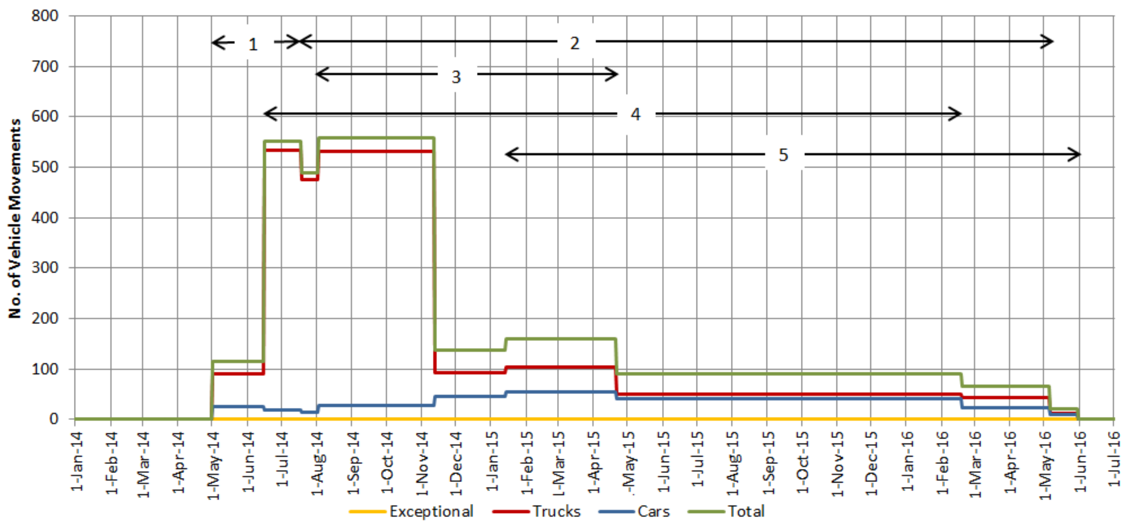
Equipment specific to the construction of the microtunnels is provided in Table 5.9. There will be considerable transportation of labour, heavy equipment and materials on local roads for the delivery of pipe and heavy equipment from the supply port. The delivery route to the landfall section is described in Section 5.3.3.

The estimated total number of vehicle movements associated with the construction of the landfall section on the public road network is presented in Table 5.8.

Table 5.8 Predicted Total Number of 2-Way Construction Phase Traffic Generation by Offsite Vehicles

Vehicle Type	Estimated Total Number of Vehicle Trips Movements by Activity				
	1. Site Preparation and Access Roads	2. Micro-tunnelling	3. Pipeline Construction	4. Landfall Facilities	5. Demobilisation /Reinstatement
Special Transport	12	33	68	50	8
Trucks	5,481	16,505	11,144	54,129	4,647
Cars / Minibus	1,811	7,029	2,796	6,600	3,586
Total per Phase	*7,304*	*23,567*	*14,008*	*60,779*	*8,241*

Figure 5.12 Average Daily Vehicle 2-Way Trips Movements to/from the Landfall Section during Construction



The table presents total 2-way vehicle trips. A 2-way trip is defined as both the arrival and departure of vehicles to and from the site and therefore comprises two additional traffic flow movements over a day (inbound and outbound direction). Weekly construction traffic movements are anticipated to peak in the second half of 2014 (Figure 5.12). Existing traffic flows on the local road network are described within Appendix 9.1 Traffic and Transport Study.

It is anticipated that the Project will share this delivery route with construction traffic associated with the construction of the Russkaya CS. The potential cumulative impacts generated by both projects are described **in Chapter 20 Cumulative Impact Assessment**, including traffic generated impacts.

5.3.4.3 Landfall Facilities Construction

The construction of the landfall facilities is expected to last approximately 19 months (May 2014 to December 2015). The equipment, materials and offices, etc. required for the construction of the landfall facilities will be located in the Landfall Facilities Construction Site and Pre-Commissioning Spread/Commissioning Spread (Site E) shown in Figure 5.10 and Table 5.7 and described in Section 5.3.4.1.

The following works will be undertaken during construction of the landfall facilities:

- Preparatory works, including surveying, site clearance and earthworks;
- Construction of internal roads;
- Preparation of foundations;
- Erection of equipment;
- Piping and mechanical works, including NDE of all welds;
- Laying of cables and electrical works;
- Installation of operational and instrumentation control systems;
- Connection to utilities (electricity); and
- Reinstatement of temporary areas that are not part of the permanent project footprint.

Preparatory works will include preparation of access to the landfall facilities site, site clearing, site levelling (including cut and fill of the site) and erection of perimeter fencing and access gates.

The preparation of the site for the construction of the landfall facilities will require extensive earthworks in order to prepare a level area and to stabilise the slopes surrounding the landfall facilities. It is estimated that approximately 257,000 m^3 of material will be cut from the site and 134,000 m^3 of fill material will be required to form a level site for the landfall facilities. Due to the structural properties of the soils at the landfall facilities not being suitable for engineering purposes, it is anticipated that all of the cut material will be taken offsite for disposal and the entire quantity of fill materials will be imported to the site.

The levelled platform area will have both upward and downward slopes. Engineered slopes are required to stabilise the platform and ensure that the landfall facilities will not be at risk from landslides from the surrounding hill slopes during its operational life. The design of the slope stabilisation techniques will be undertaken during detailed design, however the methods that may be considered to provide the necessary stabilisation include:

- Engineered structures;
- Vegetation stabilisation; and
- Soil bio-engineering systems.

In addition to earthwork, civil and structural engineering activities include excavation of foundations, surfacing of internal roads, car parking and paths, pouring of concrete foundations and slabs for pre-fabricated containers, foundations for equipment, vent stack, valve pits, erection of steel structures in the form of pipe bearings, supporting structures etc.

Fitting and connection of all communication equipment will allow the landfall facilities to be controlled locally from the containers containing the E&I equipment, and remotely from the CCR and BUCR in Amsterdam.

5.3.4.4 Pipeline Construction

General Overview

The landfall section of the Project will use a combination of open-cut and trenchless techniques for pipeline construction.

Conventional open-cut trenching techniques will be adopted for the installation of the four pipelines from the tie-in to the "Expansion of the United Gas Supply System" to the landfall facilities and from the landfall facilities to the microtunnel entry shafts. The four pipelines will be constructed one pipe at a time, although all four pipelines will be laid in one continuous construction period over a period of approximately six months to avoid the impacts associated with four separate construction periods. There will be a separation distance of approximately 19 m between the centreline of each pipeline.

Where the pipeline alignment will cross the shore there is a sea cliff with an average slope of approximately 43%, starting at sea level and rising to a height of approximately 150 m. The landward side of the coastal ridge has with an average slope of approximately 20% and drops down to a height of approximately 40 m above sea level at the microtunnel entry shaft location. Due to the steepness of the slope and the presence of rock, open-cut installation of the onshore pipeline across the sea cliffs is not feasible. The trenchless technique of microtunnelling has therefore been selected as the construction technique in this area. Each pipeline will be housed within one of four microtunnels each approximately 1.4 km long, which extend from an onshore entry shaft to approximately 400 m offshore at a microtunnel exit pit located within the nearshore section.

The alignment of the landfall section pipelines crosses one major road and two watercourses. The Varvarovka to Sukko road and the Shingar River are both crossed only by the surface trace of the microtunnels and thus impacts and disruptions are not anticipated during construction. The pipelines will directly intersect an unnamed tributary of the Sukko River that is located in the Graphova Gap (illustrated in Figure 5.10). This watercourse will be crossed using open-cut techniques as described below.

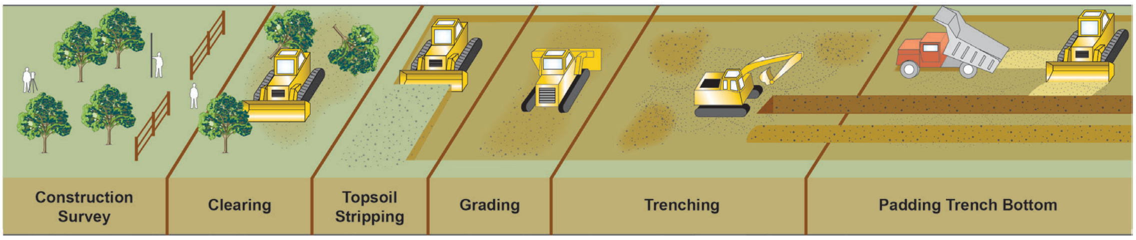
The landfall section pipelines will also pass through the southern branch of the Marfovsky Fault. The exact location of the fault is subject to further geophysical survey, however the anticipated location based on survey work carried out to date is shown in Figure 5.10. The fault will be crossed using traditional open-cut techniques as described below and further information on the characteristics of the fault are provided in **Chapter 7 Physical and Geophysical Environment**.

Open-Cut Pipeline Construction

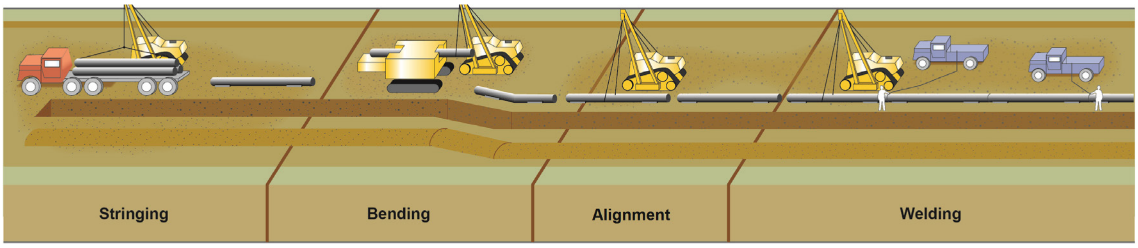
The general process for open-cut technique is shown in Figure 5.13 Typical Open-Cut Pipeline Construction Technique and summarised in the following sections.

Figure 5.13 Typical Open-Cut Pipeline Construction Technique

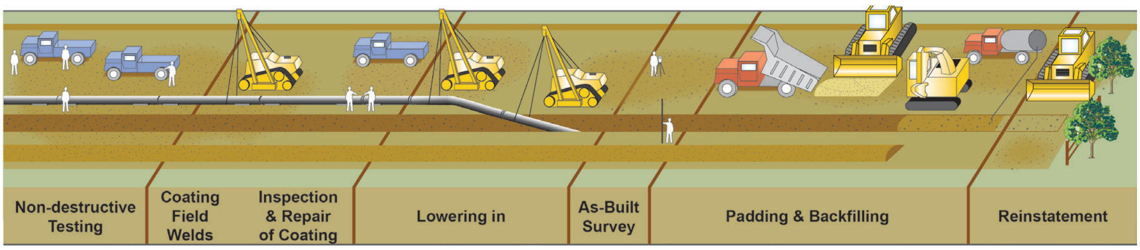
Part 1



Part 2



Part 3



Construction Corridor Preparation

The exact route of each pipeline will be surveyed and the centreline will be marked out. The temporary 120 m wide construction corridor will be clearly marked using wooden pegs. The edge of the construction corridor will require temporary fencing to prevent injury to animals, in particular the tortoise (*Testudo graeca nikolskii*), which is listed as critically endangered in both the International United Conservation Network (IUCN) Red Data List (Ref. 5.4) and Russian Federation Red Data Book (Ref. 5.5), and as Vulnerable in the Red Data Book of the Krasnodar Krai region (Ref. 5.6). Further information on methods to mitigate impacts on tortoises is provided in **Chapter 11 Terrestrial Ecology**. Environmental and archaeological specialists (appointed by the contractor) will accompany the survey crews to clearly mark sensitive environmental and archaeological sites.

Existing infrastructure that intersects the Pipeline route, such as walls, fences and paths, will be disturbed as little as possible. Existing third party services will be located, marked, and either safeguarded or diverted in accordance with owners agreements and relevant permits. It is known that the pipelines will cross beneath an underground communication cable and below a 10 kV overhead power line suspended on poles, approximately 850 m downstream from the landfall facilities.

For buried services, at the time of setting out the works, the contractor shall locate them and record depth, type and size through the use of hand excavation. All services will be adequately protected from damage by the laying of excavator mats, or geotextile membrane and hardcore and by maintaining a minimum separation distance of 1.5 m between the pipeline and existing services. Supporting spans will also be implemented to support the services if necessary. Alternatively, in agreement with the cable owner, it may be decided to cut and reroute the cable. The final decision will be subject to consultation with the cable owner and detailed design studies.

Due to the height the overhead power line is suspended over the access road and construction corridor it is possible that this may restrict certain types of vehicle from accessing the route. In order to overcome this and to maintain a safe working environment, the power will need to be cut (temporarily) and either an alternative power system provided or the power lines rerouted so that the construction equipment can travel safely along the route. A decision on which option will be selected will be based on consultation and agreement with the owners, local authorities and any other effected parties. South Stream Transport will put in place measures to ensure that disruptions to power supply are kept to a minimum.

During any works near the overhead power line, the contractor shall use extreme care to prevent contact between personnel and equipment and the power line. Clear warning signs detailing the working height and nature of the danger will be displayed either side of the overhead power line and the danger will also be explained to workers on site during safety toolbox talks.

In the event that unknown services are encountered, work will stop in this area until the nature of the services and owners have been established. Where diversions are necessary, works will be carried out in consultation with the owners. Clear warning signs will be erected for overhead cables, and temporary crossing points will be clearly marked.

Topsoil Stripping and Vegetation Removal

Prior to topsoil removal, any rare plant species (for example juniper (*Juniperus sp.*), a species listed in the IUCN Red Data List (Ref. 5.4), Red Data Book of the Russian Federation (Ref. 5.5) and Krasnodar Krai region (Ref. 5.6) will be translocated to suitable alternative habitat outside the construction corridor. Other notable species will be gathered in sufficient numbers to be used for the reinstatement work after the pipeline has been laid. In addition, the construction corridor includes areas of protected forests under the Forest Code of the Russian Federation. Tree species which are not to be translocated, and are of commercial value, will be harvested and extracted by conventional methods and standard forestry equipment. Clearance of immature or unmerchantable crops will be by use of scrub cutters or chainsaws with the resulting material being stored on site. South Stream Transport will consult with relevant land owners and the Russian Federation State Forestry Fund on the potential uses for the timber. During the Construction Phase, the requirement to strip the entire construction corridor will be reviewed by the contractor and South Stream Transport to ascertain if the area of topsoil stripping can be reduced. Further information on the habitats along the construction corridor and which species will be translocated is provided in **Chapter 11 Terrestrial Ecology**.

The topsoil will generally be stripped across the construction corridor and then stored to be used when reinstating the construction corridor. The topsoil stockpile will be typically no higher than 2 m to prevent degradation of the soil, and will be kept free from disturbance to reduce the possibility of physical damage and compaction. The careful storage of the topsoil is essential to protect the natural seed bank contained within the topsoil, which will aid the re-vegetation of the construction corridor during reinstatement works.

Some areas of the construction corridor may also be benched or graded to enable safe working, using typical construction site machinery to eliminate irregularities, large stones, tree stumps and other features.

Trenching

Each pipeline will be installed in separate, parallel trenches to achieve a centre line separation distance of approximately 19 m. The trenches will be excavated using mechanical excavators straddling or running alongside the pipeline trench. It is anticipated that some short sections of the pipeline route may encounter rock at trenching depth. Rock in such areas could be excavated by first fracturing it by mechanical means, typically a rock hammer attachment for an excavator. In the case of a large section of rock being encountered, the use of a chain trencher could be considered. Drilling and blasting of rocky sections of the pipeline route is not expected.

The open-cut pipeline trenches will be dug to a minimum depth of 2.5 m to allow for a minimum reinstated cover of 1.5 m. However, given local topography, the trench depth varies between 2.5 m and 4.5 m in order to minimise the amount of bends in the pipeline. Each trench will have a top of trench width of approximately 7 m, a trench bottom width of approximately 1.5 m and side slope angle of 45 degrees. The material excavated from the trenches (trench spoil) will be stored separately from the topsoil to prevent mixing of subsoil and topsoil that might hamper successful reinstatement.

At times it may be necessary to dewater the open-cut trench as a result of groundwater infiltration to the trench, surface run-off which has entered the trench, or directly from rainfall, although this is considered unlikely. Prior to such an activity commencing, schemes will be developed on an area by area basis. It is likely that if required, a soakaway (i.e. a pit filled with gravel or small stones) will be prepared within the construction corridor and the water will be pumped from the trench to the soakaway where it will slowly soak into the ground.

Pipe Delivery, Stringing and Bending

The 12 m pipe sections will be transported to the construction spread from the landfall pipeline construction site where the pipe sections are stored. The pipe sections will be transported along the construction corridor using stringing trucks and tracked vehicles. All pipes will arrive in a pre-coated condition (externally with 3LPP anti-corrosion coating and internally with an epoxy flow coating). Known commonly as 'stringing', the pipe sections will be placed end to end alongside the trench in preparation for welding. The pipe sections will be stored at least 100 mm above ground on timbers with padding and wedges.

In cases where there are significant changes in direction or elevation along the pipeline route (for example the crossing of the Graphova Gap), pipe sections with factory-manufactured bends will be installed. Final requirements for bending will be confirmed prior to pipeline installation. Where there are minor changes in elevation or direction along the pipeline route, cold bending of the pipeline will be undertaken by a bending crew. The bending crew will use a hydraulic bending machine to put gradual bends in the pipe. This equipment bends individual pipe sections to the desired angle at locations where there are changes in the natural ground contours, or where the pipeline route changes direction.

Welding, Testing and Joint Coating

The landfall section pipe ends will be bevelled in accordance with approved welding procedures using a pipe facing machine system to create a profile for welding, which will produce metal scraps (see Figure 5.14). The pipe sections will then be aligned and welded together using automatic, semi-automatic or manual welding equipment that travels along the length of the pipeline. The process is carried out inside a mobile shelter (see Figure 5.15) that covers the pipe section that is being welded and the people carrying out the work, thereby controlling the environment under which the weld is made. During welding, flux will be added to prevent oxidation of the base and filler materials. Metal scraps from bevelling and weld flux will be collected and stored in containers in the temporary construction sites before being collected by licensed waste hauliers for disposal.

Once welded, the welds will be subject to visual inspection and NDE, and the weld approved before a coating is applied to the welds on site. Any welds not meeting the required specification will be removed by cutting out a cylinder of pipe containing the weld and the pipeline re-welded and subject to full NDE.

After the welds have been checked, tested and approved, the coating crew will clean the exposed steel section at the joint between the pipes, sand-blast the steel, and apply a protective coating to it. The coating will consist of polyethylene HSS around the pipe (Figure 5.16).

Figure 5.14 Pipe Bevelling

Figure 5.15 Pipe Welding Shelter

Figure 5.16 Application of Field Joint Coating

Pipe Lowering and Backfilling

Following inspection of the weld coatings, the pipeline will be carefully lowered into the trench in a continuous operation with the aid of side booms (Figure 5.17). The pipeline trench will be backfilled in the reverse order to which it was excavated. The backfill will consist of fine grained granular material, mechanically sieved and well graded with a maximum particle size of 6 mm and will contain no sharp edges or deleterious matter.

The backfill material will be obtained, as far as practicable, using the same trench spoil that was taken from the trench originally. In rocky or uneven ground where the potential for pipe coating damage exists, the trench bottom will be given a protective 200 mm bed of soft earth or sand backfill material. Approximately 40,000 tonnes of imported material may be required to backfill the four pipeline trenches.

Backfill will normally be placed over the pipeline immediately after the pipeline has been lowered into the trench in order to protect the pipeline coating and to stabilise the open trench. The backfill is carefully compacted around and over the pipeline up to the top of the trench. Extreme care will be taken with the initial fill to avoid damage to the coating. During the burial process, a brightly coloured plastic warning tape will also be installed above the pipelines, along the entire length of the trench to provide warning in the event of future excavations in the area.

It will not be possible to return all the originally excavated trench spoil due to the volume of space taken up by the installed pipelines and removal of rock and other unsuitable backfill material, etc. It is estimated that up to 45,000 m^3 of surplus spoil will be left over from the installation of the four pipelines. Therefore, some will need to be either disposed of or incorporated into landscaping initiatives. Any surplus or unsuitable backfilling material (such as inert waste) will be removed from site and disposed of at an approved waste handling facility in accordance with applicable waste management regulations.

Reinstatement

After completion of pre-commissioning tests of the landfall and nearshore section pipelines (Section 5.4), the restoration of the construction corridor will begin. All affected areas along the construction corridor will be reinstated and restored as far as reasonably practicable to the original landform and condition. The removed topsoil will be placed back on the construction corridor. The original contours of the land will be restored as closely as possible; the topsoil will be stone picked and cultivated to enhance re-vegetation of the area.

Particular care will be taken to ensure that land drainage infrastructure, access roads and other networks and facilities disturbed / moved during construction, will be reinstated to their former state or replaced by a better quality system. Photographic records will be made of the route, where necessary, before and after the works to document any changes.

Figure 5.17 Pipe Lowering into Trench

The use of the stored topsoil (which preserves the natural seed bank and natural soil materials) will encourage natural processes and natural re-vegetation using only native plant species found on the site, thus conserving genetic biodiversity and composition of the original plant communities. Re-planting will take into account the requirements to protect the pipeline from deep-rooted vegetation.

Translocation of species of conservation concern gathered from the construction corridor before the start of the construction work will be undertaken in suitable locations where appropriate. Translocation will be undertaken in accordance with the requirements of the relevant Russian Federation authority and South Stream Transport environmental specialists. There will also be the opportunity to replant trees along the construction corridor outside the permanent 95 m wide RoW, which must be kept clear of deep rooted vegetation such as trees.

After re-instatement, the area will be monitored and maintained, as required, until normal growth patterns are re-established and confirmed by South Stream Transport's environmental specialists in accordance with requirements set out in South Stream Transport's activity-specific Russian Landfall CMP and overarching CMP - Biodiversity Management Plan. Details of the CMPs to be produced are described in **Chapter 22 Environmental and Social Management**. Further information on habitat reinstatement is provided in **Chapter 11 Terrestrial Ecology**, including provision for the replanting of areas outside the permanent 95 m wide RoW with trees.

Pipeline Markers

After re-instatement, the only visible evidence of the pipeline will be the RoW and pipeline and aerial markers placed along the route of each pipeline for future monitoring and line walking purposes. Each marker will have line of sight to its previous and following marker. A marker will also be installed wherever there is a change of direction.

Crossing of the Graphova Gap

Only one watercourse is crossed by the open-cut pipelines, an unnamed tributary of the Sukko River which is located in the Graphova Gap. This unnamed tributary has no or low flow during the summer months and more significant flow during the winter months. The Graphova Gap is approximately 15 m deep with slopes of up to 30 degrees.

If possible, the crossing will be undertaken during periods of low rainfall to minimise the potential for pollution and minimise the need for the installation of flume pipes or channel diversion, which may be required to maintain water flow during periods of heavy rain. Suitable mitigation measures to maintain flow and minimise transport of sediments will be undertaken as required in accordance with the Russian Landfall CMP. The location of the Graphova Gap can be seen in Figure 5.10.

The watercourse will be crossed using open-cut techniques. For each of the four pipelines crossing the gap, a dedicated trench will be excavated perpendicular to the watercourse, such that the top of pipeline will be approximately 1.5 - 2 m below the bed of the watercourse. The bottom of the trench will be approximately 2 - 3 m wide, with side slopes of approximately 45 degrees. Excavation of the pipeline trenches can be performed using standard hydraulic excavators and the pipeline will be installed conventionally using standard pipe-laying equipment. During installation some pipe sections will undergo cold bending to ensure the pipeline follows the contours of the watercourse crossing.

After installation of the pipeline in the trench, protective measures will be installed to prevent possible flash floods from eroding the bed of the watercourse and exposing the external coating of the pipeline. This protection can be achieved by installing a pre-cast concrete slab (approximately 1.2 m wide and 0.15 m thick) and suitable engineering backfill, i.e. graded material on top of the pipeline with boulders placed above to prevent erosion, prior to general backfilling. An indicative design of the watercourse crossing is shown in Figure 5.18.

A detailed design of the crossing will be prepared by the appointed contractor prior to pipeline installation, for approval by South Stream Transport.

Following backfilling of the trench the crossing will be reinstated. However, due to the steepness of the existing gully slope, the reinstated slope profile will have to undergo some excavation and grading works to ensure the slopes remain stable during the Operational Phase of the Project so as to reduce the risk of damage to the pipelines and also to allow safe access for inspection purposes.

A number of techniques exist that could be used to stabilise the slopes. A possible solution is the use of geotextiles. Geotextiles are installed in layers between layers of fill material. After every layer of fill (about 0.5 to 1.0 m, depending on the quality of the fill material and angle and height of the slope) a geotextile blanket will be added and wrapped around the subsequent layer of fill. In this way, the stability of the slopes is significantly increased. The surface of the slope will be covered with a thin layer of topsoil.

To prevent erosion of the topsoil a special erosion-control geotextile mat will be installed. This geotextile mat, with an open structure, reinforces the upper 1 to 2 cm of the topsoil, and prevents surface erosion on the slope and supports the growth of vegetation such as grass or small bushes.

All temporary works will then be removed in a controlled manner so as to minimise sediment disturbance. A detailed design of the crossing will be prepared by the appointed contractor during the detailed design phase prior to pipeline installation. The design will ensure that the water course will be fully functional following reinstatement. Although it is not anticipated that there will be water present in the watercourse during construction, silt fences and/or other suitable measures (i.e. sediment entrapment matting or straw bales) will be located along and adjacent to this watercourse as required.

Crossing of the Marfovsky Fault

The landfall section pipelines will pass through the Marfovsky Fault as shown in Figure 5.10. The fault will be crossed using traditional open-cut techniques. However, to minimise the effect of potential displacement from seismic activity, each pipeline will be laid in an enlarged trench approximately 200 m long that will have a bottom trench width approximately 5 m wide.

The depth of the excavated trench shall be at least 3 m below the lowest point of the pipeline and the cover depth above the top of the pipeline will be approximately 1.5 m. The pipelines in the fault section will be laid on a bed of sand and backfilled with loose sand rather than the previously excavated soils. The combination of the wider trench and backfilling with loose sand allows the pipelines to move in a lateral direction should there be any movement by the fault, thereby lowering the risk of damage to pipeline integrity.

Crossing of Dirt Roads

Multiple dirt roads associated with agricultural activities are crossed by the pipelines, for which the open-cut construction methods described above are considered suitable. Landowners will be consulted by South Stream Transport to inform them of temporary road closures. Measures, such as creating detours or phasing road closures, will be implemented to minimise nuisance to agricultural traffic.

Microtunnel Construction Site Requirements

The construction of the microtunnels will require a construction site of approximately 8.76 ha as shown Figure 5.10. The microtunnel construction site will contain all the plant and equipment required for construction of the microtunnels and will also include the location of the four microtunnel entry shafts. A typical layout of the microtunnel construction site is shown in Figure 5.19.

It should be noted that the final layout (within the defined area) will be subject to the preference of the appointed microtunnel installation contractor. For the purposes of this ESIA Report, it is anticipated that the microtunnels will be constructed one after the other, with only one tunnel boring machine (TBM) in operation at once. The microtunnel construction site will be in operation for approximately two years (includes from site preparation to completion of reinstatement work). However, the appointed microtunnel installation contractor may choose to start microtunnelling a second tunnel before the first is complete, which would reduce the construction period.

Microtunnel Construction Method

Microtunnelling is a trenchless construction method used to excavate underground tunnels. The microtunnelling method involves pushing pre-cast concrete jacking pipes (pipes designed to be driven through the soil to line and stabilise the pipe tunnel) behind a steerable, remotely controlled TBM from an entry shaft to an exit pit. On completion of the microtunnel, the pipelines are installed within the microtunnel by pulling the welded pipeline string through the microtunnel. The total length of each microtunnel is approximately 1.4 km (approximately 1 km is below the land surface and approximately 0.4 km of the microtunnel is below the seabed). The microtunnel will enable the crossing of the Varvarovka to Sukko road and the Shingar River without any damage or interruption.

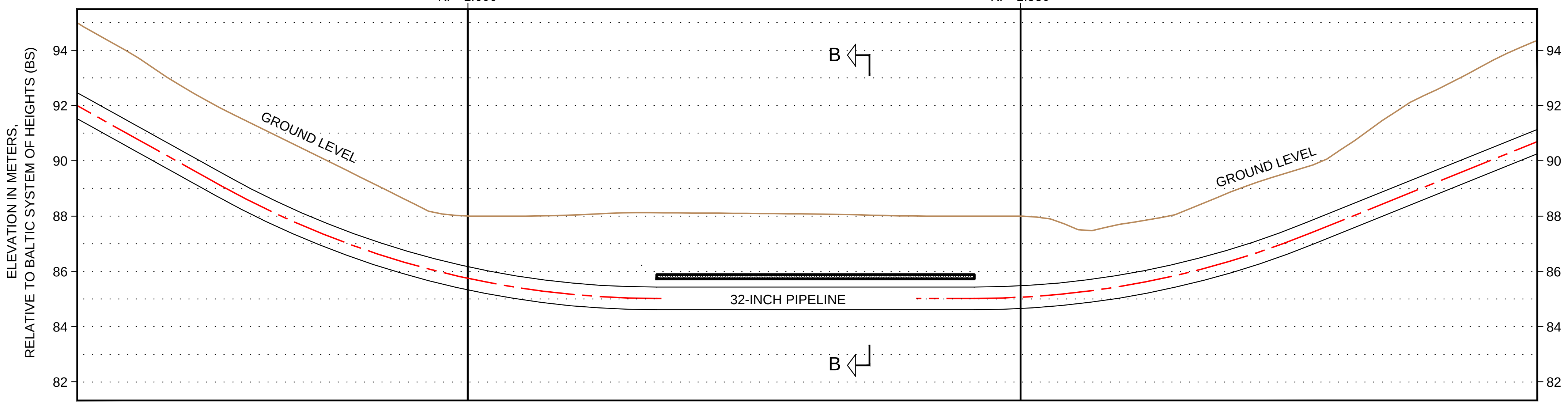
Each microtunnel will be a circular shape and will have an outer diameter of approximately 2.5 m.

The location of the four microtunnels is shown in Figure 5.20 and a longitudinal profile of the microtunnel for pipeline #1 is illustrated as an example in Figure 5.21. All four pipelines will have similar longitudinal profiles. The construction of the microtunnels will consist of the following main activities:

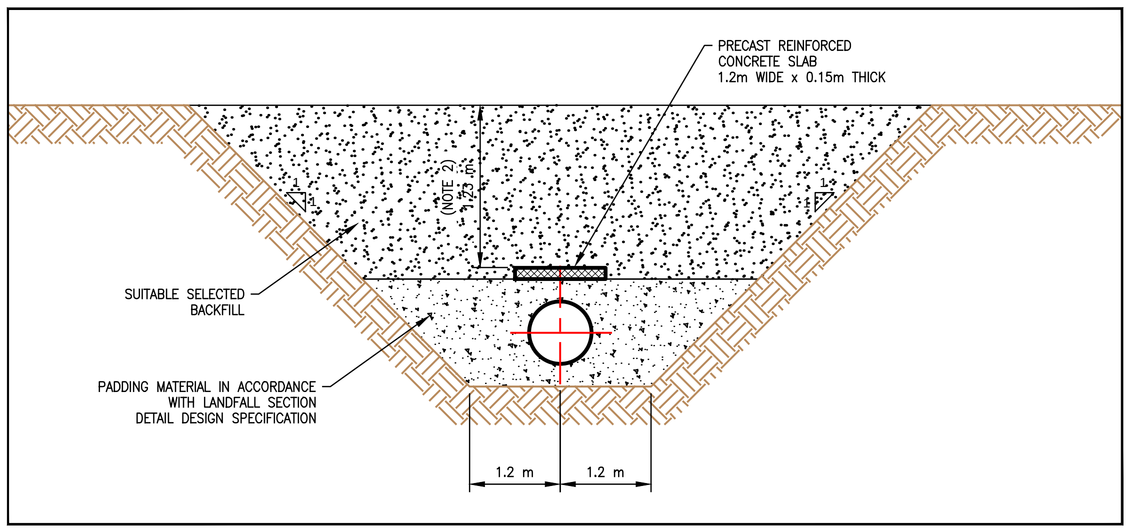
- Excavation and construction of the entry shaft to launch the TBM followed by the concrete jacking pipes;
- Excavation of the microtunnel, which will be continuously lined by the concrete jacking pipes;
- Excavation of the offshore microtunnel exit pit and recovery of the TBM; and
- Pipeline installation and grouting of the microtunnels.

An illustration of a typical microtunnel being constructed is shown in Figure 5.22 and a list of the equipment necessary to construct the microtunnels is provided in Table 5.9. The construction of the microtunnel will require construction activities to be undertaken in both the landfall and nearshore sections of the Project Area. This section of the chapter provides details on the activities associated with the landfall section although makes reference to activities in the nearshore section in order to clearly set out the microtunnelling construction process. More detailed information on the construction activities within the nearshore section is provided in Section 5.3.4.

LONGITUDINAL SECTION A - A (SCALE 1:100)



CROSS SECTION B - B (SCALE 1:50)



RUSSIAN SECTOR OF THE SOUTH STREAM OFFSHORE PIPELINE

NOTES

1. Elevations are in meters, relative to Baltic System of Heights (BS).
2. Minimum cover 1.22 m. from top of precast concrete slab.
3. Length and extend of precast concrete slabs to be determined during detail design.
4. Cover depth of pipeline section in crossing and location of concrete protection slabs to be re-evaluated with additional survey data, to be available for detail design.

Projection: Lambert Conformal Conic

Revision Details	By / Check	Date	Suffix

Purpose of issue: For Information

Client: South Stream Offshore Pipeline — ENERGISING EUROPE

Project Title: SOUTH STREAM OFFSHORE PIPELINE

Drawing Title: Indicative Design for Pipeline Crossing of the Unnamed Tributary of the Sukko River

Designed	Drawn	Checked	Approved	Date
RW	OAS	MJW		19/03/14

URS Internal Project No. 46369078 — Scale @ A3: As Shown

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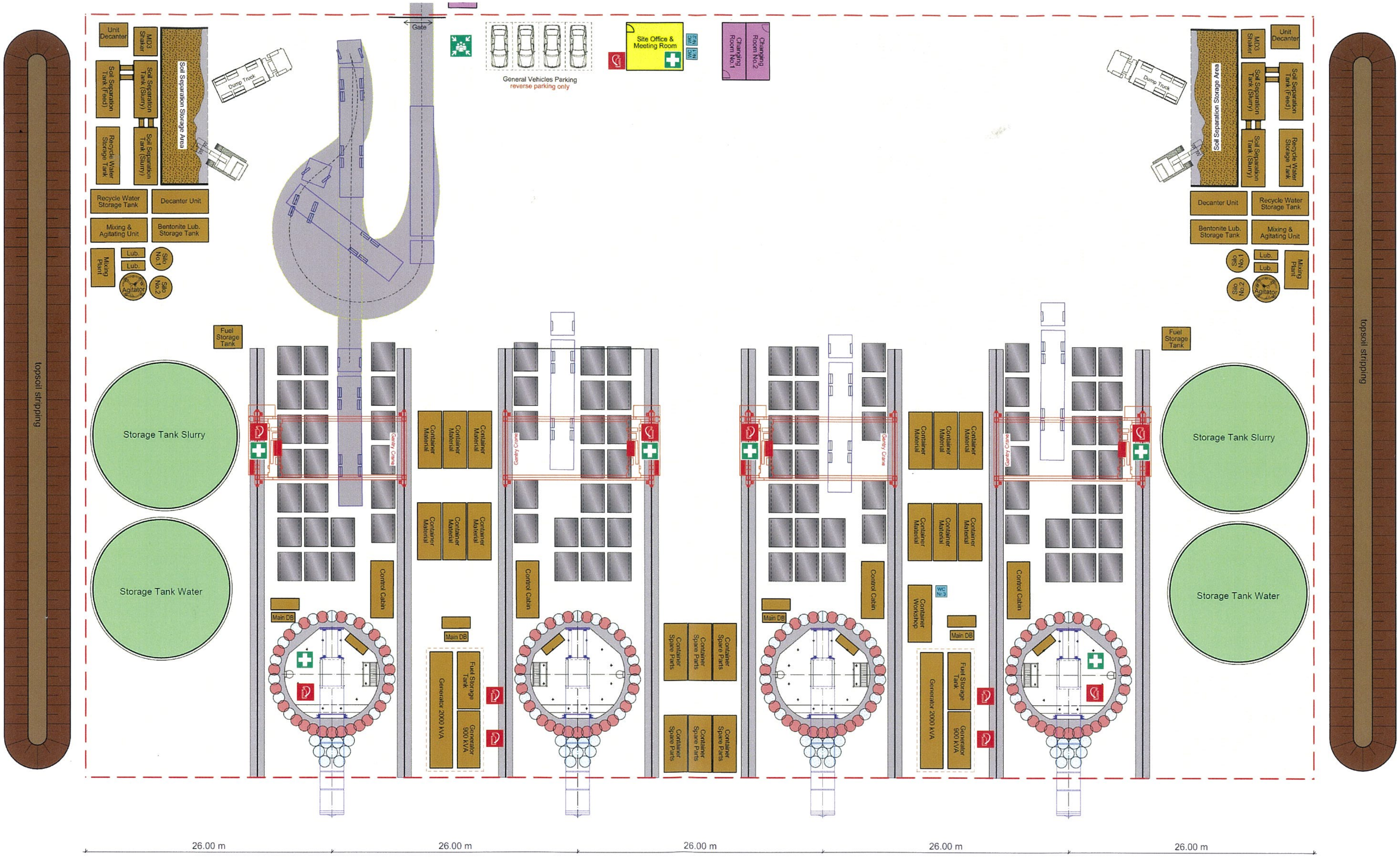
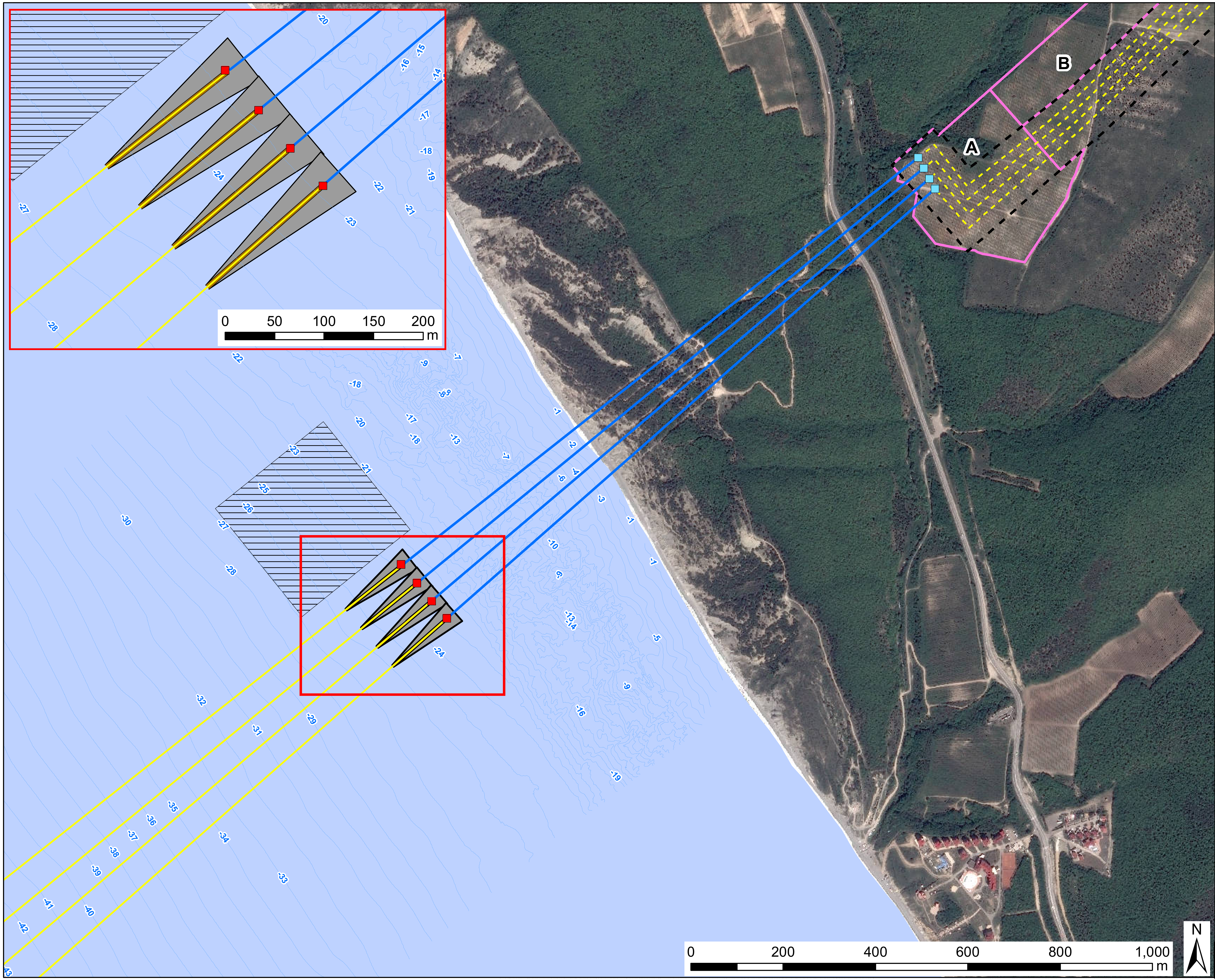
Drawing Number: Figure 5.18 — Rev:

Figure 5.19 Typical Microtunnel Construction Site Layout





LEGEND

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Proposed microtunnels
- Proposed offshore pipelines
- Microtunnel entry shaft
- Microtunnel exit pit
- Construction corridor
- Construction sites

A - Microtunnel construction site
B - Pipeline string preparation area

- Trench bottom width
- Exit pit and trench side slopes
- Temporary storage area for dredged material
- Isobaths

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: For Information

Client: South Stream Offshore Pipeline — Energising Europe

Project Title: SOUTH STREAM OFFSHORE PIPELINE

Drawing Title: MICROTUNNELS LAYOUT AND EXIT PITS

Drawn	Checked	Approved	Date
DH	RW	MW	18 Feb 2014

URS Internal Project No.	Scale @ A3
46369082	1:7,500

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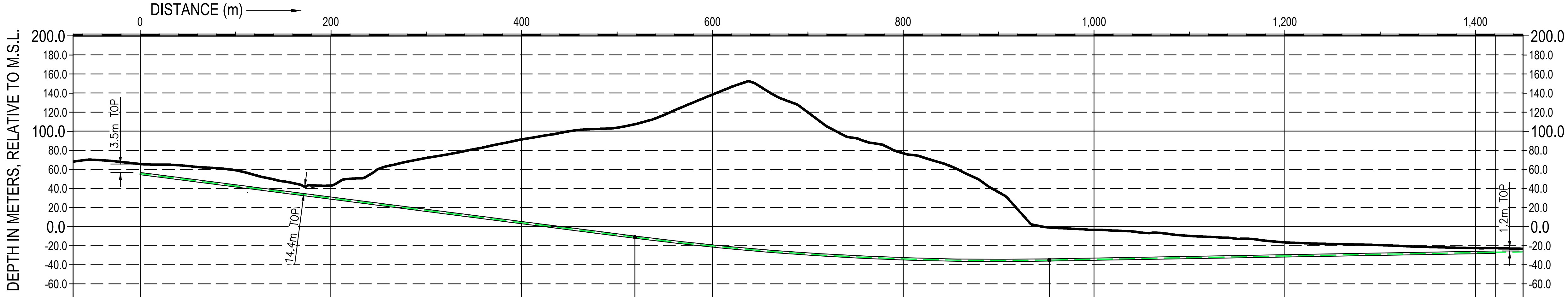
Drawing Number: Figure 5.20 | Rev:

Plot Date: 18 Feb 2014
File Name: I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 5 Project Description\Figure 5-20 Microtunnels Layout and Exit Pits.mxd

LONGITUDINAL PROFILE

VERTICAL SCALE 1: 5,000   HORIZONTAL SCALE 1: 5,000



HOR. DISTANCE FROM ENPT-1-R.1	0.00 m	200.00 m	400.00 m	518.59 m	600.00 m	800.00 m	953.18 m	1,000.00 m	1,200.00 m	1,420.66 m
GROUND ELEVATION	65.61 m	43.09 m	91.39 m	107.26 m	138.36 m	76.90 m	-0.94 m	-3.34 m	-16.52 m	-22.64 m
CENTER LINE MICRO TUNNEL	55.61 m	29.92 m	4.23 m	-11.01 m	-20.34 m	-33.76 m	-35.00 m	-34.18 m	-30.69 m	-26.84 m
VERTICAL ANGLE / LENGTH BENDING RADIUS / LENGTH	ANGLE= 7.3° / L= 522.8 m (NOTE 3)				R= 3,000 m / L= 435.6 m (NOTE 3)			ANGLE= 1° / L= 467.6 m (NOTE 3)		
TOP OF MICRO TUNNEL	56.82 m	31.13 m	5.44 m	-9.80 m	-19.13 m	-32.56 m	-33.80 m	-32.98 m	-29.49 m	-25.64 m
COVER (TOP OF MICROTUNNEL)	8.79 m	11.96 m	85.95 m	117.06 m	157.49 m	109.46 m	32.86 m	29.64 m	12.97 m	3.00 m

RUSSIAN SECTOR OF THE SOUTH STREAM OFFSHORE PIPELINE

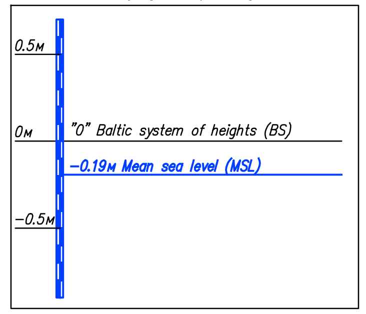
LEGEND

— — — — LANDFALL SECTION PIPELINE 1

NOTES

1. DIMENSIONS ARE IN METERS, UNLESS NOTED OTHERWISE.
2. ALL ELEVATIONS ARE IN METERS, RELATIVE TO BALTIC SYSTEM OF HEIGHTS (BS).
3. LENGTH IS MEASURED ALONG CENTER LINE OF MICROTUNNEL.
4. TOTAL LENGTH MICROTUNNEL = 1,426.0 m.
5. MICROTUNNEL DETAIL DESIGN (INCL. INSTALLATION ENGINEERING) TO BE PERFORMED BY CONTRACTOR.

Tide–gauge "Anapa" diagram



GEODETIC & PROJECTION PARAMETERS

GEODETIC DATUM	: WORLD GEODETIC SYSTEM 1984 (WGS84)
PROJECTION CONIC	: LAMBERT CONFORMAL
CENTRAL MERIDIAN	: 34° 00' 00" E
ORIGIN OF LATITUDE	: 43° 00' 00" N
FIRST STANDARD PARALLEL	: 30° 00' 00" N
SECOND STANDARD PARALLEL	: 50° 00' 00" N
FALSE EASTING	: 0.0 m
FALSE NORTHING	: 0.0 m
SCALE FACTOR	: 1.0000

METERS

0 20 100 200

HORIZONTAL SCALE 1:5000 (AT "A3" SIZE)

Projection: Lambert Conformal Conic

Revision Details	By / Check	Date	Suffix

Purpose of issue

For Information

Client

South Stream
Offshore Pipeline
ENERGISING EUROPE

Project Title

SOUTH STREAM OFFSHORE PIPELINE

Drawing Title

Longitudinal Profile of Microtunnel for Pipeline 1

Designed	Drawn	Checked	Approved	Date
RW	OAS	MJW		19/03/14

URS Internal Project No.	Scale @ A3
46369078	1:5000

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Drawing Number	Rev
Figure 5.21	

Figure 5.22 Typical Microtunnel Construction

(Image supplied courtesy of Herrenknecht AG)

Entry Shaft Construction

A microtunnel entry shaft is required to ensure that the TBM commences excavation of the microtunnel at the correct angle. It is estimated that the entry shafts will be approximately 10 - 12 m deep and 12 m in diameter. The entry shafts are formed by drilling piles (typically a combination of reinforced and unreinforced bored concrete piles) to the required depth around the shaft location to form a continuous circular secant piled wall (secant pile walls are formed by constructing intersecting reinforced concrete piles) for the shaft. Once the outer frame is in place, the shaft will be excavated out to the required depth and a reinforced concrete slab will be constructed at the base of the shaft. Each shaft will require approximately 1,250 m^3 of material to be excavated and approximately 600 m^3 of concrete to form the shaft walls.

Table 5.9 Estimated Plant and Equipment Required for Construction of the Microtunnels

Construction Activity	Equipment	No.	Size / Weight	Capacity / Rating	Predicted Noise Level	% on-time 24 hours day	Duration of usage (total unless stated)	Notes
Entry Shaft Construction Equipment	Bore pile drilling rig	1	27.5 m high 142 tonne	Drilling depth of up to 80 m	LAeq, T at 10 m of 83 dB	50	60 days per tunnel	Only one of the two bore pile drilling rigs will be required to prepare each entry shaft. The preferred rig will depend on the ground conditions present
	Bore pile drilling rig (alternative depending on ground conditions)	1	26.5 m high 96 tonne	Drilling depth of up to 71 m	LAeq, T at 10 m of 83 dB	50	60 days per tunnel	
	Hilti drop in (HDI) in anchoring rig (a drop-in anchor designed for use in solid concrete)	1	31 tonne	Stroke up to 12 m	-	50	5 days per tunnel	
	Cement grouting injection unit	2	2 x 20" containers 18 tonne		-	100	14 days per tunnel	Injection unit will include mixing and injection of soilcrete (a mixture of soil and concrete)

Continued…

Construction Activity	Equipment	No.	Size / Weight	Capacity / Rating	Predicted Noise Level	% on-time 24 hours day	Duration of usage (total unless stated)	Notes
Cranage and Excavation	Gantry crane	2	11.8 x 15 x 14.6 m	50 t lifting capacity	LAeq, T at 10 m of 75 dB	40	20 months	For moving and lowering jacking pipes to entry shaft
	All terrain mobile crane	1	8.3 m x 4.9 m, height depends on setup 115 tonne	120 t lifting capacity	LAeq, T at 10 m of 74 dB	35	2 years	For general setup, mobilisation and demobilisation, heavy equipment handling and movement of jacking pipes around site
	Excavators	4	20 – 40 tonne	60 – 215 kW	LAeq, T at 10 m of 76 dB	50	There will only be a need for one excavator to be used continuously for the two year construction period. The other three will be used as required	
Tunnel Boring	TBM	2	OD 2.5 m ID 2.25 m 48 tonne	-	Sound power level 75-80 dB (inside TBM)	100	100 days per tunnel	
	Air lock (decompression chamber attached to TBM)	2	OD 2.5 m ID 2.25 m 23 tonne	-	-	100	100 days per tunnel	

Continued…

Construction Activity	Equipment	No.	Size / Weight	Capacity / Rating	Predicted Noise Level	% on-time 24 hours day	Duration of usage (total unless stated)	Notes
Tunnel Boring	Control cabin	2	6 m x 2.4 m x 2.6 m 17 tonne	-	Sound power level 75 dB (inside cabin)	100	100 days per tunnel	
Microtunnel Ventilation and Lubrication	Compressor with air cooling and dryer	2	1.25 m x 1.8 m x 1.35 m	12.7 m^3/min @ 7.5 bar	Sound power level 70 dB	100	120 days per tunnel	Power provided by separate generator
	Ventilation fan	2	1.2 m x 1.2 m x 3 m 3 tonne	2 x 7.5 kW	Sound power level 65-70 dB	10	120 days per tunnel	Standby only – unlikely to be used
	Injection pump for lubrication	2	1.5 m x 0.8 m x 1 m 1.2 tonne	100 bar	Sound power level 65 dB	100	90 days per tunnel	
	Automatic mixing unit usable for bentonite and grouting	3	2.44 m x 2.44 m x 2.44 m 5 tonne	20 m^3/hour	Sound power level 65 dB	25	105 days per tunnel	Three months bentonite mixing and two weeks grout mixing

Continued...

Construction Activity	Equipment	No.	Size / Weight	Capacity / Rating	Predicted Noise Level	% on-time 24 hours day	Duration of usage (total unless stated)	Notes
Microtunnel Ventilation and Lubrication	Storage silos (20-30 m^3)	4	3.6 m x 3.6 m x 1 m 6 tonne	20-30 m^3	-	-	120 days per tunnel	
Solids Control and Slurry Handling	Separation plant	2	2.44 m x 2.44 m x 6.09 m 12 tonne	500 m^3/hour	LAeq, T at 10 m of 79 dB	100	20 months	
	Centrifugal plant	3	2.44 m x 2.44 m x 6.09 m 12 tonne	150 m^3/hour	Sound power level 90 dB (inside container)	20	16 months	
	Flocculation plant	2	2.44 m x 2.44 m x 6.09 m 12 tonne	30 m^3/hour	-	10	16 months	Usage unlikely due to geology along tunnel route
	Water / slurry separation tanks	10	2.4 m x 2.4 m x 6.2 m 6 tonne	25 m^3	-	-	20 months	
	Water / slurry storage tank	2	Diameter 15 m	1,000 m^3	-	-	20 months	

Continued…

Construction Activity	Equipment	No.	Size / Weight	Capacity / Rating	Predicted Noise Level	% on-time 24 hours day	Duration of usage (total unless stated)	Notes
Solids Control and Slurry Handling	Water / slurry storage tank	2	Diameter 15 m	1,000 m^3	-	-	20 months	
	Separation agitators	6	2 m x 1.8 m wings	Up to 30 m^3 5.5 kW	-	60	16 months	
Generators and Tanks	Diesel generator	2	12 m x 2.5 m x 3 m 21 tonne	1,130 kVA 904 kW 400 V	LAeq, T at 10 m of 67 dB	100	16 months	Main generator for microtunnelling equipment
	Diesel generator (back-up)	2	6 m x 2.5 m x 3 m 15 tonne	810 kVA 648 kW 400 V	LAeq, T at 10 m of 65 dB	30	16 months	Only used to supplement main generators if necessary
	Construction site diesel generator for offices, security lighting and telecoms	1	4.2 m x 1.4 m x 2.2 m 4.5 tonne	250 kVA 200 kW 400 V	LAeq, T at 10 m of 74 dB	100	20 months	Only required if the site does not have a connection to the national grid

Continued…

Construction Activity	Equipment	No.	Size / Weight	Capacity / Rating	Predicted Noise Level	% on-time 24 hours day	Duration of usage (total unless stated)	Notes
Generators and Tanks	Tanks with appropriate secondary containment for leakage control of slurry	2	6 m x 2.5 m x 3 m	9,000 litres	-	-	20 months	
	Tanks with appropriate secondary containment for diesel storage	2	3 m x 2.3 m x 3 m	3,000 litres	-	-	20 months	

Complete.

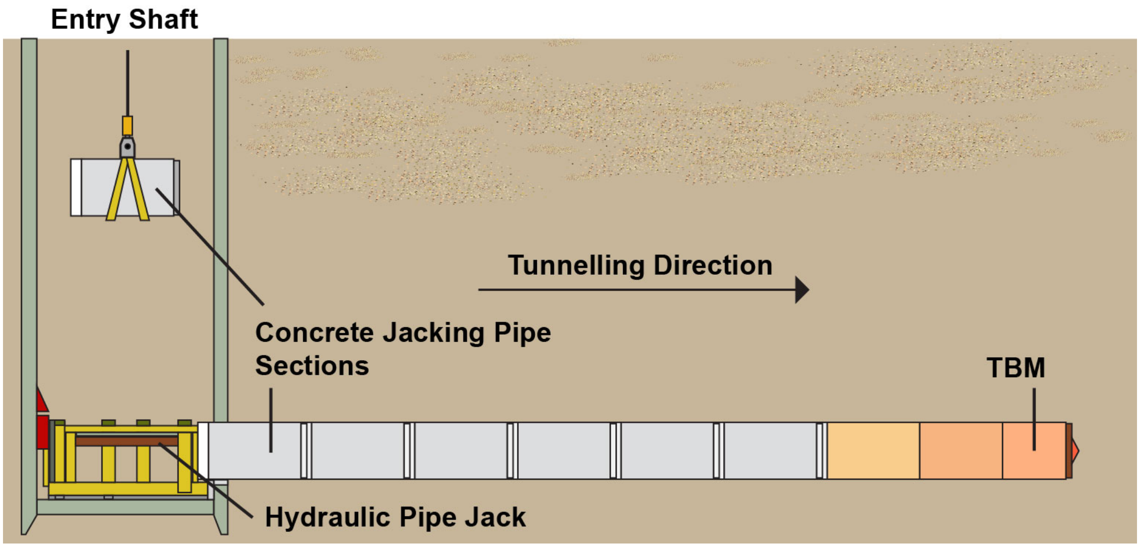
Microtunnel Excavation

Microtunnelling will be undertaken using a remotely controlled TBM, which is lowered into the entry shaft by a crane. The microtunnelling operation will be undertaken on a 24 hour day, seven day per week basis and the average rate of tunnel excavation will be approximately 10 to 15 m per day. It is anticipated that each microtunnel will take approximately four months to excavate. The construction schedule assumes that each of the four microtunnels will be constructed one after the other; however, it is possible that the contractor (with agreement from South Stream Transport) could choose to construct two tunnels simultaneously.

In addition to the TBM, additional equipment will be used to advance and control the TBM and concrete jacking pipes and manage excavated soils and slurry. Further details on equipment are provided in Table 5.9.

The pipe jacking process which will be used to advance the TBM and concrete jacking pipes is shown in Figure 5.23. Approximately 485 concrete jacking pipes (each approximately 3 m long and 2.5 m in diameter) will be required for each microtunnel. Each jacking pipe section will have a spigot at one end and a socket at the other end. The spigot end of one pipe section is inserted into the socket of another pipe section with a secure seal being made between the two within the socket. It is anticipated that concrete jacking pipes will be delivered to the site pre-fabricated and ready for installation. Alternatively, they could be prepared at site within a temporary shed constructed within the Pipeline String Preparation Area (Site B).

Figure 5.23 Pipe Jacking Process



In addition to the main hydraulic pipe jack in the entry shaft, there will be a number of intermediate jacking stations installed approximately every 100 m along the microtunnel. The intermediate jacking stations effectively break the whole microtunnel jacking length into smaller pipe jacking sections and redistribute the total required jacking force.

The TBM will be equipped with an air lock. The air lock is effectively a decompression chamber that is attached to the TBM that allows workers to safely adjust to the atmospheric conditions at the tunnel face under compressed air.

TBMs have a rotating cutting head to excavate the ground material. The cutting head is lubricated with slurry made of water and bentonite (a natural, inert, non-toxic clay) that is pumped through hoses to the cutting head from slurry mixing equipment located in the microtunnelling construction site. The bentonite will be in a dry powder clay form and will be mixed with the fresh water in the microtunnel construction site prior to being pumped to the cutting head. It is estimated that approximately 1,200 tonnes of bentonite will be required for the slurry and lubrication to construct all four microtunnels.

Each microtunnel will require approximately 9,250 m^3 of freshwater during construction for lubrication, slurry production and grouting purposes. It is anticipated that the water will be supplied by tankers, which will collect the water from a well located at the northern edge of the village of Sukko as described in Section 5.3.3.2 and shown in Figure 5.8. It is estimated that a maximum quantity 10,000 m^3 of water may need to be stored for the construction of the microtunnel due to a five month restriction period (May to September inclusive) when water may not be taken from this source. The water required for slurry (5,000 m^3 per microtunnel) will be mixed with soda ash (known chemically as sodium carbonate (Na_2CO_3)) to achieve an ideal pH of approximately 9.0 before mixing with the bentonite in a standard mixing agitator. It is anticipated that approximately 25 tonnes of soda ash will be required for the construction of the four microtunnels. The additives in the slurry (e.g. bentonite) will be selected from the OSPAR/PLONOR list of substances. The Oslo Paris Commission (OSPAR)[3] List of Substances and Preparations Used and Discharged Offshore which are considered to Pose Little or No Risk to the Environment (PLONOR) contains a list of substances whose use and discharge offshore are subject to expert judgment by the competent national authorities or do not need to be strongly regulated.

A residual coating of the slurry mixture on the exterior of the concrete jacking pipes will help reduce the friction between the jacking pipes and the surrounding soil. The TBM is also equipped with a crushing cone to crush larger particles into smaller sizes for transport through the slurry lines, a hydraulic or electric motor to turn the cutting head, a pressurised slurry mixing chamber behind the cutter head to maintain face stability, an articulated steering unit with steering jacks for steering corrections, various control valves, pressure gauges, flow meters, and a data acquisition system. Additionally, the TBM has inline cameras to relay information to the operator and a target system for guidance control.

Slurry and Waste Management

Each microtunnel will require approximately 7,000 m^3 of material to be excavated. The drill cuttings are removed from the tunnel by means of slurry. Slurry pumps in the tunnel section behind the TBM will transport the slurry through pipes to the microtunnel construction site.

[3] OSPAR refers to the Oslo and Paris *Conventions for the Protection of the marine Environment of the North-East Atlantic* (OSPAR Conventions), 1992.

Most of the slurry (consisting of water, bentonite and drill cuttings) will be returned to the surface where a separation plant located within the microtunnel construction site will filter the slurry to remove the drill cuttings and store it in temporary mud storage tanks for re-use.

The separation plant contains various stages of modular units which incorporate physical grating shaker screen filters and hydrocyclone units. Each of the stages shown in Figure 5.24 will separate and remove materials of different sizes from the slurry starting with coarse rock particles from approximately 60 mm down to fine material of size just below 0.1 mm.

The soil separation process is shown in Figure 5.24 which illustrates that after the solids and fines separation, the slurry is returned via the pumped process and will re-circulate to the TBM face via the tunnel piped circuit, thereby completing the cycle. The slurry's soil-carrying attributes will deplete over time in this process, due mainly to the inclusion of very fine excavated materials. The condition and capability of the slurry is constantly monitored. Either make-up slurry, which is mixed adjacent to the separation plant, or recycled/cleaned slurry, is added via the reservoir feed header tanks and replenishes the slurry circuit as needed.

All of the solid outputs of the slurry separation process will be removed from the temporary storage areas by dump truck to facilities capable of reusing the material (rock, gravel and sand), or to approved waste sites in accordance with national waste regulations if there are no means of recycling the material offsite or if the soil is contaminated.

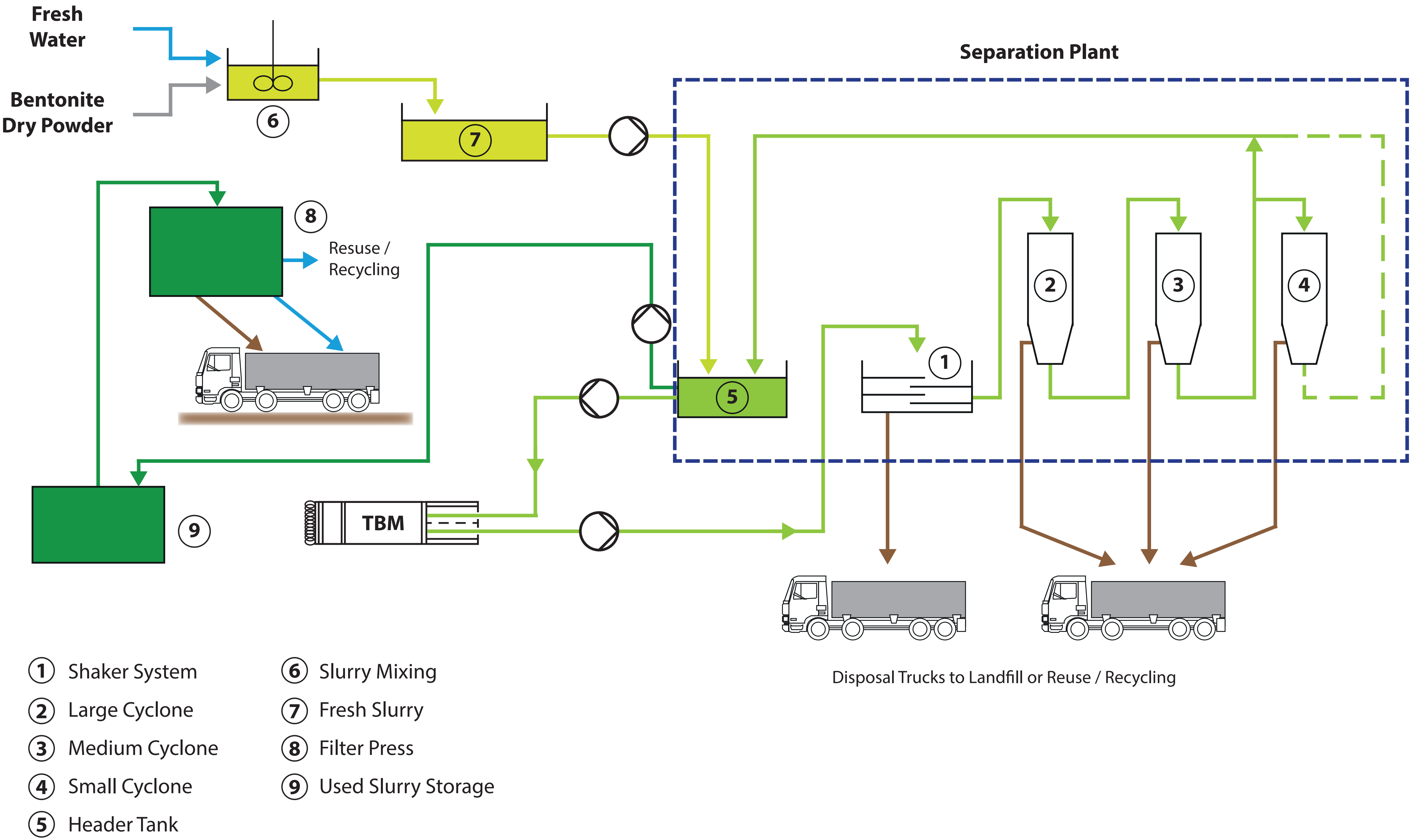
The separation plant storage area shown in Figure 5.24 will be equipped with its own floor drainage system. Wet slurry draining from the separated material will run-off to local drains within the microtunnel construction site and from there it will be pumped into the recycled slurry process for reuse.

The unused waste slurry liquid that is residual from the centrifuge or filter press is recycled and re-introduced back into slurry preparation. After completion of the microtunnel works, any remaining slurry will be transported from the used slurry storage tank to a licensed waste facility, where it is typically handled as normal soil waste. By undertaking careful calculations of slurry requirements and using efficient slurry recycling systems, the amount of surplus slurry will be kept to a minimum.

Excavation of the Offshore Microtunnel Exit Pits and Recovery of the TBM

The recovery of the TBM at the exit of the microtunnel requires the excavation of an offshore exit pit for each pipeline. The exit pits are located approximately 400 m offshore in a water depth of approximately 23 m. Further information on the excavation of the microtunnel exit pits and TBM recovery is presented in Section 5.3.5.4.

Figure 5.24 Slurry Separation Process



Installation of the Pipeline in the Microtunnel

Following completion of each excavated microtunnel exit pit and trench in the nearshore section, the pipeline will be installed within the microtunnels using a pull-in winch. Welding, field joint coating and inspection of the pipeline string will be undertaken onboard a pipe-lay vessel located near the microtunnel exit pits. As the pipeline string is welded together onboard the pipe-lay vessel the completed pipeline is pulled through the transition trench and microtunnel from the stern of the pipe-lay vessel by a cable or rods connected to a linear winch located onshore within the microtunnel construction site.

The pipeline pull-in process will require some reconfiguration of the microtunnel construction site. This is to provide room for the pull-in equipment, including a suitable area for the installation of anchor hard points for the winch system and locating the winch and reel winder that will store the pull-in cable. The winch system will likely be constructed using sheet or tubular piles as anchors. It is anticipated that a multiple winch system will be required to provide the necessary force to pull-in each pipeline. The pipeline string will have the outer surface of the pipe coated with a Glass-Fibre Reinforced Plastic (GFRP) sheath to protect the 3LPP coating against impact or friction wear as it is pulled through the microtunnel. It is anticipated it will take approximately five days to complete the pipeline installation within each of the microtunnels.

Construction activities in the nearshore section associated with the installation of the pipeline in the microtunnels is described in more detail in Section 5.3.5.5.

Following pipeline installation within the microtunnel, a tie-in between the microtunnel pipeline string and the open-cut landfall section pipelines will be made within the entry shaft.

Grouting of Microtunnels

The gap between the outside of the pipeline and the inside wall of the microtunnel will be filled with grout following hydrotesting of the landfall and nearshore sections of the Project pipelines (described in more detail in Section 5.4.2). The purpose of the grout is to secure the pipelines within the tunnels. The grout (a mixture of cement, bentonite and freshwater) will be batched within the microtunnel construction site. Approximately 5,500 m^3 of grout will be required per tunnel, and 22,000 m^3 for all four tunnels.

Prior to grouting, both ends of the microtunnels will be sealed. At the entry shaft end, a brick wall is built by hand and sealed around the product pipeline and the various grouting fill pipes. The grout shall be pumped into the flooded and sealed microtunnel from the entry shaft end through several injection tubes until the microtunnel is completely filled. This process will displace the seawater through a seaward-end outlet pipe. It is expected that a certain amount of mixing of the grout with the seawater will occur. The expelled water will be monitored at a sea surface outlet pipe where it is expected a mixture including some grout will eventually appear. The amount of mixed material that may be released to the marine environment is estimated to be small.

The mixed material will be tested and if it is deemed to contain too much solid grout material for discharge to sea (as determined by local regulations and international standards), it will be pumped to a tank upon a vessel at the microtunnel exit pit where separation of the grout from the seawater will be undertaken using on-board filtering equipment. There are three possible filtering methods that could be selected:

- Settlement and dilution with seawater;
- Centrifuges; and
- Flocculation.

The chosen filtering option will be selected by the installation contractor based on the quantity of mixed material, the grade of grout, and water pH and temperature. The grouting process will be monitored until the correct (input) concentration of grout appears on the discharge end. The grouting pipes at both ends of the microtunnel will be plugged and the microtunnel construction will be completed.

5.3.4.5 Landfall Section Construction Material Use, Utilities, Waste and Emissions

Material Use

During construction of the landfall section pipelines and landfall facilities a number of materials will be required. An estimate of the quantities of the main materials to be consumed for construction of the four landfall section pipelines and landfall facilities are shown in Table 5.10. Quantities shown are approximate and subject to final optimisation during the detailed design process.

Table 5.10 Material Consumption during Construction of the Landfall Section

Material	Quantity (all four pipelines)
Landfall Section Pipelines	
Steel (pipe sections)	8,600 tonnes
Imported Backfill Material (sand or soft earth)	20,600 tonnes
Field Joint Coating (HSS)	950 sleeves
Weld Material	21.5 tonnes
Pre-cast Concrete Jacking Pipes	2,000 jacking pipes
Concrete (microtunnel entry shafts)	2,400 m^3
Bentonite	1,200 tonnes
Grout	22,000 m^3

Continued…

Material	Quantity (all four pipelines)
Landfall Facilities	
Steel (piping and equipment)	6,000 tonnes
Concrete (foundations of piping, equipment and containers)	10,000 tonnes
Imported fill material for site preparation (stone/rock)	134,000 tonnes
Field Joint Coating (HSS)	80 sleeves
Weld Material	0.5 tonnes
Paving Blocks / Slabs (to form areas of hardstanding)	6,000 tonnes
Crushed Rock (paving foundations)	8,000 tonnes
Gravel (surfacing of areas outwith hardstanding)	6,000 tonnes
Access Roads and Temporary Facilities	
Rock for access roads	297,331 m^3
Asphalt concrete for access roads	960 m^3
Rock for temporary facilities hardstanding areas	62,930 m^3

Complete.

Fuel Use

It is anticipated that an average of approximately 4.1 m^3 of diesel per day will be consumed by construction vehicles and equipment required for the construction of the landfall section. Diesel required for construction will be delivered to the construction sites by appropriately licenced road fuel tankers.

Fuel / Chemical Storage and Refuelling

There will be dedicated plant and vehicle refuelling areas within the construction sites, which will be situated away from surface waters, groundwater and surface water drains. Fuel tanks will be bunded. Secondary containment will be provided by forming an impermeable bund (i.e. a wall) around the refuelling area to provide containment in the event of a spill or rupture. Both storage tank and secondary bunding will be sufficient to contain at least 110% of the volume of fuel being stored. The location of the fuel tank storage areas within the construction sites will be subject to contractor preference.

Strict procedures will be followed when refuelling to minimise the risk of spills to the environment. All refuelling activities will be undertaken in line with requirements set out in the

Russian Landfall CMP, which will be developed as part of South Stream Transport's ESMP. The requirements of the CMP need to be met by both South Stream Transport and the appointed contractors (and sub-contractors). Other fuels, oils and chemicals will be securely stored in clearly marked containers in a contained area to prevent pollution. It will also be ensured that spill kits, containing clean-up/absorbent materials etc. are stored in close proximity to the refuelling areas and with any mobile fuel bowsers.

Chemicals and materials will be clearly labelled and Material Safety Data Sheets (MSDS) will be displayed at point of storage. Chemical and material storage areas will be well maintained, neat and tidy, with adequate inventory control. Chemical storage will be weather-proofed and on bunded hard standing. The bunds and hardstanding will be impermeable and resistant to the materials being stored. Requirements for the chemical storage will be set out in the Russian Landfall CMP.

Water Consumption

During construction of the landfall section water will be required for domestic purposes (drinking water, mess and welfare facilities) and industrial use (for example wheel washing, dust suppression; and microtunnel construction). Water will be brought in by road tankers. Bottled water will be provided for drinking purposes. The estimated consumption of water is presented in Table 5.11. Water requirements for hydrotesting are described in Section 5.4.

Table 5.11 Estimated Water Consumption during Construction of the Landfall Section

Water Type	Details	Maximum Consumption
Freshwater	60 l / person per day for domestic use	19.8 m^3 (at peak of construction) per day
Freshwater	Microtunnel construction	37,000 m^3
Freshwater	Various use (dust suppression, wheel washing etc.)	5 m^3 per day

Utilities

Utilities required during the construction of the landfall section will include:

- **Power** – the power required by plant, machinery and temporary offices etc. within the construction sites and construction corridor will be provided by diesel generators. When required, the generators will be refuelled by mobile bowsers;
- **Water** – potable and non-potable water will be available within the temporary construction sites shown in Figure 5.10. Water for general use within construction sites and construction corridor (including wheel-washing of vehicles going off-site, and dust suppression methods if necessary) will be supplied by bowsers as required. As described in Section 5.3.3.2, water will be sourced from a well near Sukko. Due to seasonal restrictions (May to September inclusive) when water may not be taken from this source it is anticipated that the

Contractor may require to store up to 10,000 m^3 of water in large water tanks within the Pipeline String Preparation Area (Site B) for microtunnel construction and up to 800 m^3 of water at the Landfall Facilities Construction Site and Pre-Commissioning/Commissioning Spread (Site E) for general construction use and hydrotesting of the landfall facilities pipework. The exact storage locations and dimensions of the storage tanks will be finalised during the detailed design and will be agreed between the Contractor, South Stream Transport and the relevant Local Authorities;

- **Sewage** – temporary sanitary facilities (i.e. chemical toilets) will be provided at a number of locations across the construction sites. Sewage will be contained and tankered and then collected by an appropriately licenced waste haulier to take the sewage offsite for appropriate treatment; and
- **Drainage** – to prevent possible pollution of surface waters, sediment and erosion controls, including appropriate drainage systems, will be implemented at construction sites to manage run-off and to limit the loss of soil from the site. The drainage systems will separate out the sediments from the drainage water and will include oil interceptors. Where vehicles carrying concrete and other equipment are required to be washed out on site this will be undertaken in dedicated bunded areas.

5.3.4.6 Summary of Waste Generated during Construction of Landfall Section

There are a number of activities during the Construction Phase of the landfall section that have the potential to generate waste. Table 5.12 presents a summary of the waste types anticipated to be generated using the Federal Waste Classification Catalogue (FWCC), in accordance with Ministerial Order 786 '*On the adoption of the Federal Classificatory Catalogue of Wastes'* (Ref. 5.7) to categorise waste types.

All wastes will be collected, stored and transported off-site in appropriate bins and containers in accordance with applicable Russian Federation waste policy. The locations of potential waste disposal facilities which may be used for the Project are shown in Figure 5.9 However, it should be noted that no decisions as to which of these sites could or may be used have been taken at this time and will be subject to further investigation. Only appropriately licenced companies will be employed for the transportation, recycling and disposal of waste. Further information on waste generation and management, including predicted quantities, is described in **Chapter 18 Waste Management**.

Table 5.12 Estimated Types of Waste Generated during Construction of the Landfall Section

Description of Waste Type	FWCC Code	Hazard Class
Fluorescent tubes and other mercury-containing lamps	353 301 00 13 01 1	1
Oily wastes, including: - waste oils, filters, oily rags, spill response waste, etc.	546 015 01 04 03 3 541 002 05 02 03 3 920 000 00 00 00 0 549 027 01 01 03 3 314 023 03 04 03 3 546 002 00 06 03 3	3
Waste protective clothing and worn work footwear	582 000 00 00 00 0 147 006 01 13 00 4	4
Waste drilling sludge	314 000 00 00 00 0	4
Waste paint resources	555 000 00 00 00 0	4
Sludge from wastewater treatment	943 000 00 00 00 0	4
Mixed municipal waste	912 004 00 01 00 4	4
Scrap metal	351 301 00 01 99 5	5
Uncontaminated soil	314 011 00 08 99 5	5
Welding waste	351 216 01 01 99 5	5
Crushed stone	314 009 02 01 99 5	5
Uncontaminated rock / sand	314 023 01 01 99 5	5
Plastic	571 018 00 13 00 5	5
Cardboard	187 102 02 01 00 5	5
Tree stumps	173 001 02 01 00 5	5
Waste (slurry) from cesspools and domestic sewage	951 000 00 00 00 0	4

The estimated generation of sanitary waste (black water) and wash water (grey water) during the peak of construction (approximately 330 workers on site) is provided in Table 5.13.

Table 5.13 Estimated Volumes of Grey and Black Water

Discharge Type	Details	Maximum Produced per Day (m^3)
Grey Water	48 l / person per day	15.8 (at peak of construction)
Black Water	12 l / person per day	3.96 (at peak of construction)

5.3.4.7 Emissions to Atmosphere during Construction of the Landfall Section

Table 5.14 presents the anticipated GHG and non-GHG emissions from the construction and installation (excluding pre-commissioning (Section 5.4)) of the landfall section pipelines and landfall facilities based on the expected plant and equipment required on site outlined in Table 5.7 and Table 5.9

Table 5.14 Atmospheric Emissions from Landfall Construction Plant (tonnes/year)

	CO_2	NO_X	CO	PM	SO_2	NMVOC
Tonnes / year	10,529	319	135	24	0.13	33

Table 5.15 presents the anticipated GHG and non-GHG emissions predicted to be generated by road traffic emissions associated with the daily movement of construction traffic to and from site as outlined in Table 5.8.

Table 5.15 Atmospheric Emissions from Road Traffic during Construction (tonnes/year)

	CO_2	NO_X	CO	PM	SO_2	NMVOC
Tonnes / year	2,147	11	41	0.2	0.01	5

Further information on emissions to atmosphere is provided in **Chapter 9 Air Quality**.

5.3.5 Construction of Nearshore Section

5.3.5.1 General Overview

The nearshore section of the Project Area commences at the exit of the microtunnels in a water depth of approximately 23 m and extends out to a water depth of approximately 30 m where an above water tie-in between the nearshore and offshore section pipelines will be made.

The main construction activities in the nearshore section include:

- Surveys of the pipeline route prior to, during and after the pipe-laying process;

- Dredging of each microtunnel exit pit and transition trench and recovery of the TBM on four occasions;
- Installation of the pipelines in the microtunnels;
- Pipe-laying;
- Backfilling of the microtunnel exit pits and transition trench; and
- Tie-in of the nearshore / offshore pipeline sections at the 30 m water depth.

Furthermore, there will be a requirement to temporarily store some of the dredged material from the microtunnel exit pits and transition trenches for the duration of the dredging works associated with each respective pipeline. The stored material will be used for backfilling of the exit pits and trenches following pipeline installation. Temporary storage areas will be located adjacent to the microtunnel exit pits, to the north, as indicated in Figure 5.20.

Marine plant and equipment used for the Project that originates from outside the Black Sea brings a risk of introducing marine invasive alien species. Specific measures will be adopted to reduce this risk. Where relevant and practical, these measures will be based on those identified in the IPIECA (Global Oil and Gas Industry Association for Environmental and Social Issues) document *Alien Invasive Species and the Oil and Gas Industry, Guidance for Prevention and Management* (Ref. 5.8) and the International Maritime Organization (IMO) *Ballast Water Management Convention and Guidelines* (Ref. 5.9). They will be applied to all marine plant and equipment that is used on the Project and which has the potential to be a vector of live organisms, spores, larvae and young and will include ballast water management, use of antifouling coatings, cleaning of equipment prior to deployment and the change of cooling water. Ballast management will be included in the Vessels and Marine Transport CMP. Further information on the Vessels and Marine Transport CMP and South Stream Transport's ESMP are described in **Chapter 22 Environmental and Social Management**.

5.3.5.2 Nearshore Vessel Spread

Table 5.16 presents a summary of the type and number of vessels that are anticipated to be used during the nearshore pipeline installation works.

Construction activities associated with the installation of the nearshore pipelines will require a number of vessels. The main vessel will be the vessel required for the installation of the pipeline in the microtunnels, which may be a multipurpose vessel equipped with winching gear or a shallow water pipe-lay vessel depending on the installation method selected by the contractor. In addition, other vessels will be involved in construction activities, such as dredging vessels, support vessels (survey, dive support, etc.) and supply vessels (pipes, fuel and provisions). The vessels associated with the marine pre-commissioning spread are presented in Table 5.31.

The actual vessel spread will depend on the contractors preferred method of pipeline installation in the microtunnels and the availability of vessels at the time that the necessary construction permits are granted.

Table 5.16 Typical Nearshore Construction Vessel Spread per Pipeline

Construction Activity	Type of Vessel	Task	No.	Duration (days) per vessel	Indicative Vessels	Power Rating (kW)	Persons on Board	Utilisation (%)
Dredging microtunnel exit pits and 170 m long transition trenches (from 23 – 26 m water depth)	Cutter Suction Dredger (CSD) (Option 1)	Dredging of microtunnel exit pit and transition trench	1	5 days Plus 19 days at 25% capacity for mobilisation/ demobilisation	Dikson	3,795	13	60
	Trailer Suction Hopper Dredger (TSHD) (Option 2)	As above	1	As above	Taccola	6,330	17	60
	Grab crane (Option 3)	As above		As above	Kahmari 2	920	4	60
	Hopper barge	Transport of dredged spoil	2	As above	Sand Carrier 101	300	10	60
	Small survey vessel	Surveys during and after dredging works	1	As above	Dunai	500	10	60

Continued…

Construction Activity	Type of Vessel	Task	No.	Duration (days) per vessel	Indicative Vessels	Power Rating (kW)	Persons on Board	Utilisation (%)
Dredging microtunnel exit pits and 170 m long transition trenches (from 23 – 26 m water depth)	Tug	Transporting the CSD or grab crane and transport of water and fuel, etc.	1	As above	Mustang	4,536	8	60
	Fast supply vessel	Crew changes	1	1 (i.e. 2 half-day trips)	GSP Lyra	2,520	70	60
	Fuel / waste water collection vessel	Bilge and waste water collection	1	1	Bryansk	610	5	60
	Rescue Vessel	Safety and Rescue Operations	1	Only required in case of emergency	GSP Vega	9,548	23	60
Backfilling of microtunnel exit pits and transition trenches	CSD (Option 1)	Collection of stored spoil from temporary storage areas for backfilling exit pit and transition trench	1	4 days	Dikson	3,795	13	60
	TSHD (Option 2)	As above	1	As above	Taccola	6,330	17	60
	Grab crane (Option 3)	As above		As above	Kahmari 2	920	4	60

Continued…

Construction Activity	Type of Vessel	Task	No.	Duration (days) per vessel	Indicative Vessels	Power Rating (kW)	Persons on Board	Utilisation (%)
Backfilling of microtunnel exit pits and transition trenches	Hopper barge	Transport of dredged spoil	2	As above	Sand Carrier 101	300	10	60
	Small survey vessel	Surveys during and after backfilling works	1	As above	Dunai	500	10	60
	Tug	Transporting the CSD or grab crane and transport of water and fuel, etc.	1	As above	Mustang	4,536	8	60
	Fast supply vessel	Crew changes	1	1 (i.e. 2 half-day trips)	GSP Lyra	2,520	70	60
	Fuel / waste water collection vessel	Bilge and waste water collection	1	1	Bryansk	610	5	60
	Rescue vessel	Safety and Rescue Operations	1	Only required in case of emergency	GSP Vega	9,548	23	60

Continued…

Construction Activity	Type of Vessel	Task	No.	Duration (days) per vessel	Indicative Vessels	Power Rating (kW)	Persons on Board	Utilisation (%)
Shallow water (23-30 m water depth) pipe-lay activities including pipeline installation in microtunnels	Shallow water pipe-lay or multipurpose vessel	Fabrication of pipeline string for shore pull and nearshore pipe-lay (if applicable)	1	6 (5 days installation of pipeline in microtunnel and 1 day pipe-lay from 23-30 m water depth (if applicable) Plus 3 days at 25% capacity for mobilisation/ demobilisation	Tog Mor	3,750	144	40
	Anchor handling tug	Handling the anchors for the pipe-lay or multipurpose vessel	2 (plus 1 standby)	As above	Normand Neptun	13,880	40	60
	Pipe Supply Vessel (PSV)	Supplying pipe to pipe-lay vessel. This vessel will only be required if the pipeline is to be welded on the pipe-lay vessel and pulled onshore through the microtunnel	1	As above	Normand Flipper	7,160	16	60

Continued…

Construction Activity	Type of Vessel	Task	No.	Duration (days) per vessel	Indicative Vessels	Power Rating (kW)	Persons on Board	Utilisation (%)
Shallow water (23-30 m water depth) pipe-lay activities including pipeline installation in microtunnels	Survey vessel	Surveying the sea floor in front and behind the pipelay vessel	2	As above	GSP Prince	7,604	62	60
	Multi Service Vessel (MSV)	ROV and diving support, and supply of consumables, bunker, provisions and freshwater	2	As above	Normand Mermaid	10,000	70	60
	Fast supply vessel	Crew changes	1	1 (i.e. 2 half-day trips)	GSP Lyra	2,520	70	60
	Fuel / waste water collection vessel	Bilge and waste water collection)	1	1	Bryansk	610	5	60
	Rescue vessel	Safety and Rescue Operations	1	Only required in case of emergency	GSP Vega	9,548	23	60

Continued...

Construction Activity	Type of Vessel	Task	No.	Duration (days) per vessel	Indicative Vessels	Power Rating (kW)	Persons on Board	Utilisation (%)
Above water pipeline tie-in between nearshore and offshore sections at 30 m water depth	Multipurpose supply vessel	Lifts and lowers pipeline to seabed and performs above water tie-in	1	14 days Plus 6 days at 25% capacity for mobilisation / demobilisation	Calamity Jane	15,086	72	60
	Small survey vessel	Surveys during above water tie-in	1	As above	Dunai	500	10	60
	Fast Supply Vessels	Crew changes	1	1	GSP Lyra	2,520	70	60
	Fuel / waste water collection vessel	Bilge and waste water collection	1	1	Bryansk	610	5	60
	Rescue vessel	Safety and rescue operations	1	Only required in case of emergency	GSP Vega	9,548	23	60

Complete.

5.3.5.3 Surveying

The design and routing of the microtunnels and nearshore section of the pipelines has been informed by a number of studies as outlined in the baseline data sections of Chapters 7-18 of this ESIA Report. However, a number of further surveys will be required before, during and after installation of the pipeline.

Pre-Construction Surveys

Pre-construction surveys will be carried out along each pipeline route prior to commencement of the dredging and pipe-lay works. The purpose of such surveys is to confirm the previous route surveys and optimise the exact route of the pipeline. The survey will typically include a range of standard geophysical survey techniques, and/or visual surveys using a remotely operated vehicle (ROV).

These surveys will also confirm the need for and guidance of the removal of boulders, rocks or potentially unexploded ordnance (UXO). Potential UXO could constitute a danger for the construction workers, the pipelines and the environment during the installation works and the operational life of the Project.

UXO surveys will be carried out in specific areas along the pipeline route where there is a higher likelihood of UXOs being present in advance of the pre-lay surveys. Identified UXOs will either be avoided through re-routing or cleared. A UXO Clearance Plan will be developed by the Contractor in close conjunction with South Stream Transport and relevant national authorities. However, a final check for the presence of UXOs may be undertaken during pre-lay surveys ahead of the pipe-lay spread.

It is anticipated that some of the vessels working in the nearshore section will use anchors. Therefore, an anchor corridor survey will also be carried out within a corridor on either side of the pipeline routes, the area of which will be calculated by the EPC contractor. Within this corridor, anchors from dredgers, pipe-lay vessel or anchor handling tugs may be laid on the seabed during installation of the pipelines.

The primary purpose of the anchor handling survey is to identify potential risks that will result from anchoring activity, as a result of the presence of potential UXO, anthropogenic debris or geological features and also Cultural Heritage Objects (CHO), which require safeguarding from damage by the anchors, and to avoid or minimise disturbance of sensitive habitats. The surveys will include standard geophysical and visual survey (such as ROV) techniques and the results will be subject to expert evaluation. Where UXO, CHO, sensitive habitats or potentially dangerous debris is detected, anchor exclusion zones will be established where practicable. The appointed pipeline installation contractor will be required to develop anchor patterns and procedures and undertake a risk assessment to ensure that the areas of concern are not impacted by the anchors or the sweep of the anchor cables.

Touch-down Monitoring and As-Laid Surveys

During installation of the pipelines in the nearshore, real-time touch-down monitoring will be conducted to ensure correct installation of the pipeline with regard to its alignment and with respect to lateral separation between adjacent pipelines. The real-time monitoring will ensure that boulders and, potential UXOs are avoided and that environmentally and culturally sensitive areas are not accidentally encroached by the pipelines. An as-laid survey will be performed once each pipeline has been laid on the seabed. The survey will establish the as-laid position (horizontal and vertical) and condition of the pipeline and would comprise bathymetry and other survey sensors in conjunction with visual inspection by ROV.

As-Built Survey

After completion of pipe-laying works, an as-built survey will be conducted to ensure the pipeline has been installed correctly, to document the condition and to ensure the integrity of the installed pipelines. The survey will comprise the integration of as-laid survey results from free-lay installation operations with the post-installation rectification/acceptance surveys for specific construction activities, e.g. crossing supports, post-lay interventions and site rectification.

5.3.5.4 Excavation of the Offshore Microtunnel Exit Pits and Recovery of the TBM

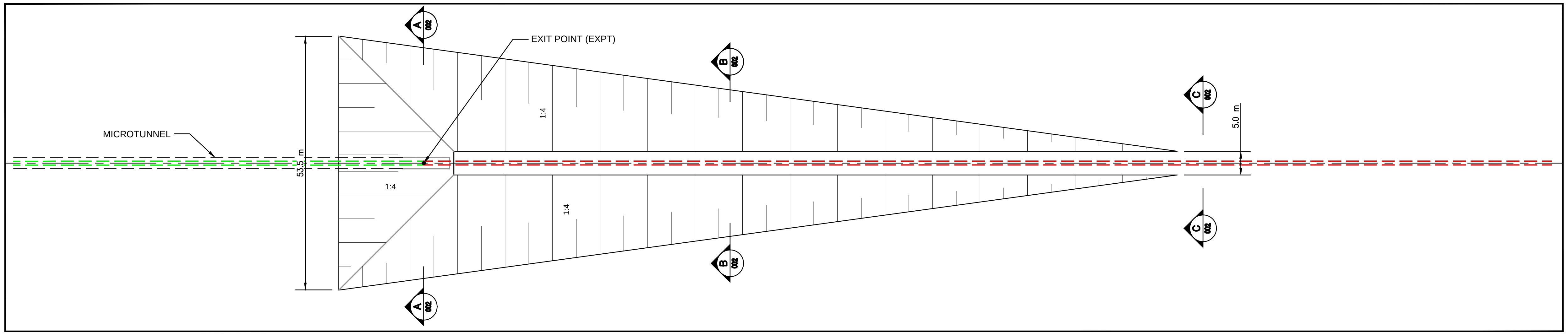
The recovery of the TBM at the exit of each microtunnel requires the excavation of an offshore exit pit. The exit pits are located approximately 400 m offshore. At the microtunnels exit locations, the spacing between the centreline of the pipelines will be approximately 50 m, and consequently each microtunnel will require its own exit pit. The microtunnel exit pits will be located in a water depth of approximately 23 m and the topside of the microtunnel will be approximately 3 m below the surface of the seabed.

From the microtunnel exit pit, the pipelines will be laid in a pre-dredged transition trench for a length of approximately 170 m out to a water depth of approximately 26 m. The exit pit and trench will be excavated in a single dredging operation. The transition trench will gradually reduce in depth as it moves away from each microtunnel exit pit (located approximately 5 m below the seabed surface) to provide a shallow gradient transition for the pipeline between each microtunnel exit pit and the seabed surface itself as illustrated in Figure 5.25.

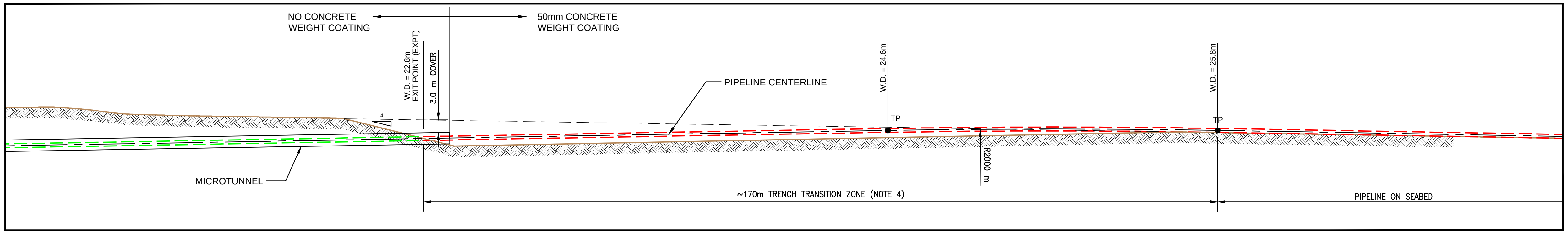
The TBM will be recovered from each exit pit using a barge that will be fitted with a crane to lift the TBM from the water. The TBM will be transferred back to the microtunnel construction site where, following any necessary repairs, it will start work on the next microtunnel, or alternatively, it will be demobilised on completion of all four microtunnels.

When the TBM emerges into each exit pit, there will be a small discharge of slurry into the marine environment. However, this will be carefully controlled by reducing the pressure of slurry supplied to the TBM on nearing emergence to each exit pit and immediate shutdown of the TBM slurry circuit when the TBM emerges into each exit pit. Since bentonite is denser than seawater, the slurry tends to stay on the seabed rather than mix with the surrounding water column. Furthermore, the depth of each exit pit (approximately 5 m) will reduce the exposure of the slurry to seabed currents and will capture the majority of slurry discharged from the tunnel. The slurry mixture can then be collected and disposed of onshore.

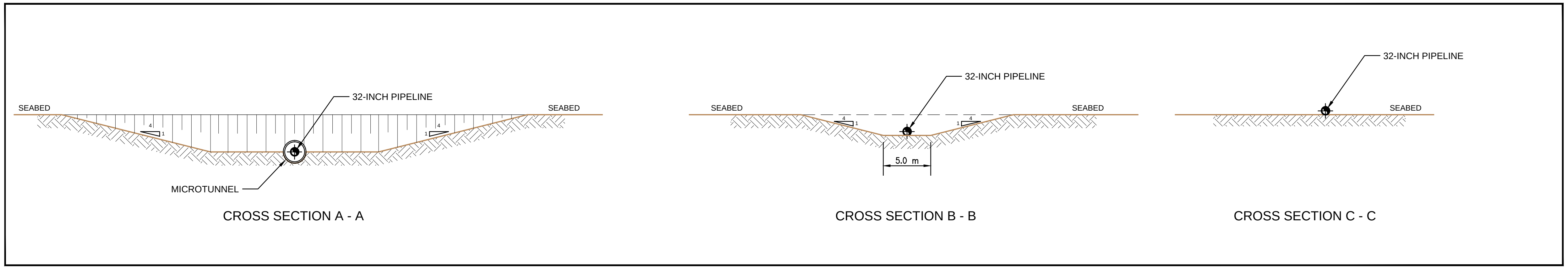
PLAN VIEW (SCALE 1:1000)



LONGITUDINAL PROFILE ALONG PIPELINE CENTER LINE (SCALE 1:1000)



CROSS SECTIONS (SCALE 1:500)



METERS
0 25 50
HORIZONTAL SCALE 1:1000 (AT "A3" SIZE)

METERS
0 2 10 20
HORIZONTAL SCALE 1:500 (AT "A3" SIZE)

RUSSIAN SECTOR OF THE SOUTH STREAM OFFSHORE PIPELINE

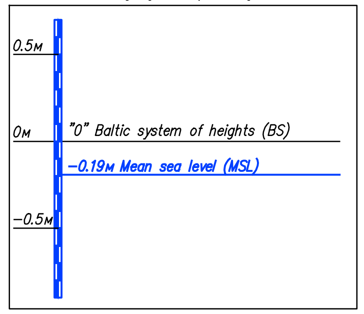
LEGEND

- LANDFALL SECTION PIPELINE
- NEARSHORE SECTION PIPELINE
- SIDE SLOPES
- SEABED PROFILE

NOTES

1. DIMENSIONS ARE IN METERS, UNLESS NOTED OTHERWISE.
2. ALL ELEVATIONS ARE IN METERS, REDUCED TO BALTIC SYSTEM OF HEIGHTS (BS).
3. FINAL DEPTH OF MICROTUNNEL WILL BE BASED ON DETAIL INSTALLATION ENGINEERING.
4. TRANSITION LENGTH BASED ON MINIMUM BENDING RADIUS OF 2,000m.
5. MICROTUNNEL DETAIL DESIGN (INCL. INSTALLATION ENGINEERING) TO BE PERFORMED BY CONTRACTOR.

Tide–gauge "Anapa" diagram



GEODETIC & PROJECTION PARAMETERS

GEODETIC DATUM	: WORLD GEODETIC SYSTEM 1984 (WGS84)
PROJECTION	: LAMBERT CONFORMAL CONIC
CENTRAL MERIDIAN	: 34° 00' 00" E
ORIGIN OF LATITUDE	: 43° 00' 00" N
FIRST STANDARD PARALLEL	: 30° 00' 00" N
SECOND STANDARD PARALLEL	: 50° 00' 00" N
FALSE EASTING	: 0.0 m
FALSE NORTHING	: 0.0 m
SCALE FACTOR	: 1.0000

Projection: Lambert Conformal Conic

Revision Details	By / Check	Date	Suffix

Purpose of issue
For Information

Client
South Stream Offshore Pipeline ENERGISING EUROPE

Project Title
SOUTH STREAM OFFSHORE PIPELINE

Drawing Title
Microtunnel Exit Pit and Transition Trench Dredging Requirements

Designed	Drawn	Checked	Approved	Date
RW	OAS	MJW		19/03/14

URS Internal Project No. 46369078 — Scale @ A3: As Shown

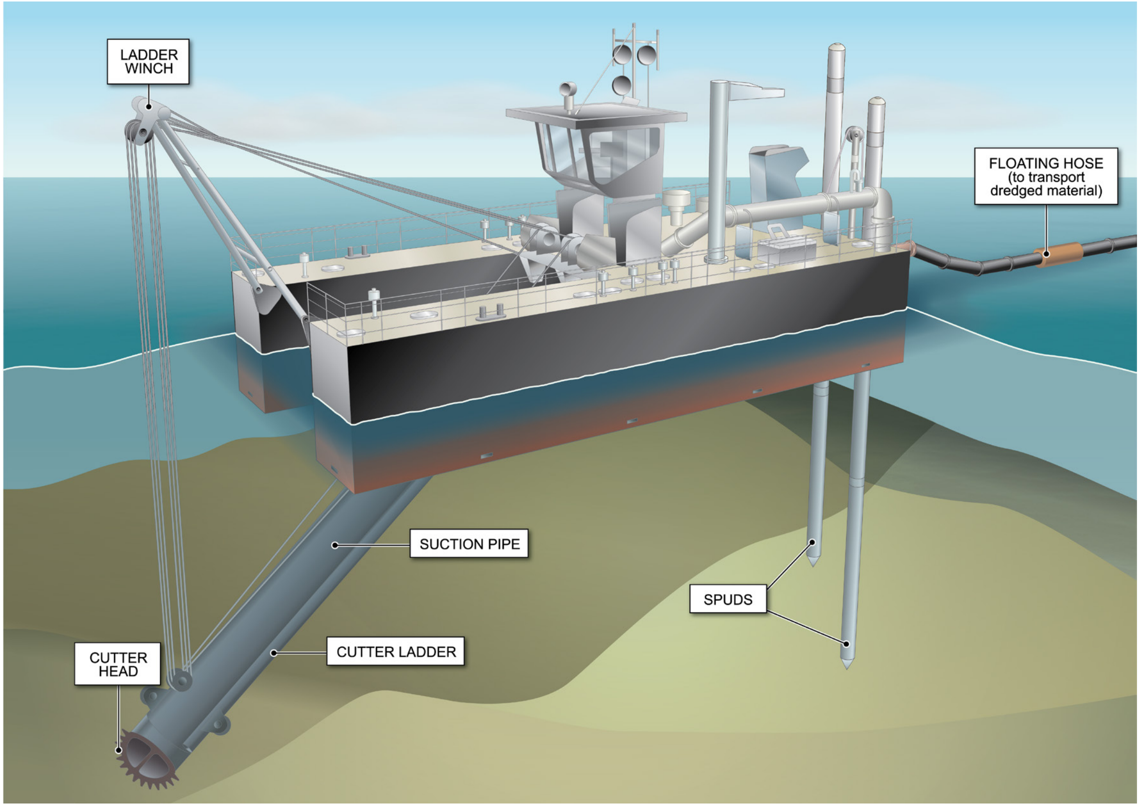
URS Infrastructure & Environment UK Limited
URS House
Horne Lane
Bedford MK40 1TS
44 (0) 1234 349641
44 (0) 1234 216268
www.ursglobal.com

Drawing Number: Figure 5.25 — Rev

It is anticipated that a Cutter Suction Dredger (CSD) or a grab crane will be employed to dredge each microtunnel exit pit and associated transition trench. A trailing suction hopper dredger (TSHD) may be employed, if sediment conditions allow (the TSHD cannot be used for hard sediments/rock), to dredge part of the trench, and to clean out the trench prior to pipeline installation if it has backfilled with sediments.

A CSD is either anchored to the seabed or kept in position by poles (known as spuds) that penetrate into the seabed below the barge. A CSD is equipped with a rotating cutter head, which cuts hard soil into fragments. The cut soil is sucked in by dredge pumps and then transported away from the trenches to a specified location using pumps and a floating pipeline attached to a spreader pontoon. Alternatively, the spoil can be loaded into a split hopper barge moored alongside, which in turn can then transport the dredged spoil to the specified storage area. A schematic of a typical CSD vessel is shown in Figure 5.26.

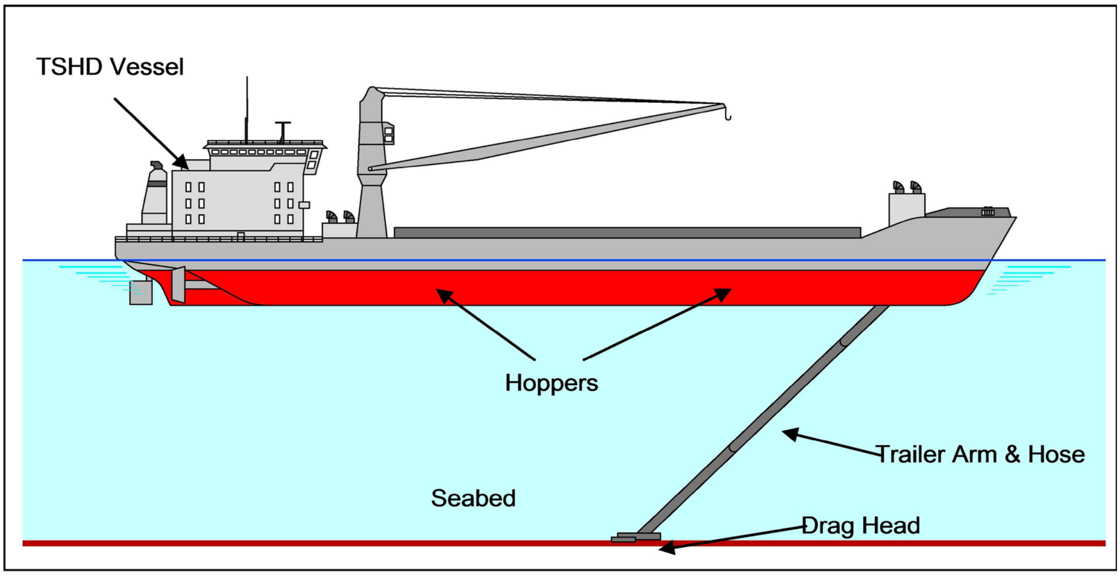
Figure 5.26 Schematic of a Cutter Suction Dredger



Floating grab cranes are mounted on a pontoon (either self-propelled or stationary) and dredge material using a bucket mounted to the crane, the jaws of which are opened and closed like a clamshell to trap sediments. The grab cranes deposit excavated material in independently operated split hopper barges, which transport the dredged material to the desired location. The pontoon is usually anchored by spuds, however in exposed locations or in deeper waters anchors can be used to increase stability.

The TSHD uses a drag head attached to a suction pipe to excavate material from the seabed. The excavated material is then stored in compartments (hoppers) on the vessel itself. The excavated spoil is temporarily stored offshore until it is re-utilised to bury the pipelines. A schematic of a typical TSHD vessel is shown in Figure 5.27.

Figure 5.27 Schematic of Trailer Suction Hopper Dredger



Each pipeline will be laid in an individual trench from the microtunnel exit point to a water depth of approximately 26 m depth. Each trench will be approximately 170 m long with side slopes of approximately 1:4 and width of approximately 10 m at the trench bottom. The trench will be excavated to a maximum depth of approximately 5 m at the microtunnel exit point with the excavation depth gradually reducing to the 26 m water depth where the pipeline will start to be laid directly onto the seabed. This will result in an estimated dredged volume of 25,000 m^3 per pipeline.

The total estimated volume of material to be dredged for all four pipelines (for the four microtunnel pits and four transition trenches) is approximately 100,000 m^3. A summary of the dredging required is shown in Table 5.17.

Table 5.17 Estimated Volume of Dredged Material in the Nearshore Section

Length of Dredged Section (m)	Side Slope	Trench Bottom Width (m)	Dredging Depth (m)	Dredged Volume per Pipeline (m^3)	Total Dredged Volume (four pipelines (m^3)
170	1:4	10	Gradually decreases from 5 m to 0 m	25,000	100,000

Material removed from the dredged trenches may be deposited either adjacent to the exit pits and trenches or in a temporary storage area located to the north of the microtunnel exit pits and transition trenches as shown in Figure 5.20. The dredged materials may not be able to be stored immediately adjacent to the trenches as there is the potential for sea currents to transport the sediments and refill the trenches prior to pipe installation. Following pipe installation in the trenches, the stored material will be dredged back up (using the same dredging equipment used previously) and used to backfill the microtunnel exit pits and transition trenches. Backfilling of the trenches with the direct placement of the previously excavated sediment over the pipelines will not be undertaken until completion of pre-commissioning tests. It is anticipated the material from each exit pit and trench will be stored for approximately two months, before it is dredged back up and used as backfill.

A detailed Dredging Management Plan will be developed once the dredging contractor has been appointed and the dredging plant identified. This will be developed by the Contractor in collaboration with South Stream Transport and the regulatory authority.

5.3.5.5 Installation of the Pipelines in the Microtunnel and Nearshore Section

Installation of Pipelines within the Microtunnels

As described in Section 5.3.4.5, following completion of the microtunnels, the pipelines will be installed within the microtunnels by welding together the pipeline string on an anchored pipe-lay vessel located near the microtunnel exit pits. The pipeline string is pulled through the transition trench and microtunnel towards the onshore entry shafts with a cable or rod system connected to a winch located within the onshore microtunnel construction site.

Upon completion of the microtunnel pipeline installation, pipe-lay in the nearshore section will be continued by the pipe-lay vessel laying away from the Russian coast towards the tie-in location at 30 m water depth. The construction activities associated with pipe-lay in the nearshore section is described in the following section.

Pipe-lay in the Nearshore Section

Pipe-lay in the nearshore section is accomplished by the sequential alignment, welding and lowering of pipe from a shallow water pipe-laying vessel. Pipe sections are transported to the pipe-lay vessel pre-coated with polypropylene anti-corrosion coating and internally with epoxy flow coating. Furthermore, to ensure the protection of the pipelines in shallow water, concrete coating of the pipelines is undertaken to provide on-bottom pipeline stability and also acts as a safety measure to avoid damage through interaction with respect to third party activities (for example, trawling gear and anchors). The concrete coating protecting the pipelines will be approximately 50 mm thick. It is anticipated that pipelines will be concrete coated out to a water depth of approximately 88 m.

The pipes are carefully stacked on board the pipe-lay vessel using deck cranes. The pipes are then transported using conveyor systems to the pipe bevelling station where the pipes are made ready for welding. Bevelling consists of shaping the edge of the pipe, which is to be welded, so that the weld itself fits within the overall pipe profile. The bevelling process produces large volumes of scrap metal which require to be stored in containers for collection and disposal onshore. It is estimated that approximately 161 tonnes of bevel waste will be generated by the construction of each pipeline from each microtunnel exit pit to the Russian and Turkish EEZ boundary.

Following bevelling, the pipes are transported to the line-up station, where the pipes are lined up in preparation for welding, using traverse carriage (roller) systems. This is the beginning of what is called the firing line.

Following alignment, the pipe sections are moved along the firing line to the first welding station where the pipe sections are clamped and joined together using automatic welding techniques. Root pass (first, and most critical layer of a multi-layer weld) and hot pass (second weld, which cleans out any remaining slag from root pass) welds are undertaken in the first welding station before the pipe is then moved to subsequent weld stations for the external welds to be completed. When the welding process is completed, the welded pipe section is moved to the inspection station where the weld is subject to visual inspection and NDE to ensure the weld meets the required specification. Any welds not meeting the required specification will be cut and the pipeline re-welded and subject to full NDE.

Following successful weld testing, the pipes move along to the coating stations. The number of coating stations will depend on the pipe-lay vessel used. In the coating stations, field joint coating will be applied to the welds for corrosion protection. For concrete coated pipe sections, infilling of the gap between the concrete ends of the pipe sections will be undertaken with moulded solid polyurethane or polypropylene to ensure a flush outer pipe surface is obtained.

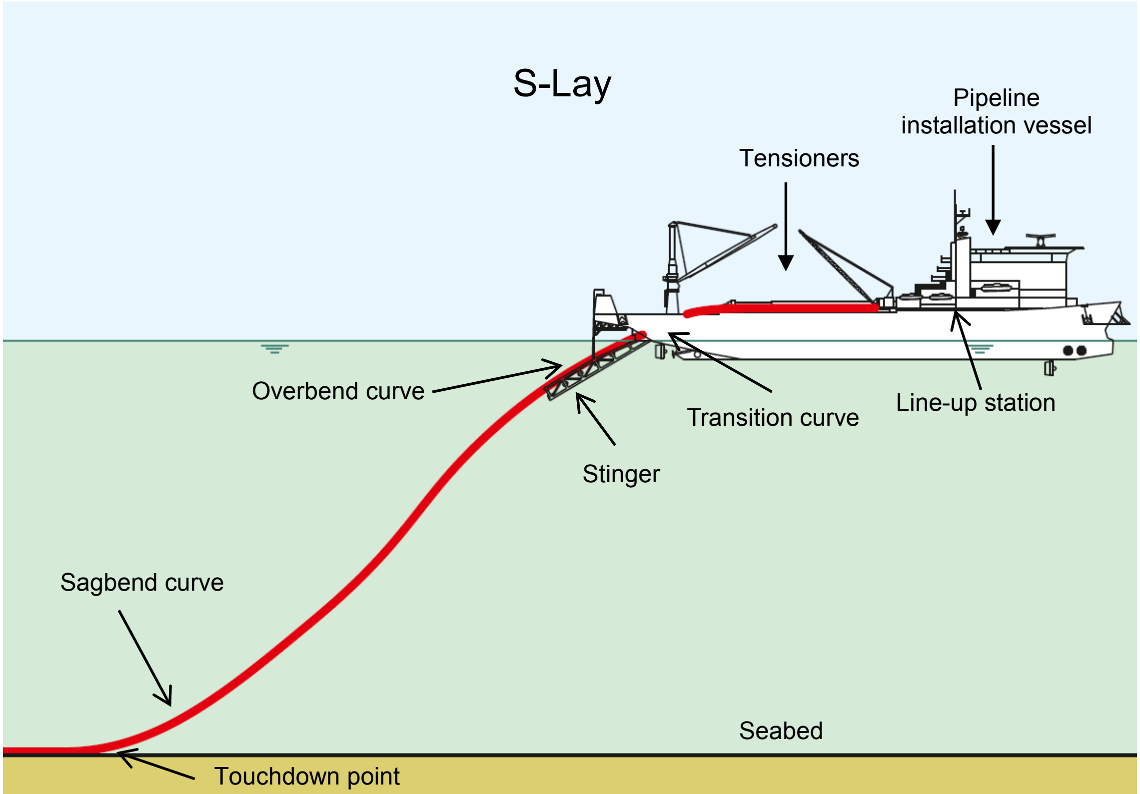
All critical processes onboard the pipe-lay vessel will be inspected by the pipe-lay contractor's quality assurance crew, and thereafter inspected by representatives of the certification company and South Stream Transport.

The newly welded, coated and inspected pipe section is then moved into the water via the stinger, which is buoyancy controlled to maintain a smooth curve profile to the target water depth to minimise stresses on the pipeline during installation. Stingers are a steel structure, which extend from the stern of the vessel to support the pipe as it is moved into the water, as well as control the curvature of the installation.

During the installation of the pipeline in the microtunnel, the pipeline string will be pulled from the pipe-lay vessel by the land based winch. However, during pipe-lay in the remainder of the nearshore section the pipe-lay vessel moves the pipe section into the water by advancing an appropriate distance (dependent on pipeline string length) by pulling on its anchor lines, resulting in the pipeline string exiting the pipe-lay vessel via the stinger. Once the pipeline string has exited the pipe-lay vessel, the pipe-lay vessel will stop forward motion, and work on welding the next pipeline string together commences.

Pipe-lay in the nearshore section will be performed by the S-lay technique. The S-Lay technique requires the load out of single 12 m pipe sections to the pipe-lay vessel. This method involves welding the pipe sections horizontally, and continuously 'feeding' the jointed sections over the vessel's pipe-lay stinger from the stern of the vessel as the vessel moves forward in such a way that the pipeline forms an "S" shape from the vessel's exit point to the touchdown point on the seafloor. Sufficient tension is required during the S-Lay process to avoid overstressing the pipeline. This is maintained via tensioning rollers and a controlled forward thrust, that keeps the pipe from buckling. Figure 5.28 presents a schematic drawing of the S-Lay pipe-lay method.

Figure 5.28 Schematic of S-Lay Pipe-Lay Method



It is anticipated that it will take approximately one day for the S-Lay pipe-lay vessel to complete pipe-lay in the nearshore section out to 30 m water depth following the installation of the pipeline in the microtunnel, depending on weather conditions.

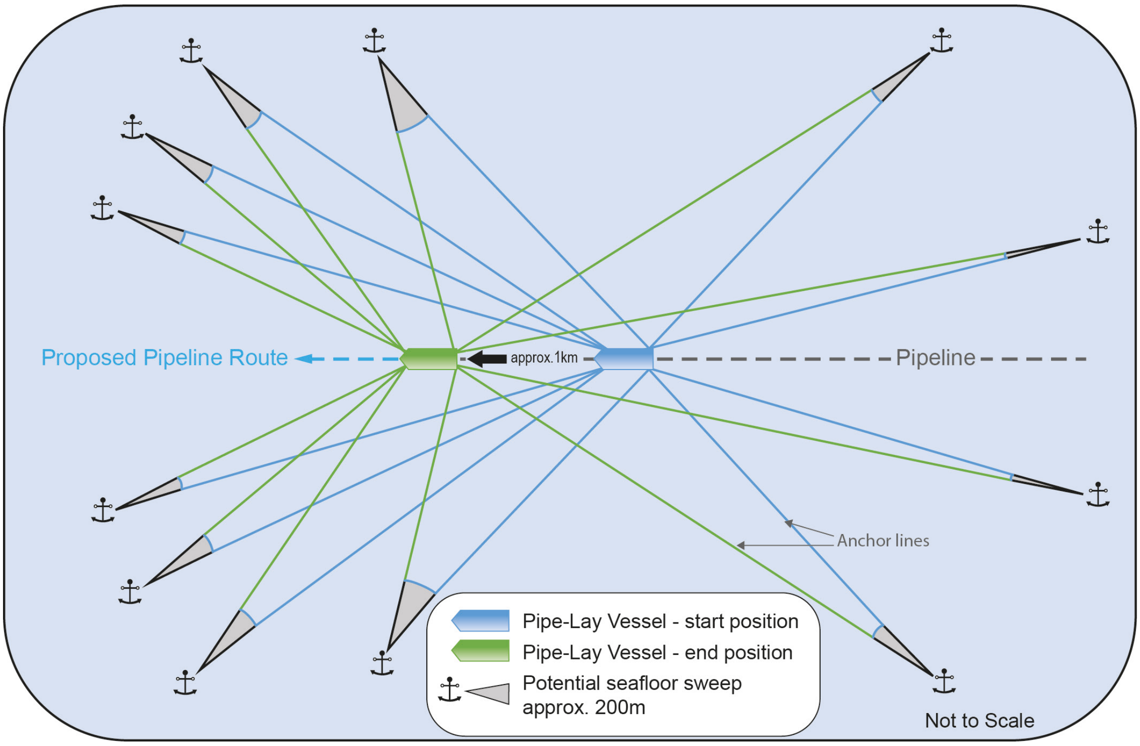
In order to lay pipe in shallow water, a vessel must be of shallow draft. This shallow draft typically requires a flat bottom vessel with limited or no built-in propulsion systems. Figure 5.29 shows a typical shallow water S-Lay vessel.

Typical shallow water vessels are outfitted with anchor winches, anchor wires and anchors. Typically, an anchored vessel deploys 8 to 12 anchors in a semi-circular pattern in the fore and aft position, generally from its four corners. There are normally two or three anchor wires located at each corner of the vessel. During pipe-lay, an anchor handling tug boat is used to run the anchors out in a pattern that allows the pipe-lay vessel to move itself ahead by hauling in wire on the forward winches while paying out wire on the aft winches. As pipe-lay continues, the tug boat(s) continually re-locate the anchors forward as necessary to allow the vessel to lay pipe without delays. It is estimated that all anchors will be re-positioned for every 1 km of pipeline laid. The position of the anchors could be as far as 1.5 km (0.8 nautical miles (NM)) from the centreline of the vessel, depending on the water depth and pipe-lay vessel used. A typical pipe-lay vessel anchor pattern is shown in Figure 5.30.

Figure 5.29 Typical Shallow Water S-Lay Vessel

Image supplied courtesy of Allseas, Switzerland

Figure 5.30 Typical Pipe-Lay Vessel Anchor Spread



A safety exclusion zone will be enforced around the pipe-lay vessel during pipe-laying. A safety exclusion zone of approximately 3 km (1.6 NM) radius (depending on the extent of the anchor spread) around the pipe-lay vessel will be enforced during pipe-laying to avoid incidents with marine traffic. Agreement with the appropriate marine authorities shall be obtained regarding the exact exclusion distances and safety measures to be adopted during pipe-laying to avoid incidents with marine traffic. Unauthorised vessels including fishing vessels will not be permitted access to the safety exclusion zone. The pipe-lay vessel will be equipped with navigation lights, radar and radio communications. Due to the construction spread advancing along the pipeline route as the pipe is laid, constant (at least daily) consultation will be undertaken by the pipe-lay contractor with the appropriate marine authorities to inform them of the location of the construction spread. The marine authorities will then be responsible for informing marine traffic of the location of the pipe-laying activities and the associated exclusion zones. Further information on safety exclusion zones and marine navigation safety measures will be included in the Vessels and Marine Transport CMP which is outlined in **Chapter 22 Environmental and Social Management**.

Following completion of the nearshore pipe-laying at the 30 m water depth location, a temporary subsea laydown / test head (capable of launching and receiving PIGs) will be fitted to the end of each pipeline. The pipeline is then lowered to the seabed and left there until pre-commissioning tests of the landfall and nearshore section pipelines are carried out as described in Section 5.4.2.

After the successful pre-commissioning tests of the landfall and nearshore sections, the two ends of the pipeline (nearshore and offshore sections) will need to be joined (tied-in) above water. The above water tie-in will be performed where the water depth is approximately 30 m. The pipelines will be picked up from the seabed by the pipe-lay vessel by means of a davit wire connected by divers to the laydown head on the pipeline and subsequently winched on to the pipe-lay vessel.

The two pipeline ends are lifted above the water to the side of the pipe-lay vessel to enable a dry welded connection to be made. Following cutting of the two pipeline ends to the correct length, the ends are welded together. The weld will be subject to NDE prior to application of the field joint coating and careful lowering of the connected pipeline back to the seabed. This process will be carried out for each of the four pipelines.

A safety exclusion zone of approximately 0.5 km (0.3 NM) radius for tie-in construction vessels will be adopted during construction to avoid incident with marine traffic.

5.3.5.6 Reinstatement of Nearshore Section

Backfilling of the dredged microtunnel exit pits and transition trenches with spoil stored in the temporary storage locations will be undertaken following successful pre-commissioning tests of the nearshore and landfall section pipelines. It is anticipated that it will take approximately four days to backfill and reinstate each microtunnel exit pit and transition trench. Final seabed relief and bathymetry restoration of the microtunnel exit pits, transition trenches and temporary storage areas will be performed using side scan sonar and a survey vessel to perform bathymetric surveys. Both survey vessels and the dredgers used in the works will be equipped with a positioning system that allows them to work with the necessary precision.

5.3.6 Construction of Offshore Section

5.3.6.1 General Overview

The main activities in the offshore section of the Project Area include:

- Surveys of the pipeline route prior to, during and after the pipe-laying process;
- Offshore pipe-laying;
- Seabed intervention works;
- Crossings of existing offshore cables; and
- Tie-in of the nearshore / offshore sections.

5.3.6.2 Offshore Construction Vessel Spread

As with the nearshore section, the contracts for the installation of the Pipeline in the offshore section have not yet been awarded. However Table 5.18 presents a summary of the type and number of vessels that are anticipated to be used during the installation of a single offshore section pipeline. The actual pipe-laying spread will depend on the availability of vessels at the time that the necessary permits are granted.

The main vessel required will be the pipe-lay vessel. In addition, other vessels will be involved in the pipe-laying activities, such as support vessels (survey, dive support, crew change) and supply vessels (pipes, fuel and provisions).

5.3.6.3 Surveying

As described in Section 5.3.5.3, a number of further surveys will be required before, during and after installation of the pipeline. Please refer to that section for a description of these surveys.

5.3.6.4 Offshore Pipe-laying Process

Offshore pipe-laying is accomplished by the sequential alignment, welding and lowering of pipe from the pipe-lay vessel. Pipe sections are transported to the pipe-lay vessel pre-coated with polypropylene anti-corrosion coating and internally with epoxy flow coating. The pipe fabrication process on board the pipe-lay vessel (bevelling, line-up, welding and inspection etc.) will be similar to the process described for the shallow water S-Lay vessel in Section 5.3.5.5.

Table 5.18 Typical Offshore Construction Vessel Spread per Pipeline

Construction Activity	Type of Vessel	Task	Number of Vessels	Duration (days) per vessel	Indicative Vessels	Power Rating (kW)	Persons on Board	Utilisation (%)
Pre-Lay Seabed Intervention Works (for free-span correction)	MSV plus subsea excavating equipment (Option 1)	Pre-lay free-span correction and span shoulders sheaving	1	19 days of peak shaving per pipeline 7 days for pre-lay rock dump for span correction Pipeline #1 1 day each for pre-lay rock dump span correction for Pipelines #2, #3 and #4 Plus 3 days at 25% capacity for mobilisation/ demobilisation	Calamity Jane	15,086	72	60
	Grab crane (Option 2)	Dredging on the continental rim/ slope	1	As above	Tertnes	8,390	46	60
	Hopper barge (if soils are not allowed to be stored on seabed) (Option 2)	Spoil transport	2	As above	Sand Carrier 101	300	10	60

Continued...

Construction Activity	Type of Vessel	Task	Number of Vessels	Duration (days) per vessel	Indicative Vessels	Power Rating (kW)	Persons on Board	Utilisation (%)
Pre-Lay Seabed Intervention Works (for free-span correction)	Survey Vessel	Surveying the sea floor during intervention works	1	As above	GSP Prince	7,604	62	60
	Fast supply vessels	Crew changes	1	1 (i.e. 2 half-day trips)	GSP Lyra	2,520	70	60
	Maintenance vessel	Delivery of spare parts / equipment	1	1	Normand Flipper	7,160	16	60
	Fuel / waste water collection vessel	Bilge and waste water gathering	1	1	Bryansk	610	5	60
	Rescue vessel	Safety and rescue operations	1	Only required in case of emergency	GSP Vega	9,548	23	60
Pre-Lay Seabed Intervention Works (for pipeline protection, stability and cable crossings)	Fall-pipe rock dumping Vessel	Accurate placement of rock	1	10 days Plus 3 days at 25% capacity for mobilisation / demobilisation	Tertnes	8,390	46	60
	Survey Vessel	Surveying the sea floor during intervention works	1	As above	GSP Prince (GSP)	7,604	62	60

Continued…

Construction Activity	Type of Vessel	Task	Number of Vessels	Duration (days) per vessel	Indicative Vessels	Power Rating (kW)	Persons on Board	Utilisation (%)
Pre-Lay Seabed Intervention Works (for pipeline protection, stability and cable crossings)	Fast supply vessels	Crew changes	1	1 (i.e. 2 half-day trips)	GSP Lyra	2,520	70	60
	Maintenance vessel	Delivery of spare parts / equipment	1	1	Normand Flipper	7,160	16	60
	Fuel / waste water collection vessel	Bilge and waste water gathering	1	1	Bryansk	610	5	60
	Rescue vessel	Safety and rescue operations	1	Only required in case of emergency	GSP Vega	9,548	23	60
Offshore Pipe-laying 30 m to 600 m water depth	Intermediate depth pipe-lay vessel	Pipe-laying	1	9 (30 km at 3.5 km per day) Plus an additional 38 days running at 25% capacity for mobilisation/ demobilisation	Castoro Sei	20,500	342	40
	Anchor handling tugs	Handling the anchors for the pipe-lay vessel	3	As above	Normand Neptun	13,880	40	60
	PSV	Supplying pipe to pipe-lay vessel	1*	As above	Normand Flipper	7,160	16	60

Continued...

Construction Activity	Type of Vessel	Task	Number of Vessels	Duration (days) per vessel	Indicative Vessels	Power Rating (kW)	Persons on Board	Utilisation (%)
Offshore Pipe-laying 30 m to 600 m water depth	Survey vessel	Surveying the sea floor in front and behind the pipe-lay vessel	2	As above	GSP Prince	7,604	62	60
	MSV	ROV support Diving support Consumables supply Bunker supply Provisions supply Water supply	2	As above	Normand Mermaid	10,000	70	60
	Fast supply vessels	Crew changes	2	1 (i.e. 2 half-day trips)	GSP Lyra	2,520	70	60
	Helicopter	Crew changes	2	1 (i.e. 2 half-day trips)	Super Puma	1,200	10	60
	Maintenance vessel	Delivery of spare parts / equipment	1	1	Normand Flipper	7,160	15	60
	Fuel / waste water collection vessel	Bilge and waste water gathering	1	1	Bryansk	610	7	60
	Rescue vessel	Safety and rescue operations	1	Only required in case of emergency	GSP Vega	9,548	50	60

Continued…

Construction Activity	Type of Vessel	Task	Number of Vessels	Duration (days) per vessel	Indicative Vessels	Power Rating (kW)	Persons on Board	Utilisation (%)
Offshore Pipe-laying >600 m water depth	Deep water pipe-lay vessel	Deep water pipe-laying	1	71 (195 km at 2.75 km per day) Plus 44 days at 25% capacity for mobilisation	Saipem 7000 Castorone	70,000	725	40
	Tug	General support	1	As above	Normand Neptun	13,880	15	60
	PSV	Supplying pipe to pipe-lay vessel	3†	As above	Normand Flipper	7,160	15	60
	Survey vessel	Surveying the sea floor in front and behind the pipelay vessel	2	As above	GSP Prince	7,604	50	60
	MSV	ROV support Diving support Consumables supply Bunker supply Provisions supply Water supply	2	As above	Normand Mermaid	10,000	70	60
	Fast supply vessels	Crew changes	1	2 (i.e. 4 half day trips)	GSP Lyra	2,520	70	60

Continued...

Construction Activity	Type of Vessel	Task	Number of Vessels	Duration (days) per vessel	Indicative Vessels	Power Rating (kW)	Persons on Board	Utilisation (%)
Offshore Pipe-laying >600 m water depth	Helicopter	Crew changes	1	4 (i.e. 8 half day trips)	Super Puma	1,200	10	60
	Maintenance vessel	Delivery of spare parts / equipment	1	4	Normand Flipper	7,160	16	60
	Fuel / waste water collection vessel	Bilge and waste water gathering	1	4	Bryansk	610	5	60
	Rescue vessel	Safety and rescue operations	1	Only required in case of emergency	GSP Vega	9,548	23	60
Post-lay Seabed Intervention Works (for free span correction and stabilisation of the pipeline on continental shelf edge)	Fall-pipe rock dumping vessel for post-lay rock dumping	Pipeline protection from rockfall and at cable crossing location	1	22 days Plus 19 days at 25% capacity for mobilisation / demobilisation	Tertnes	8,390	46	60
	Post-lay Trenching Support Vessel	Post-lay trenching on the slope for free-span correction and pipeline stabilisation on slope	1	As above	GSP Prince equipped with Beluga Trenching System, Calamity Jane	15,086	72	60

Continued…

Construction Activity	Type of Vessel	Task	Number of Vessels	Duration (days) per vessel	Indicative Vessels	Power Rating (kW)	Persons on Board	Utilisation (%)
Post-lay Seabed Intervention Works (for free span correction and stabilisation of the pipeline on continental shelf edge)	Survey Vessel	Surveying the sea floor during intervention works	1	As above	GSP Prince	7,604	62	60
	Fast supply vessels	Crew changes	1	1 (i.e. 2 half-day trips)	GSP Lyra	2,520	70	60
	Maintenance vessel	Delivery of spare parts / equipment	1	2	Normand Flipper	7,160	16	60
	Fuel / waste water collection vessel	Bilge and waste water gathering	1	2	Bryansk	610	5	60
	Rescue vessel	Safety and rescue operations	1	Only required in case of emergency	GSP Vega	9,548	23	60

* This indicative number only accounts for the maximum number of PSVs that may be present within the 'Offshore (30 mbsl - 600 mbsl)' section of the Russian EEZ whilst pipe-laying is undertaken in that section. A PSV will also pass through this section to reach the construction spread when it is pipe-laying in the Nearshore Section in Russia. This additional movement is accounted for in the fuel use (Table 5.24) and emission estimates (Table 5.28).

† This indicative number only accounts for the maximum number of PSVs that may be present within the 'Offshore > 600 mbsl' section of the Russian EEZ whilst pipe-laying is undertaken in that section. PSVs will also pass through this section to reach the construction spread when pipe-laying to the east of the 600 mbsl location. These additional PSV movements are accounted for in the fuel use (Table 5.24) and emissions estimates (Table 5.28).

Complete.

Offshore pipe-laying may be performed by the S-lay technique, or by a combination of S-lay and J-lay techniques. The method chosen mainly depends on water depth and/or cost/availability of an installation vessel. At the time of preparing this ESIA Report, the technique(s) to be employed for pipe-laying in the offshore section have yet to be confirmed. Therefore, it is assumed that either technique may be used for the Project and both are described in the following sections.

The S-Lay technique requires the load out of single 12 m pipe sections to the pipe-lay vessel, whilst the J-Lay technique requires some prior welding of the pipe sections at the marshalling yards in Bulgaria before load out to the offshore pipe-lay vessel. The average pipe-lay rate for S-Lay technique is expected to be in the order of 3.5 km per day (24 hour period), depending on weather conditions. Please refer to section 5.3.5.5 for further information on the S-Lay method.

For J-Lay, the pipe sections will be welded into strings of four pipes (quad joints), or two pipes (double joints). As described in Section 5.3.2.1, the welding, and field joint coating activities associated with quad jointing can be performed either onshore within a dedicated factory located in one of the marshalling yards in Bulgaria, or onboard a dedicated pipe-lay vessel that moors alongside the marshalling yard quayside and acts as the factory producing welded quads or double joints for load out to the J-Lay vessel offshore.

J-lay pipeline installation was developed for laying pipe in deep waters as it puts less stress on the pipeline by installing the pipeline from an almost vertical position. In the J-Lay method, the pipes are assembled and welded vertically in a tower erected on the centre or side of the pipe-lay vessel. A pipe tensioner or support frame is used to lower the pipeline string (quad or double joint) through the tower. As the pipe-lay vessel moves forward, the jointed pipeline is lowered near vertically in a J-shape from the launching point down to the bottom of the sea. The average pipe-lay rate using J-Lay technique is expected to be in the order of 2.75 km per day (24 hour period), depending on weather conditions. The J-lay method is considered to be suitable from a minimum water depth of 300 m, depending on the pipeline diameter. Figure 5.31 presents a schematic drawing of the J-Lay pipe-laying method.

The installation of the offshore pipeline section may require both intermediate depth and deep water pipe-lay vessels. An intermediate depth pipe-lay vessel is capable of working in a water depth range of approximately 20 m up to approximately 600 m. These vessels install the pipeline by the S-Lay method and may advance by pulling on their anchor lines or utilising dynamic positioning (DP) thrusters. DP is a computer-controlled system that drives the vessels thrusters (directional propellers) to maintain position without the use of anchors. A deep water pipe-lay vessel is capable of laying pipe in water depths from approximately 300 m to any depth required depending on the pipeline dimensions. These vessels are dynamically positioned and may use either the S-Lay or J-Lay methods.

Figure 5.31 Schematic of J-Lay Pipe-Lay Method

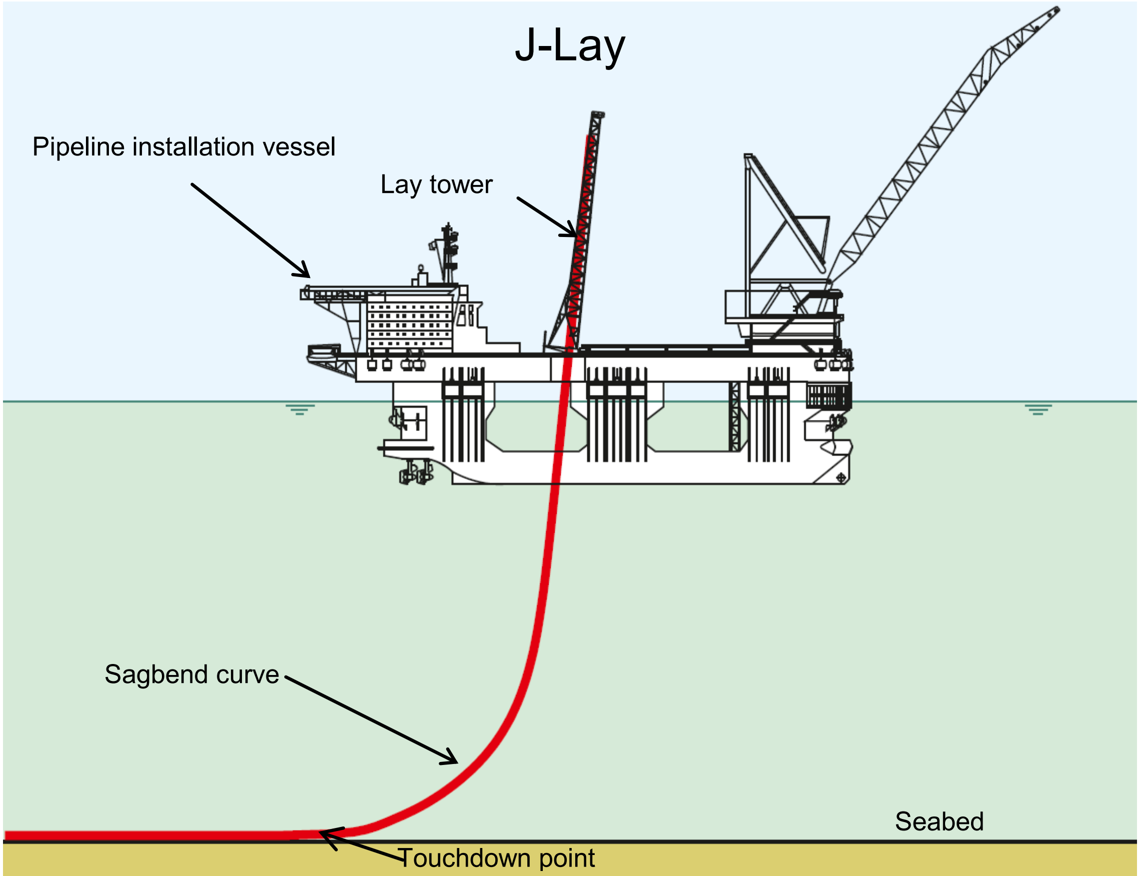


Figure 5.32 shows a typical intermediate water depth S-Lay pipe-lay vessel and Figure 5.33 shows a typical deepwater J-Lay pipe-lay vessel.

For the majority of the offshore section pipe-lay work the pipe-lay vessel will be manoeuvred along the pipeline route using DP. Anchored vessels can potentially be used in water depths of up to 600 m, however for the Project it is anticipated that anchored pipe-lay vessels will only be used up to a maximum water depth of approximately 350 - 380 m. If anchors are used, up to 12 anchors may be deployed from the pipe-lay vessel and the position of the anchor itself could be as far as 1.5 km from the centreline of the pipe-lay vessel, depending on the water depth. As described in Section 5.3.5.3, an anchor corridor survey will be required. A typical anchor spread is illustrated in Figure 5.30.

A safety exclusion zone will be enforced around the pipe-lay vessel during pipe-laying of approximately 2 km (1.1 NM) radius for DP vessels and approximately 3 km (1.6 NM) radius for anchored vessels (depending on the anchor spread). As described in Section 5.3.5.5, agreement with the appropriate marine authorities shall be obtained regarding the exact exclusion distance to be adopted during pipe-laying to avoid incidents with marine traffic.

Figure 5.32 Typical Intermediate Water Depth S-Lay Vessel

Image supplied courtesy of Allseas, Switzerland

Figure 5.33 Typical Deep Water J-Lay Vessel

Image supplied courtesy of Saipem

If a combination of S-Lay and J-Lay methods are utilised it is anticipated that the S-Lay method will be employed from the 30 m water depth pipeline tie-in location out to a water depth of approximately 600 m, a distance of approximately 30 km, although the J-lay method could potentially be used from a water depth of approximately 350 - 380 m. At this location, an abandonment and recovery head is welded to the end of the pipeline to prevent sea water entering the pipeline and it is then lowered to the seabed by a davit wire connected to a winch on the S-Lay vessel and left on the seabed. The S-Lay vessel spread is then demobilised. The J-Lay vessel spread is then mobilised to the pipeline abandonment location. The pipeline is recovered by the J-Lay vessel using a recovery winch. The J-Lay vessel then commences pipe-laying towards the EEZ boundary of Russia and Turkey, a distance of approximately 195 km.

Although the EEZ boundary of Russia and Turkey is the downstream boundary of the Project, the J-Lay vessel will maintain pipe-laying through the EEZ of Turkey and Bulgaria to continue construction of the South Stream Offshore Pipeline.

Pipeline Flood Protection during Installation

A flood prevention device will be developed by the appointed pipe-lay contractor for installation within the pipeline during construction. The device will sit inside the pipeline close to where the pipeline touches down onto the seabed. As the pipe-lay progresses the device will be moved along the pipeline in the same direction as pipe-laying. The actual means of movement of the flood prevention device will be determined by the pipe-lay contractor during the development of the flood prevention device. However, possible methods are listed below:

- Air pressure from a start-up head;
- Control umbilical connected to the pipe-lay vessel; and
- A battery powered drive unit.

Each device will be designed to be controlled remotely and to allow adequate operation and monitoring control.

In the event that there is a loss of tension or loss of vessel position during pipe-laying causing the pipeline to become overstressed to the point where it ruptures and floods, then the flood prevention device will detect the change in pressure, will activate and seal the pipeline, thus preventing untreated sea water from flooding the pipeline. The damaged section of the pipeline between the flood prevention device and the pipe-lay vessel will then be removed and the undamaged pipeline section (protected by the flood prevention device) will be recovered back to the pipe-lay vessel and pipe-lay will resume.

Pipeline Repair during Construction

Emergency pipeline repair, including information on South Stream Transport's Emergency Pipeline Repair Strategy (EPRS), during both the Construction and Pre-Commissioning Phase and Operational Phase is described in detail in Section 5.6.5.

5.3.6.5 Seabed Intervention Requirements

In the offshore section, the pipeline will be laid directly on the seabed. This technique will minimise seabed disturbance over most of the 225 km section. However, although the route of the pipelines has been designed to minimise seabed intervention requirements, some intervention will be required in specific areas, either before or after pipe-laying. This is to limit or remove pipeline free span lengths (for example in areas where the sea bed is rough and uneven), to protect the pipeline from geo-hazards such as rockfall in areas of excessive slopes (for example on the continental slope) and to protect the pipelines and cables at cable crossing locations.

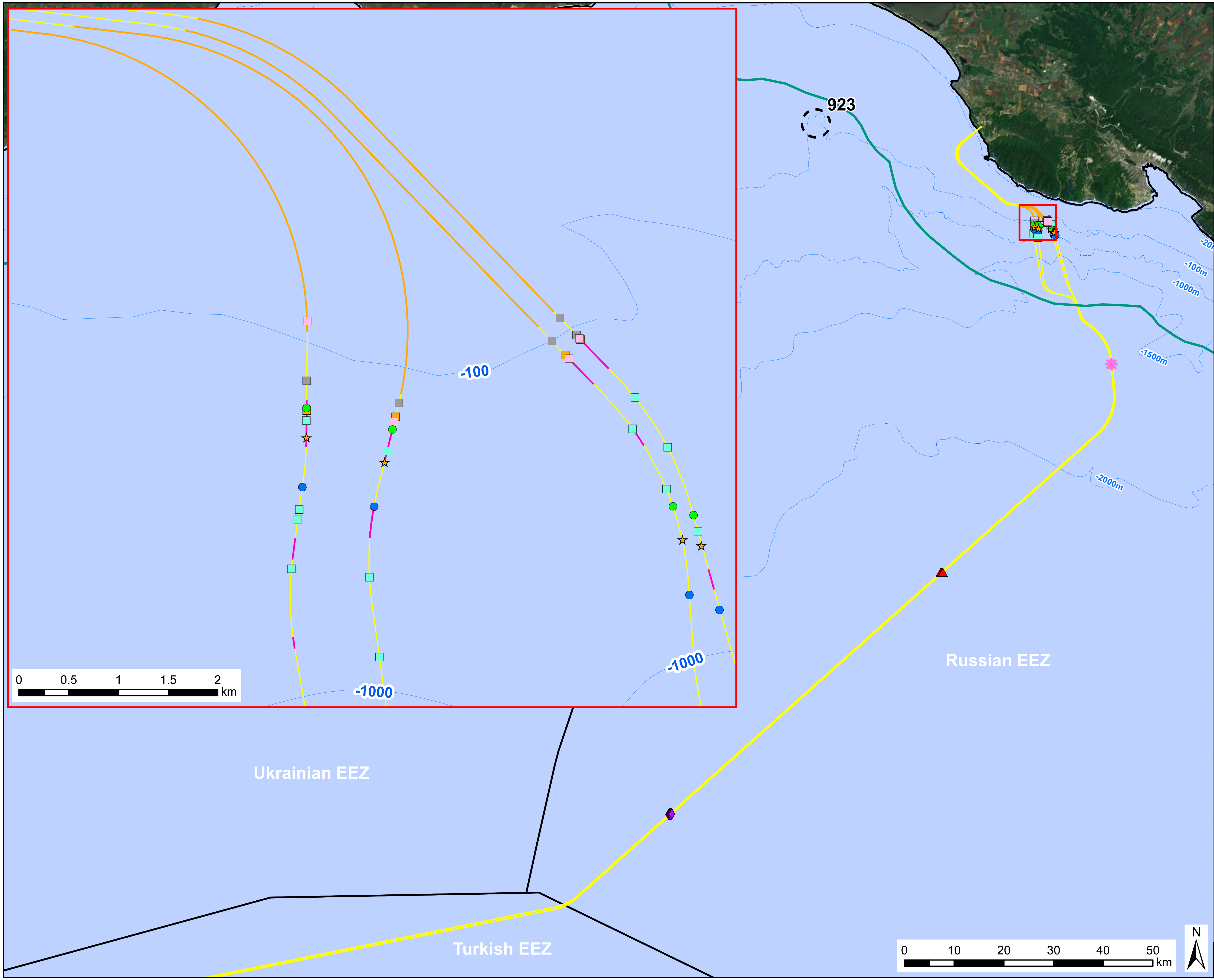
The type and extent of seabed intervention which is currently considered to be necessary is described in the following sections and the locations are shown in Figure 5.34. Full intervention requirements will not be confirmed until detailed design studies have been completed; however, any changes are anticipated to be minor and are not anticipated to alter the results of this ESIA Report. Should any major design changes be required which may affect the results of the ESIA, the management of change process described in Section 5.11 will be followed. There are various intervention methods and within each method a wide range of alternatives exist, which may be applied depending on particular circumstances such as water depth, burial depth or soil conditions.

The seabed intervention methods can be divided in two main categories: pre-installation intervention and post-installation intervention.

Pre-installation methods include dredging, and placing of supports by means of gravel or mattresses in areas where free span pipeline sections are anticipated. For post-installation intervention, a wide variety of methods can be applied. Typical post-installation methods include post-lay trenching, rock dumping, placement of mattresses and the installation of Vortex Induced Vibration (VIV) suppression strakes. The various intervention methods that may be applied along the Project pipelines are described below.

The seabed intervention requirements are summarised in Table 5.19, Table 5.20 and Table 5.21. It should be noted that where supports are listed as being required, these may be installed either before or after pipe-laying. Similarly, there are locations where either pre- or post-installation trenching may be undertaken. The decision on the techniques to be employed will be subject to detailed design and preference of the appointed pipe-lay contractor.

Pre- and post-installation methods associated with cable crossings are described in Section 5.3.6.6.



LEGEND

Russian Sector of South Stream Offshore Pipeline

Proposed offshore pipelines

Cable crossing location

- Cable 1
- Cable 2
- Black Sea Fibre Optic Cable (BS FOCS)
- Italy-Turkey-Ukraine-Russia (ITUR)
- Feodosiya (Ukraine) - Novorossiysk (Russia)
- Planned Fibre Optic Cable

Seabed intervention locations

- Pre-lay dredging/MFE
- Pre-lay rock dumping
- Pre/Post-lay support
- Pre/Post-lay trenching/MFE
- Post-lay rock dumping
- Post-lay trenching and backfilling
- Existing permitted disposal site
- Territorial waters boundary
- Exclusive Economic Zone boundary
- Isobaths

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check / Date	Suffix

Purpose of Issue: For Information

Client: South Stream Transport AG – South Stream ENERGISING EUROPE

Project Title: SOUTH STREAM OFFSHORE PIPELINE

Drawing Title: CABLE CROSSINGS AND SEABED INTERVENTION LOCATIONS

Drawn	Checked	Approved	Date
AH	RW	MW	12 Feb 2014

URS Internal Project No. 46369082

Scale @ A3 1:700,000

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Drawing Number: Figure 5.34

Rev

Plot Date: 12 Feb 2014
File Name: I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 5 Project Description\Figure 5-34 Cable Crossings and Seabed Intervention Locations.mxd

Table 5.19 Offshore Section Seabed Intervention Requirements for Free Span Correction

Pipeline Number	Approximate Distance from Russian Coast (km) Measured along the Pipeline Route	Water Depth (m)	Volume of Dredging or Rock (m^3)	Seabed Area (m^2)	Seabed Intervention Required
1	28.8	90	N/A	100 per support	Pre- or post-installation artificial support (e.g. mattresses/grout bag)
	29.4	110	12,000	5,150	Pre-installation dredging or mass flow excavation (MFE)
	29.8	300	210	220	Pre- or post-installation trenching or MFE
	30.7	500	450	470	
	30.8	550	310	330	
	31.3	660	550	570	
	29.7	220	1,765*	6621	Pre- or post-installation mechanical, structural and / or rock berm support (it can be substituted with VIV suppression strakes if validated by detailed design)
	30.7	500	1,835	688	Pre-installation rock dump

Continued…

Pipeline Number	Approximate Distance from Russian Coast (km) Measured along the Pipeline Route	Water Depth (m)	Volume of Dredging or Rock (m^3)	Seabed Area (m^2)	Seabed Intervention Required
2	30.3	120	15,000	5,450	Pre-installation dredging or MFE
	30.5	200	1,4001	8201	Pre- or post-installation mechanical, structural and / or rock berm support (it can be substituted with VIV suppression strakes if validated by detailed design)
	30.8	350	510	530	Pre- or post-installation trenching or MFE
	32.1	680	510	540	
	32.9	860	500	520	
3	30.2	100	6,000	3,880	Pre-installation dredging or MFE
	30.4	165	370	390	Pre- or post-installation trenching or MFE
	31.4	420	500	520	
	32.1	580	650	680	
	30.4	140	1,8001	6751	Pre- or post-installation mechanical, structural and / or rock berm support (it can be substituted with VIV suppression strakes if validated by detailed design)

Continued…

Pipeline Number	Approximate Distance from Russian Coast (km) Measured along the Pipeline Route	Water Depth (m)	Volume of Dredging or Rock (m^3)	Seabed Area (m^2)	Seabed Intervention Required
4	29.9	100	6,000	3,880	Pre-installation dredging or MFE
	30.4	150	3,500	1,700	
	31.0	390	250	270	Pre- or post-installation trenching or MFE
	31.6	520	540	560	
	32.5	720	730	760	
	30.2	150	1,8001	6751	Pre- or post-installation mechanical, structural and / or rock berm support (it can be substituted with VIV suppression strakes if validated by detailed design)

Complete.

* Assumes use of rock dumping as this requires largest seabed footprint and volume of material

Table 5.20 Offshore Section Seabed Intervention Requirements for Pipeline Stabilisation

Pipeline Number	Approximate Distance from Russian Coast (km) Measured along the Pipeline Route	Water Depth (m)	Volume of Dredging / Rock (m^3)	Seabed Area (m^2)	Seabed Intervention Required
1	24.15-28.85	60-95	11,000 /	7,100	Post-lay trenching
	24.15-28.85	60-95	16,000	21,150	Post-lay backfilling of trench with Imported gravel / rock
2	24.46-30.16	60-90	11,000 /	7,100	Post-lay trenching
	24.46-30.16	60-90	16,000	21,150	Post-lay backfilling of trench with Imported gravel / rock
3	25.26-29.96	60-90	11,000 /	7,100	Post-lay trenching
	25.26-29.96	60-90	16,000	21,150	Post-lay backfilling of trench with Imported gravel / rock
4	25.07-29.77	60-90	11,000 /	7,100	Post-lay trenching
	25.07-29.77	60-90	16,000	21,150	Post-lay backfilling of trench with Imported gravel / rock

Table 5.21 Offshore Section Seabed Intervention Requirements for Rockfall Protection

Pipeline Number	Approximate Distance from Russian Coast (km) Measured along the Pipeline Route	Water Depth (m)	Volume of Rock (m^3)	Seabed Area (m^2)	Seabed Intervention Required
1	29.61-29.80	200-300	2,140	3,035	Post-installation rock dump
	29.90-30.09	340-400	2,140	3,035	
	31.02-31.18	610-650	1,800	2,550	
	31.95-32.05	820-850	1,120	1,580	

Continued…

Pipeline Number	Approximate Distance from Russian Coast (km) Measured along the Pipeline Route	Water Depth (m)	Volume of Rock (m^3)	Seabed Area (m^2)	Seabed Intervention Required
2	30.61-30.81	270-360	3,200	4,550	Post-installation rock dump
	31.41-31.66	500-570	4,000	5,650	
3	30.51-30.76	200-290	3,800	5,350	Post-installation rock dump
	31.41-31.51	445-465	1,600	2,300	
4	30.22-30.57	170-305	5,300	7,500	Post-installation rock dump
	32.90-33.02	800-830	1,900	2,700	

Complete.

Pre-Installation Seabed Intervention Requirements

As shown in Table 5.19, some pre-installation seabed intervention work is required in areas where sections of free span pipeline are anticipated due to the uneven seabed profile. Pre-installation seabed intervention methods proposed for the Project include dredging or mass flow excavation to remove shoulder spans, and the placement of pipeline support structures.

Dredging

Pre-installation dredging is undertaken to level or flatten out the seabed in areas of predicted pipeline spanning before the pipeline is laid. It is anticipated that approximately 42,500 m^3 of seabed sediments will require to be dredged for all four pipelines to correct free span locations. The dredged sediments will be transported to an existing permitted underwater dump site for disposal (Disposal Site Number 923). The dump site is located on the Russian continental slope as illustrated in Figure 5.34. No other dredged sediment is proposed to be taken to this permanent disposal site.

Due to the water depths where pre-dredging is necessary (between approximately 110-150 m water depth) to remove shoulder spans it is unlikely that conventional dredging vessels such as CSDs or TSHDs will be employed due to restrictions in the water depths that they can operate in. There are however, grab crane dredgers (as described in Section 5.3.5.4) that may be able to operate at these depths. Alternatively, dredging at these depths could be undertaken using special ROV dredging tools / vehicles designed to work in deep water and on steep slopes, which are controlled by operators located aboard a support vessel.

One such tool is a grab excavation system that uses an ROV that is mounted on top of the grab for precise manoeuvrability of the grab. By using two lifting points – one forward and one aft - the excavation system is able to transport the excavated material underwater and deposit it where necessary. An alternative method is the use of a dredging vehicle that levels or flattens out the seabed using a combination of water jetting and suction to remove soil from the area.

The dredging head is installed on an extendable arm to cover the operational area. The dredging vehicle moves along the seabed using powered tracks and/or articulated walking legs and is capable of working on steep slopes. Both excavation tools are controlled from a support vessel.

Mass Flow Excavation

An alternative option is the use of a mass flow excavation tool. This tool is an ROV that uses subsea jetting equipment to excavate the seabed. The mass flow excavation tool generates a large volume column of water travelling vertically down to the seabed at high velocity. The water column hits the seabed at high speed to produce a powerful excavation force. This type of equipment allows for localised pre- and post-installation span correction in very deep waters in most soils without risk of damage to the pipeline. The excavation tool is controlled from a support vessel.

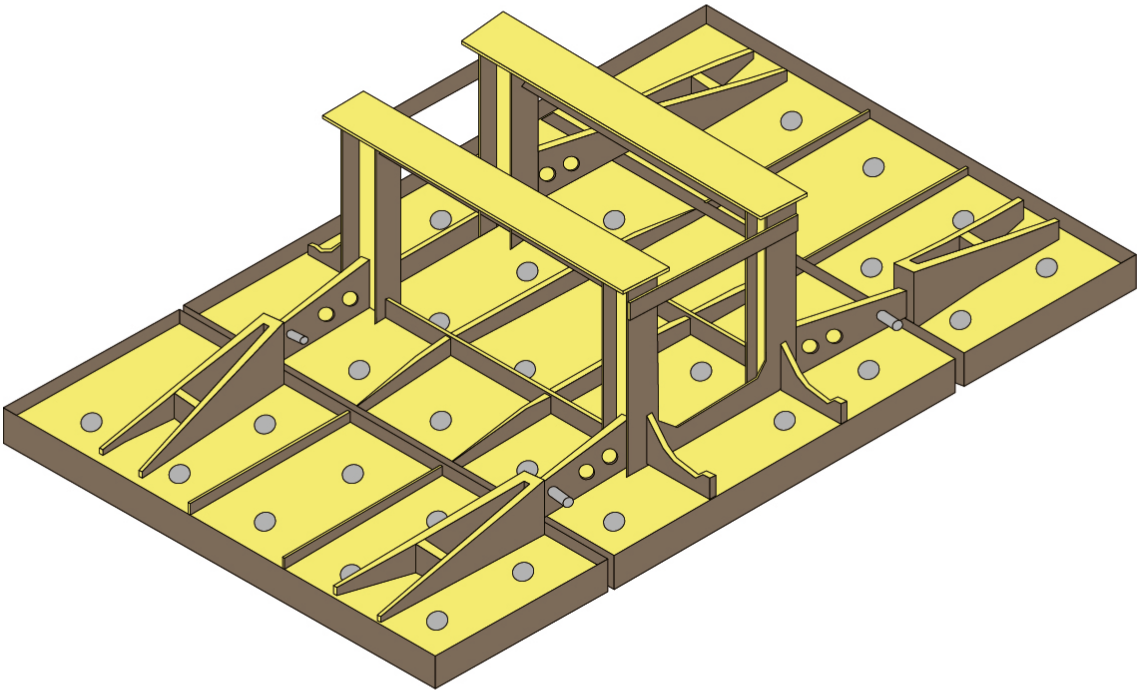
Support Structures

Support structures are strategically placed to provide vertical support to the pipeline at excessive span length locations. The exact details of the support structures are still subject to detailed design, although descriptions of typical methods are described below. Alternatively, it may be decided during detailed design studies to install these supports after pipe-lay or that the pre-installed supports for the VIV spans can be substituted with VIV suppression strakes. Suppression strakes are helical shaped plastic moulded structures which are designed to suppress damaging vibration forces to an acceptable level. If required, the strakes will be fitted to the pipelines on the pipe-lay vessel during pipe-laying.

Pre-installed supports may include concrete mattresses, structural support or rock berm, which need to be stable under earthquake and seabed currents conditions. Mattresses are normally installed from a vessel with a crane or A-frame with ROV support. Mattresses are available in different shapes and types and are generally made of concrete.

Rigid supports such as mud mats can also be installed to support the pipeline. Mud mats, which are made of steel (with self-sustaining cathodic protection system consisting of sacrificial anodes), consist of a base and top plate and a number of perpendicular vertical stiffeners that function as load-bearing beams. Rigid supports are installed with similar equipment as concrete mattresses, i.e. from a vessel with a crane or A-frame with ROV support. An indicative mud mat design is shown in Figure 5.35.

Figure 5.35 Indicative Mud Mat Design



Alternatively, pre-installation rock dumping can be undertaken. Pre-installation rock dumping will involve the placement of rock berms, which are constructed using coarse gravel or small stones to locally reshape the seabed to provide support for the pipelines to ensure their long-term integrity. The rock berm length and spacing will vary with location and will not be confirmed until the detailed design stage. However, it is conservatively estimated at this time that each rock berm will have a footprint of approximately 100 m^2. The total volume of rock required to complete the works should rock berms be constructed at all pre-installation support locations is conservatively estimated to be approximately 8,600 m^3.

Accurate placement of rock will be assured through the use of a dedicated rock-dumping vessel equipped with a fall-pipe, from which the rock is transported from the surface to just above the seafloor using suspended pipe sections. The shape of rock placements will depend on seabed conditions, but will be designed such that rock requirements are minimised. The end of the fall-pipe will be positioned by an ROV which is equipped with a positioning system to aid the accuracy of the rock placement and a post construction survey will be performed to confirm correct placement.

The placement of all rock material will be subject to a licence from the local authorities. The rock material selected will be chemically and mechanically stable for the entire lifetime of the Project. The type of rock selected will have to meet certain strength and durability requirements to ensure it lasts the length of the operational phase of the Project. The average size of the rock material will be 50 mm but may range from 20-100 mm. It will be a condition that the material used will not contain any contaminants, such as heavy metals.

Material for rock placement will be extracted from appropriately licensed onshore quarries or marine aggregate sites. At the time of preparing this ESIA Report, the source of rock material is unknown; rock may come from within Russia or from another country depending on the availability and quality of rock sources. Suitable rock types that could be used include basalt, gabbro and/or granite. The rock material will most likely be transported via a rock dump vessel and taken directly to the rock dump locations. Alternatively, if the rock comes from another country it may be transported by bulk carrier. If this is the case the rock will be transferred to a Russian port (Novorossiysk) and loaded onto a rock dump vessel.

Post-Installation Seabed Intervention Requirements

As shown in Table 5.19 some post-installation seabed intervention work is required in areas where sections of free span pipeline are anticipated due to the uneven seabed profile. Post-installation seabed intervention methods proposed for the Project include dredging (trenching) or mass flow excavation to remove shoulder spans and the placement of pipeline support structures. As shown in Table 5.20 post-lay trenching and backfilling of the trench with imported rock / stone may be required on the ridge of the continental slope (in water depth s of between approximately 60 - 95 m) to provide the pipeline with additional stabilisation. The actual requirement for this intervention work will be confirmed during the detailed design stage as concrete coating of the pipeline alone may be sufficient to meet stabilisation requirements. As shown in Table 5.21 rock dumping is required over the pipelines in areas where they are at risk from rock fall on the continental slope.

Mattresses and Grout Bags

Concrete mattresses or grout bags may be required to rectify a single free span section on pipeline #1 if the as-laid free span length exceeds 110 m length and 1.7 m height. The requirement will be identified during post-lay surveys. If required, concrete mattresses or grout bags will be installed underneath the pipeline to provide vertical support. Concrete mattresses will be installed as per the description in the pre-installation section above.

Empty grout bags would be lowered to the seabed on a deployment frame from a vessel for ease of ROV manipulation and filling. The empty bag is placed under the pipeline and subsequently pumped full of grout material. The weight of the pipeline is taken by the grout bag as it fills. The grout then hardens to create a rigid support point.

Post-Installation Dredging

Post-installation dredging (also referred to as post-lay trenching) will be necessary for rectifying free-span sections where shoulder spans have been identified (see Table 5.19) and where additional pipeline stabilisation (at the ridge of the continental slope) may be required as shown in Table 5.20. It will be carried out by lowering the pipeline sections in question below the natural seabed level using post-installation trenching techniques. Post-lay trenching can be done by various means. Some equipment is self-propelled, others pulled by a surface vessel, and some make contact with the pipeline, whereas others avoid direct contact and loads on the pipeline. The method to be applied depends on water depth, soil conditions and burial depth to be achieved. The trenching methods can be grouped into three main categories; jetting, mechanical cutters and ploughs. The final decision on which method to be employed will depend on the appointed installation contractor and subject to further detailed design. Each option requires a support vessel which will be equipped with special equipment to operate the ROV trenching equipment.

The jetting technique lowers the pipeline below the seabed surface through a combination of lateral excavation and high pressure water jetting to displace the sediment from under the installed pipeline. The pipeline then descends into the excavated space below it. If necessary, the displaced sediment may be pumped over the preceding section of the pipeline to backfill the trench. This method minimises displacement of sediment and associated benthic organisms and requires no temporary or permanent disposal of excavated sediments.

Mechanical cutters cut the soils under the pipeline to gradually lower it under the seabed surface. Mechanical cutters are normally heavy pieces of equipment fitted with crawlers that allow the cutter to crawl along the surface of the pipeline. This tool typically consists of cutter discs and suction pumps at the rear of the tool that push the excavated soil away from the trench. A mechanical cutter requires a support vessel to lower it into the water and position it accurately over the pipeline.

The ploughing technique uses a relatively large structure which is pulled over the seabed, which lifts the pipeline, cuts the soil and deposits it at the side of the trench and finally lowers the pipeline in the created trench. The trench can be left to backfill naturally or the deposited soil can be replaced on top of the pipeline in a successive operation by a backfill plough. A plough requires a support vessel with a large bollard pull and a large lifting A-frame.

At each span correction location to be trenched (shown in Table 5.19) it is anticipated that the pipelines will be lowered to a depth of approximately 1 m below the seabed surface. The width of seabed surface impacted by post-installation trenching will depend on the method employed, however it is anticipated to be approximately 20 m.

Mass Flow Excavation

Alternatively, MFE, as described in the Pre-Installation Seabed Intervention Requirements section above, could also be used for post-installation pipeline lowering / burial into the seabed. If MFE is used the management of change process described in Section 5.11 will be followed if it is deemed that this change may affect the results of the ESIA Report.

Backfilling of Trench with Gravel / Rock

As shown in Table 5.20, some areas of the pipeline located on the ridge of the continental slope may require post-lay trenching and backfilling of the trench to improve the stability of the pipeline. Backfilling of the trench with imported gravel / rock will be undertaken using a fall-pipe vessel as described in the pre-installation seabed intervention requirements section above. It is conservatively estimated that a total of approximately 64,000 m^3 of gravel/rock will be required to backfill the four pipeline trenches.

Rock Dumping

Rock dumping is required to cover the pipelines at certain sections of the pipeline route where there is a risk of damage from potential rockfall (see Table 5.21). Rock placement will be undertaken using a fall-pipe vessel as described in the pre-installation seabed intervention requirements section above. It is conservatively estimated that a total of approximately 27,000 m^3 of rock will be required to meet rockfall protection requirements.

The exact extent of these post-lay seabed intervention measures may be adjusted during the detailed design stage, and will be further reviewed after the pipeline has been installed and surveyed. However, any changes are anticipated to be minor and are not anticipated to alter the results of this ESIA Report. Should any major design changes be required which may affect the results of the ESIA, the management of change process described in Section 5.11 will be followed.

A safety exclusion zone of approximately 0.5 km (0.3 NM) radius for rock placement or mattress installation vessels will be adopted during construction to avoid incident with marine traffic.

5.3.6.6 Crossings of Existing Subsea Infrastructure

No existing pipelines will be crossed by the Project offshore pipelines. However, the offshore pipeline route will cross six subsea cables. Three cables have been identified on the continental slope (one in-service and two unknown) and two in-service cables have been identified on the abyssal plain, the final cable was laid on the abyssal plain in 2013. The locations of the first five cables listed have been confirmed by ROV surveys carried out during Front End Engineering Design (FEED). The location of the latest telecommunication cable, laid in 2013, has also been confirmed since completion of FEED. An overview of the six known cables and their operators is provided in Table 5.21 and the crossing locations are shown in Figure 5.34.

The in-service Feodosiya (Ukraine) to Novorossiysk (Russia) cable is thought to be one of the three cables on the continental slope; however, it is unclear which of the three cables it actually is as the other two cables are located in close proximity. The status (in service or out-of-service) of these other two cables (Identified Cable No. 1 and No. 2) is presently unknown, however a number of cable breaks in Identified Cable No.2 were observed during ROV surveys. Therefore, it is assumed that this cable is out-of-service. The two confirmed in-service cables on the abyssal plain are the Black Sea Fibre Optic Cable (BS-FOCS) and Italy-Turkey-Ukraine-Russia (ITUR). The new cable n is the Anapa-Dzhubga-Adler telecommunication cable that will be operated by Upravlenie Perspectivnyh Tehnologiy.

In addition, two further new telecommunication cables between Myskhako (City of Novorossiysk) – Cape Utrish and Cape Utrish – Cape Zhelezny Rog are understood to be planned for development in future although no route specific information has been obtained. These two cables are not shown in Table 5.22 and Figure 5.34.

Table 5.22 Cable Crossings

Name	Cable Type	Operator / Owner
Identified Cable Number 1	Unknown (out-of-service)	Russian Ministry of Defence
Feodosiya (Ukraine) - Novorossiysk (Russia)	Telecommunication	Russian Ministry of Defence
Identified Cable Number 2	Unknown (out-of-service)	Russian Ministry of Defence
BS-FOCS	Telecommunication	BTC / Vivacom / Rostelecom
ITUR	Telecommunication	Rostelecom
Anapa-Dzhubga-Adler	Telecommunication	Upravlenie Perspectivnyh Tehnologiy

Crossing Agreements

Known owners of active cables were approached with the aim of reaching mutual crossing agreements covering liabilities and procedures for crossing methods. According to the agreements, South Stream Transport will be required to provide crossing designs and installation procedures to the satisfaction of the owners prior to installation of the pipelines.

The crossing agreements used by South Stream Transport with the cable operators will be based on the guidelines prepared by the International Cable Protection Committee (ICPC) (Ref. 5.10), which are used worldwide for telecommunication cables.

Cable Crossing Techniques

For the in-service cables on the Russian Slope (assumed to be Identified Cable No.1 and the Feodosiya - Novorossiysk Cable), the identified cables are in free span at the location where they are crossed by the Project pipelines.

For the out-of-service cable on the Russian slope (assumed to be Identified Cable No.2), 150 m of the cable either side of the crossing location will be cut (after obtaining final permission from cable owner/authority). The cut cable will be removed from the pipeline corridor prior to pipeline construction and recovered and disposed of in an environmentally friendly manner as proposed by the ICPC. To ensure that the cut cable could not return to the pipeline corridor during the design life of the pipeline, the cable ends will be weighted with clump weights.

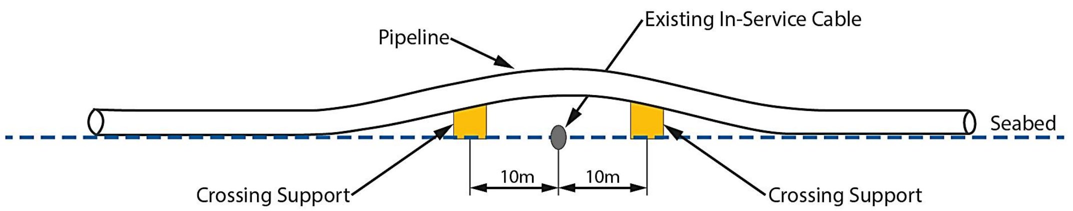
For the BS-FOCS, ITUR and Anapa-Dzhubga-Adler cables, the cable crossings will be constructed to ensure that the pipelines and cables remain at a safe distance from each other. The support height is selected in order to guarantee the agreed minimum vertical separation between the cable and the pipelines. The vertical separation between the pipelines and existing cables will be a minimum of 0.3 m for the BS-FOCS and Anapa-Dzhubga-Adler cable and 0.5 m for the ITUR cable (as specified by the owner Rostelecom) during the design life of the pipelines, taking into account settling of the pipeline and support settlement in the seabed as well as further settlement by the cables. The separation distance will also take account of free span vibrations, where this is applicable. This will ensure that the cables are not unduly stressed or loaded by the pipelines passing over them.

The cable crossing is achieved by elevating the pipeline by supporting it with rigid concrete mattresses or mud mat structures either side of the cable. The use of mud mats will be adopted if the soils are deemed too soft for the use of concrete mattresses.

It is anticipated that crossings of the BS-FOCS, ITUR and the Anapa-Dzhubga-Adler cable, which are located on the abyssal plain will be crossed using mud mat structures to provide the vertical support for the pipelines due to the soft sediments present at the cable crossing locations. This crossing method involves installing crossing supports (mud mats) on both sides of the existing cables prior to pipeline installation. It is anticipated that each mud mat will have base dimensions of 10 m x 5 m and an approximate submerged weight of 10 tonnes. The crossing support will be installed parallel to the existing cables with a distance of 10 m from centre of support to the existing cable; however the distance of the cable from the edges of the support should be 2 m as a minimum. The minimum height of the crossing supports will be specified accordingly during the detailed design process.

The final crossing designs will be subject to agreements between South Steam Transport and individual cable owners. However, an indicative illustration of the crossing layout for the BS-FOCS and ITUR cables is shown in Figure 5.36.

Figure 5.36 Indicative Cable Crossing for the BS-FOCS and ITUR Cables



5.3.6.7 Nearshore and Offshore Construction Material Use

Use of Resources

Materials

During construction of the nearshore and offshore section pipelines a variety of materials will be required. An estimate of the quantities of the main materials to be consumed is shown in Table 5.23. Quantities are approximate and subject to final optimisation.

Table 5.23 Material Consumption

Material	Quantity per Pipeline	Total (all four pipelines)
Steel (pipelines)	163,883 tonnes	655,532 tonnes
Concrete Coating	11,138 tonnes	44,552 tonnes
Coating (3LLP)	2,165 tonnes	8,660 tonnes
Coating (Field Joint)	499 tonnes	1,996 tonnes
Weld Material	161 tonnes	644 tonnes
Rock (pre- and post-installation seabed intervention)	Pipeline 1 – 26,800 m^3 Pipeline 2 – 24,600 m^3 Pipeline 3 – 23,200 m^3 Pipeline 4 – 25,000 m^3	99,600 m^3

Fuel

At sea, fuel and refuelling is referred to as bunker and bunkering, respectively. Where practical, vessels deployed in the Project area will use light fuels such as Marine Diesel Oil (MDO) or Marine Gas Oil (MGO). Sulphur content in fuel will be in compliance with requirements of Annex VI – 2008 to the MARPOL 73/78 Convention and any national legislation. Some vessel bunkering may be undertaken at support ports (most likely Novorossiysk) in Russia. The bunkering for some vessels (e.g. PSVs) will be undertaken at the marshalling yards in Bulgaria, as these vessels will be making return trips. However, for vessels located continually at sea (e.g. the pipe-lay vessel), the bunker will be pumped into the ships' tanks by the bunkering tanker. All bunkering activities will be undertaken in accordance with the Vessels and Marine Transport activity-specific CMP, which will be developed as part of South Stream Transport's ESMP. The CMP will contain activity-specific requirements, to be met by both South Stream Transport and the appointed contractors (and sub-contractors). Further details on the Vessels and Marine Transport CMP and South Stream Transport's ESMP are described in **Chapter 22 Environmental and Social Management**. Estimates of the average daily fuel consumption during the construction phase of the nearshore and offshore sections are provided in Table 5.24.

Table 5.24 Estimated Fuel Consumption

Fuel	Use	Average Quantity per Day (tonnes)	
		Nearshore	Offshore
MDO	Vessels	210	422
Diesel	On board Equipment	Included within MDO calculation	

Water Consumption

During construction of the nearshore and offshore section pipelines water will be required for domestic purposes on-board the vessels (this includes drinking water, washing, cooking, laundry and general vessel cleaning) and industrial use (various uses during pipeline fabrication process). Although some of the vessels listed in Table 5.16 and Table 5.18 may possess desalinisation equipment (distillation or reverse osmosis) to produce freshwater, it is assumed for the purposes of the ESIA that freshwater will be supplied by tankers. Bottled water may be provided for drinking purposes. Water requirements associated with the terrestrial construction activities associated with nearshore construction are included in Table 5.11. Water requirements for hydrotesting activities are described in Section 5.4.

Table 5.25 Estimated Water Consumption during Construction per Pipeline

Water Type	Details	Maximum Consumption per day during Peak of Construction (m^3)	
		Nearshore	Offshore
Freshwater	200 l / person per day	192.4	519

5.3.6.8 Summary of Waste Generated during Construction of Nearshore and Offshore Sections

There are a number of activities during the Construction and Pre-Commissioning Phase of the nearshore and offshore sections that have the potential to generate waste. Table 5.26 presents a summary of the waste types anticipated to be generated using FWCC codes to categorise waste types. For each waste type, a likely range is estimated for waste volumes arising from the installation of the nearshore and offshore section pipelines. It also includes wastes (such as Monoethylene Glycol (MEG)) generated during the pre-commissioning activities (excluding hydrotest seawater) for the landfall and nearshore section pipelines described in Section 5.4, as the MEG shall be collected by marine vessels. A more detailed breakdown of the waste generated during construction of the nearshore and offshore section pipelines is presented in **Chapter 18 Waste Management**.

Table 5.26 Estimated Types of Waste Generated during Construction of the Nearshore and Offshore Sections

Description of Waste Type	FWCC Code	Hazard Class
Fluorescent tubes and other mercury-containing lamps	353 301 00 13 01 1	1
MARPOL Annex I oily wastes	546 002 00 06 03 3 546 003 00 04 03 3	3

Continued…

Description of Waste Type	FWCC Code	Hazard Class
Mixed municipal waste	912 004 00 01 00 4	4
Ash, slag and dust from on-board incineration	313 000 00 00 00 0	4
Medical waste	971 000 00 00 00 0	4
Glass scrap (excluding fluorescent tubes)	314 008 02 01 99 5	5
Uncontaminated soil	314 011 00 08 99 5	5
Plastic	571 018 00 13 00 5	5
Scrap metal	351 301 00 01 99 5	5
Waste textiles	581 011 08 01 99 5	5
Biodegradable kitchen waste	912 010 01 00 00 5	5
Waste MEG	590 000 00 00 00 0	3
Sewage	951 000 00 00 00 0	4

Complete.

The estimated generation of sanitary waste (black water) and wash water (grey water) during construction of the nearshore and offshore sections is provided in Table 5.27.

Table 5.27 Estimated Volumes of Grey and Black Water Generated per Pipeline

Waste Type	Details	Average Quantity Produced per Day (m^3)	
		Nearshore	Offshore
Grey Water	180 l / person per day	173.4	467
Black Water	12 l / person per day	11.6	31

Should any of the vessels use desalinisation equipment to produce freshwater, the waste brine solution will be discharged to sea. Brine from the distillation and reverse osmosis processes must not contain or come in contact with machinery or industrial equipment, toxic or hazardous materials, or wastes. If brine does become contaminated by such materials, the brine will be transferred to a support vessel and disposed of properly onshore.

All wastes generated will be handled and disposed of in accordance with applicable Russian waste policy and MARPOL requirements. The locations of potential waste disposal facilities for waste generated by the Project at sea that needs taken ashore for disposal are shown in Figure

5.9. However, it should be noted that no decisions as to which of these sites could or may be used have been taken at this time and will be subject to further investigation. Further information on waste generation and management is described in **Chapter 18 Waste Management**. Waste water in relation to pre-commissioning tests is described in Section 5.4.

5.3.6.9 Summary of Nearshore and Offshore Emissions to Atmosphere

Table 5.28 presents the greenhouse gas (GHG) (i.e. CO_2) and non-GHG emissions predicted to be generated from the installation of the nearshore and offshore pipeline sections for a single pipeline, based on the expected vessels and number of days of operation outlined in Table 5.16 and Table 5.18. The emission estimates sources include marine equipment supporting microtunnelling activities in the nearshore section but excludes pre-commissioning activities (Section 5.4). Further information on emissions to atmosphere is provided in **Chapter 9 Air Quality**.

Table 5.28 Estimated Atmospheric Emissions from Construction Vessels per Pipeline (tonnes)

	CO_2	NO_X	CO	PM	SO_2	NMVOC
Nearshore vessels	10,912	271	26	5	104	10
Offshore vessels	144,541	3,591	338	69	1,372	128
Total	***155,453***	***3,862***	***364***	***74***	***1,476***	***138***

5.4 Pre-Commissioning Phase

5.4.1 Overview

After each pipeline has been installed a number of activities, known as pre-commissioning activities (as illustrated in the construction schedule shown in Figure 5.7), will be undertaken to ensure that the pipelines meet operational requirements. The primary objective of these activities is to verify that the pipeline has been laid without significant defects and that it is in a suitable condition to be filled to transport the gas at the anticipated pressure and to deliver the gas to the required specifications. The equipment required for the pre-commissioning activities will be used for cleaning, gauging, hydrotesting and drying of the installed pipelines.

The pre-commissioning approach for the Project involves hydrotesting of the landfall facilities and landfall and nearshore (to 30 m water depth) sections of the pipelines only. Hydrotesting (a hydrostatic test) involves filling the pipelines with water which is then pressurised to a level in excess of the design pressure of the pipelines to test the strength of the pipeline and confirm that there are no leaks.

The offshore section of the South Stream Offshore Pipeline (from 30 m water depth in Russia to approximately 36 m water depth in Bulgaria) will not be hydrotested. A traditional hydrostatic test pressure may cause lateral buckling all along the South Stream Offshore Pipeline and, as a result, the risk to the pipeline integrity may not be as low as reasonably practical. Furthermore, waiving of the hydrostatic test for the South Stream Offshore Pipeline presents various environmental and technical benefits, as follows:

- Costly and time consuming effects of pipeline flooding and dewatering operations are eliminated and any adverse environmental effects associated with the discharge of the test water from the full length of the Pipeline will be avoided;
- The construction schedule is shortened thereby reducing the duration of disturbance and temporary land use requirements;
- The potential adverse effects to the environment of lateral buckling (loss of containment) which may be caused by the relatively high hydrostatic test pressure will be eliminated, which will also result in elimination of the risk to the pipelines due to this failure mode; and
- Absence of flooding, dewatering and hydrostatic testing minimises the volumes of water, fuel and chemicals required and associated emissions and discharges to the environment.

Hydrotesting has been thoroughly investigated and intensively discussed with DNV (DNV are contracted by South Stream Transport for the verification of FEED and pre-qualification test of line pipe, buckle arrestors, coating and anodes for the Project) during the FEED design stage in 2012. The hydrotest for the pipelines in more than 345 m water depth is allowed to be waived according to DNV-OS-F101 (2010), Section B204. In addition a Concession Request has been approved by DNV for pipelines in water depth between 30 m and 345 m provided the following additional requirements are fulfilled:

- Safety class "High" shall apply for the installation and tie-in of the pipeline between 30 m and 345 m water depth;
- Subsea leak inspection by ROV shall be performed as soon as practicable following the start of operation of the pipelines;
- The allowable defect sizes for the girth welds shall be more restrictive than that permitted by the Engineering Critical Assessment; and
- The local incidental pressure (level of pressure that occurs incidentally at which safety devices operate) at 30 m water depth on the Bulgarian shelf does not exceed 291 bar.

All pre-commissioning activities will be undertaken in accordance with the requirements of South Stream Transport's Pre-commissioning CMP. Details of the CMPs are described in **Chapter 22 Environmental and Social Management**.

5.4.1.1 Hydrotest Sections

Each pipeline will be hydrotested separately between a temporary PIG launcher/receiver fitted to the pipeline just downstream of the landfall facilities fence and the edge of the nearshore section at 30 m water depth where a tie-in between the nearshore and offshore pipelines will be made. During the installation of the nearshore section pipelines, a temporary subsea test head will have been welded to the ends of the pipelines to enable pre-commissioning tests to be undertaken. The temporary subsea test head will be designed to contain and launch flooding, cleaning and gauging PIGs towards the onshore PIG traps and to receive dewatering PIGs sent from the temporary PIG launcher/receiver located at the landfall facilities.

The landfall facilities themselves, upstream of the temporary PIG launcher / receiver location will be cleaned, hydrotested and dried separately from the landfall section pipelines.

The offshore section of the pipeline will not be hydrotested as described above. However, following the completion of pre-commissioning tests of the nearshore and landfall sections in Bulgaria and in Russia, and pipeline tie-ins at the 30 m water depth in Russia and approximately 36 m water depth in Bulgaria, the pipeline will undergo cleaning, gauging and drying between the temporary PIG launcher/receiver at the fence of the landfall facilities in Russia and a temporary PIG launcher/receiver located at the fence of the landfall facilities in Bulgaria.

5.4.2 Landfall and Nearshore Section Pipeline Testing and Pre-commissioning (Hydrotesting)

The pre-commissioning of the landfall and nearshore sections of each pipeline will be undertaken separately. The pre-commissioning of each pipeline will take approximately four weeks to complete (including mobilisation of the pre-commissioning spread). There is a gap of approximately three months between the pre-commissioning of each pipeline.

In order to undertake the pre-commissioning test, a suitable offshore support vessel will be mobilised to the tie-in location at 30 m water depth. The vessel will be equipped with a diving or ROV spread to deploy and connect a down line (hose) between the vessel and the subsea test head. Pre-commissioning tests of the landfall and nearshore section pipelines will use seawater.

A flooding, gauging and hydrostatic testing spread will be installed onboard the support vessel. This pre-commissioning spread will enable water supply, water treatment, flooding and testing of the pipeline. PIGs will also be launched from the subsea test head towards the PIG launcher/receiver located at the fence of the landfall facilities.

The terrestrial pre-commissioning equipment (compressors, water storage tanks etc.) will be located within the Landfall Facilities Construction Site and Pre-Commissioning/Commissioning Spread (Site E) (shown in Figure 5.10) and connected to the temporary PIG launcher/receiver via a series of hoses. In order to reduce noise pollution from the equipment, a sound wall comprising temporary noise attenuation panels which will surround the rotating assets, may be used. These panels shall be designed and built with high noise absorption characteristics.

5.4.2.1 Cleaning and Gauging

Typically, cleaning and gauging are performed as a single operation together with flooding. It is expected to take approximately three hours to flood each pipeline. Upon connection of the vessel based spread to the subsea test head, a PIG train(s) is inserted to the pipeline to clean and gauge the pipeline and remove construction debris. The PIG trains are pushed through the pipelines to the onshore PIG launcher / receiver near the landfall facilities by pumped seawater (drawn from the Black Sea), which has been chemically treated and filtered.

Diesel driven water supply pumps with a capacity of 25 cubic metres per minute (m^3/minute) will be used to extract water from the sea via two temporary 6-inch hoses whose intakes are supported by buoys and suspended approximately 3-5 m above the seabed in a suitable offshore location near the tie-in location at 30 m water depth. The suction hoses will be equipped with suitable strainers (2 mm screen mesh) to prevent coarse debris or sea life from entering the suction hose. Water will be collected in a break tank (water tank fitted with filter systems) on board the supply vessel. From the break tank, water will be pumped through a filtration skid to remove all particles larger than 50 microns. The filtered water is then injected with an oxygen scavenger (sodium bisulphite)[4] to prevent internal corrosion of the pipeline prior to dewatering at an injection rate of 250 parts per million (ppm). It is anticipated that approximately 452 litres (l) of oxygen scavenger will be necessary per pipeline.

Diesel driven flooding pumps with a capacity of 25 m^3/minute and suitably sized downlines will be used to inject the filtered and chemically treated seawater directly into the subsea pipeline to push the cleaning and gauging PIGs.

A valve will be open on the onshore test head during the flooding operation, which will be connected to vents to vent air from the pipeline as it is filled with seawater. During the flooding operation, 100 m^3 of seawater will initially be pumped into the pipeline followed by a cleaning and gauging PIG. A further 1,900 m^3 of seawater will then be pumped into the pipeline. The first 100 m^3 of water and debris (consisting of rust, coating and weld debris) in front and in-between the PIGs, as well as overfill water, will be captured in temporary onshore water storage (break) tanks.

On receipt of the PIG, the valves at both ends of the pipeline will be closed. The collected water will be stored for a sufficient length of time to allow the debris to settle to the bottom. It is expected that approximately 200 kg of debris may be produced per pipeline. The debris will be removed from site and disposed of through an approved waste disposal company. The 100 m^3 of water will be temporarily stored and then pumped back into the pipeline during hydrotesting.

When all the cleaning and gauging PIG train(s) have been received into the temporary PIG receiver and the gauge plate(s) have been inspected for pipeline defects, the cleaning and gauging operation is complete.

The total seawater volume required for flooding, cleaning, gauging and hydrostatic testing will be approximately 2,000 m^3 per nearshore and landfall pipeline section. Seawater intake information for each pipeline is summarised in Table 5.29.

[4] Sodium Bisulphite is listed in OSPAR's PLONOR list.

Table 5.29 Seawater Intake Information at Subsea Test Head Location (per pipeline)

Subject	Value
Location	Nearshore / offshore section tie-in location at 30 m water depth
Intake Water Depth	Approximately 3-5 m above the seabed
Flooding Flow Speed	2 x 6.25 m^3/minute
Flooding Duration	3 hours
Flooding Fluid:	
Type	Seawater
Total Volume	2,000 m^3
Intake Dimensions:	2 x 6-inch
Intake Hose	2 mm
Intake Mesh Size	
Chemical:	
Type	Sodium Bisulphite (oxygen scavenger)
Injection Rate	250 ppm
Total volume	452 litres

5.4.2.2 Hydrotesting

Upon confirmation of successful cleaning and gauging of the pipeline, the pipeline will be hydrostatically tested. Hydrotesting will be undertaken by pumping the 100 m^3 stored treated seawater used to clean and gauge the pipelines back into the pipelines. Further treated seawater will then be pumped into the pipeline, using hydrostatic test pumps located on the support vessel, to raise the pressure in the pipeline to 330.8 bar (at +180 m reference elevation). The test pressure is based on the requirements set out in DNV Offshore Pipeline Standard DNV-OS-F101 requirements. In line with DNV-OS-F101 acceptance criteria, the pipeline pressure test will have a hold period of at least 24 hours.

Once the results of the hydrotest have been validated and accepted, the pipeline will be depressurised to ambient pressure. In the event that the hydrotest fails, the contractor will be required to detect the leak and then propose a repair method to South Stream Transport. The repair method will depend on the nature and location of the leak. Following agreement between South Stream Transport and the contractor of the repair method to be employed, the repair will be undertaken and the hydrotest repeated following the steps described above.

5.4.2.3 Dewatering and Drying

After a successful hydrostatic test, the pipeline will be dewatered and chemically conditioned (dried) using MEG. Dewatering/conditioning (drying) will be undertaken from the temporary PIG launcher/receiver at the landfall facilities towards the temporary subsea PIG receiver at 30 m water depth.

It is anticipated that dewatering will be performed by sending a PIG train consisting of two PIGs, separated by a batch of MEG from the temporary PIG launcher/receiver to the subsea PIG receiver to push out the seawater. The PIG train will be propelled by oil free, dry, compressed air provided by an onshore based compressor spread. In order to accomplish an average dewatering PIG speed of 0.5 metre per second (m/s) the compressor spread will consist of primary air compressors feeding air into an air drying unit. Each compressor will have a total capacity of maximum pressure of 34.5 bar and have a standard flow rate of 59.4 Standard Cubic Metres per Minute (Sm^3/minute) at 20°C.

In order to remove and treat residue seawater from the pipeline wall during dewatering, a pre-calculated slug of MEG will be sent through the pipeline. The slug volume is estimated to be a worst case of 30 m^3 based on the need to remove a 0.1 mm thick residual water film after pigging, and a required remaining water film mix in the pipelines of at least 97% MEG versus 3% water content after dewatering and conditioning. It is expected that approximately three hours will be required to dewater each pipeline.

During dewatering operations, the rate of discharge of treated seawater into the sea at the subsea PIG receiver will be 12.5 m^3/minute, corresponding to a PIG speed of 0.5 m/s. Seawater will be disposed of from the temporary subsea test head (PIG receiver). The subsea test head is equipped with several valves and down line connection points to enable the launch and receipt of PIGs and water separately. The water exit point (located in the approximately the same location as the initial intake) will consist of a four or six-inch diffuser positioned approximately 1 m above the seabed, which is used to reduce the speed of water flow as it exits the pipe in order to reduce turbidity and possible creation of sediment plumes. The diffuser also act as an aerator, improving the oxygen concentration in the water, thereby compensating for the oxygen scavenging effect of the oxygen scavenger added to the hydrotest water.

The conditioning agent (MEG) will form part of the dewatering PIG train. MEG will not be disposed into the sea but will be pumped from the subsea test head to the support vessel via a down line. MEG will be received and stored in suitable secure tanks onboard the vessel and will be shipped to shore to be disposed or recycled by an approved waste handling company. The pipeline will then be depressurised to atmospheric pressure at a controlled rate through silenced vents.

Table 5.30 presents the expected volume and location of discharges associated with cleaning and gauging, hydrotesting and dewatering of the nearshore and landfall section pipelines. It should be noted that the water required for hydrotesting of the first pipeline will not be re-used for hydrotesting of the other pipelines and each pipeline will require separate water intake and discharge activities.

Should the detailed design process and discussions with the appointed contractor result in any changes to the dewatering and drying operations described here, the management of change process described in Section 5.11 will be followed if it is deemed that this change may affect the results of the ESIA Report.

Table 5.30 Estimated Pipeline Cleaning, Gauging, Hydrotesting and Dewatering Discharges

Activity	Substance	Discharge Location	Estimated Discharge Volume per pipeline (m^3)	Total Estimated Discharge Volume (m^3)
Cleaning and gauging	Filtered and chemically treated seawater and debris from cleaning PIGs	Temporary PIG launcher / receiver at landfall facilities fence	Up to 100 (temporarily stored in onshore tanks)	400 (temporarily stored in onshore tanks prior to injection back into pipeline)
Flooding, hydrotesting / dewatering	Chemically treated seawater	Temporary subsea test head at 30 m water depth	2,000	8,000
	MEG	Collected and stored in tanks on support vessel for onshore disposal	30	120

On completion of the drying operations, and prior to the introduction of gas, the pipeline will require purging with nitrogen to a pressure of 0.5 bar to avoid the formation of a potentially explosive gas/air mixture. When the oxygen level in the pipeline, as measured at each pipeline end, is equal to or less than 5% by volume, nitrogen purging is stopped, pre-commissioning of the pipeline is finished and commissioning can commence by introducing gas at the Russian end. Approximately 3,000 m^3 (1.5 times the pipeline volume) of nitrogen will be injected to each pipeline from the offshore pre-commissioning spread or the temporary onshore PIG launcher/receiver. The nitrogen will be generated and injected into the pipelines by an electrostatic nitrogen membrane unit in conjunction with the air compressor spread. The membrane unit works by extracting nitrogen from the air and emitting the oxygen and carbon dioxide to the atmosphere. The units will generate nitrogen with a minimum purity of 95%.

The estimated equipment and vessels required for the pre-commissioning tests of the landfall and nearshore section pipelines are presented in Table 5.31.

5.4.3 Landfall Facilities Testing and Pre-commissioning (Hydrotesting)

The landfall facilities will undergo pre-commissioning tests separately from the landfall and nearshore section pipelines. The 24-inch and 32-inch pipelines within the landfall facilities may undergo pre-commissioning simultaneously or separately. For the purposes of this ESIA it is assumed that the pre-commissioning of the landfall facilities will be undertaken in two segments. The first segment to be tested is associated with the 32-inch pipelines and associated pipework upstream of the landfall and nearshore section pipelines previously tested, and the second segment is associated with the 24-inch pipelines and associated pipework. A schematic showing the two segments to be tested is shown in Figure 5.37.

No PIGs are required for cleaning and gauging of the landfall facilities pipework. Checks for defects in the landfall facilities pipework are made during fabrication and construction of the pipework. The internal pipework will be cleaned by the water used for the hydrotesting and collected during the dewatering process. Each pipeline segment will have a temporary test head fitted which will be equipped with valves system to allow the connection of hoses and venting to take place during pre-commissioning activities.

5.4.3.1 Hydrotesting

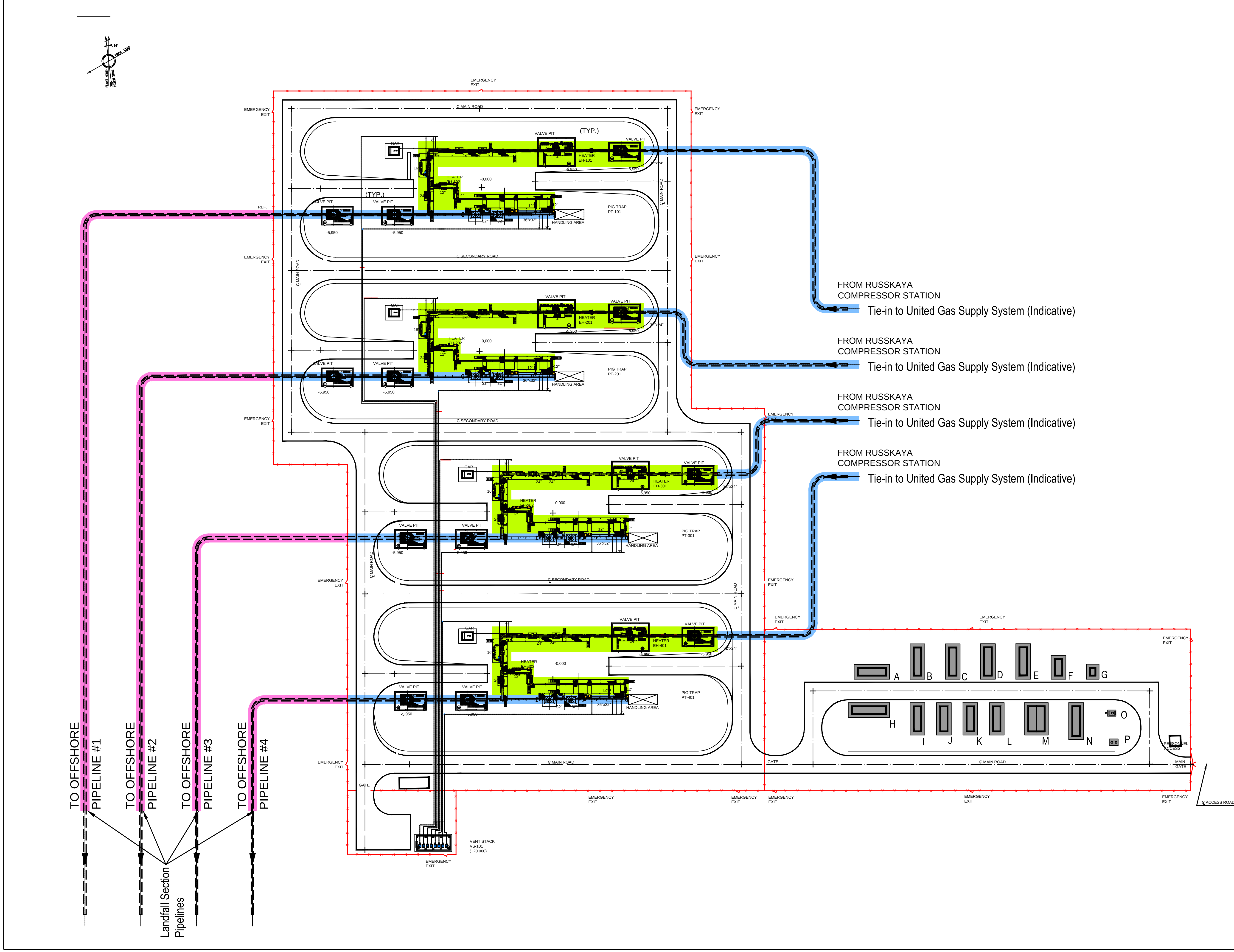
It is anticipated that it will take up to six days to undertake the hydrotest of the pipework associated with a single 32-inch pipeline (first segment) and the corresponding 24-inch pipeline (second segment). Hydrotesting of each segment of the landfall facilities will be undertaken by pumping freshwater into the pipelines via the temporary test head from one end of the pipeline. It is anticipated that approximately 500 m^3 of water will be required in total to hydrotest both 32-inch and 24-inch pipeline segments of the landfall facilities. The freshwater required will be imported by road tankers (lorries). The water will be pumped into the pipeline using a hydrostatic test pump to raise the pressure in the pipelines and associated pipework. It is anticipated that it will take up to two days to completely fill the pipework associated with a single 32-inch pipeline (first segment) and the corresponding 24-inch pipeline (second segment).

A valve will be open on one of the test heads during the flooding operation, which will be connected to a vent to vent air from the pipeline as it is filled with water. Once water is seen discharging from the vent, the vent point on the test head shall be closed. The 32-inch pipeline segment will be filled with water to raise the pressure in the pipelines to a maximum test pressure of 260 bar and the 24-inch segment pipelines will be pressured to a maximum of 450 bar (at +180 m reference elevation). The pipework will be pressure tested for a 24 hour period although the pipework will only be tested to the maximum test pressure for two separate one hour periods.

Once the results of the hydrotest have been validated and accepted, the pipelines will be depressurised to ambient pressure. In the event that the hydrotest fails, the contractor will be required to detect the leak and propose a repair method to South Stream Transport. The repair method will depend on the nature and location of the leak. Following agreement between South Stream Transport and the contractor of the repair method to be employed, the repair will be undertaken and the hydrotest repeated following the steps described above.

Table 5.31 Summary of Equipment and Vessels Required for Pre-Commissioning of the Landfall and Nearshore Sections per Pipeline

Equipment (per pipeline)	Number	Engine Power (kW)	Activity dB LAeq,T @10 m	Duration of Use (days)
Diesel water extraction pumps	2 (on pre-commissioning vessel)	1,000	87	1
Diesel flooding pumps	2	700	85	1
Diesel hydrostatic test pumps	2	700	85	1
Primary high pressure compressor	2 onshore and 2 on pre-commissioning vessel. Maximum of 2 working at any one time on vessel and onshore	440	72	4 (2 onshore and 2 on pre-commissioning vessel)
Air drying unit	1	300	72	5
Nitrogen membrane unit	1	672	85	5
Pre-commissioning spread vessel	1	15,086	Located offshore	18 plus 10 days at 25% capacity for mobilisation/ demobilisation
Fast supply vessel	1	2,520	Located offshore	1
Fuel / waste water collection vessel	1	7,160	Located offshore	1
Rescue vessel	1	610	Located offshore	Only required in case of emergency



RUSSIAN SECTOR OF THE SOUTH STREAM OFFSHORE PIPELINE

LEGEND:

- SECURITY FENCING
- LANDFALL AND NEARSHORE SECTION HYDROTEST
- LANDFALL FACILITIES 32" HYDROTEST SEGMENT
- LANDFALL FACILITIES 24" HYDROTEST SEGMENT
- PRE-FABRICATED CONTAINERS AND PORTAKABINS

A. COMMON ELECTRICAL AND INSTRUMENTATION ROOM
B. ELECTRICAL AND INSTRUMENTATION ROOM PIPELINE 1
C. ELECTRICAL AND INSTRUMENTATION ROOM PIPELINE 2
D. ELECTRICAL AND INSTRUMENTATION ROOM PIPELINE 3
E. ELECTRICAL AND INSTRUMENTATION ROOM PIPELINE 4
F. MEASURING ROOM
G. CP CONTAINER
H. COMMON LOCAL CONTROL ROOM
I. MEETING / STAFF ROOM
J. MEETING / STAFF ROOM
K. OPERATORS ROOM
L. STORAGE FOR SPARE PARTS
M. TRANSFORMERS
N. DIESEL GENERATOR
O. DIESEL STORAGE TANK (9 m³)
P. DIESEL DISCHARGE TANK (1 m³)

NOTES:

1. ALL DIMENSIONS ARE IN mm.

Projection: Lambert Conformal Conic

Revision Details	By / Check	Date	Suffix

Purpose of issue: For Information

Client: South Stream Offshore Pipeline — Energising Europe

Project Title: SOUTH STREAM OFFSHORE PIPELINE

Drawing Title: Landfall Facilities Pre-commissioning Segments

Designed	Drawn	Checked	Approved	Date
RW	OAS	MJW		19/03/14

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Drawing Number: Figure 5.37 — Rev

5.4.3.2 Dewatering and Drying

Following a successful hydrostatic test, the pipeline will be dewatered and dried using oil free, dry compressed air provided by compressors and heatless desiccant air drying units. The compressor will have a total capacity of maximum pressure of 34.5 bar and have a standard flow rate of 59.4 Sm^3/minute at 20°C.

The dewatering process will clean the pipelines of any debris. Dewatering and drying will be performed by connecting a primary high pressure compressor and air drying unit to the temporary test head at one end of the testing segment and connecting a mobile tanker (lorry) or break tank to the test head at the other end of the testing segment to collect the hydrotest water. Oil free, dry, compressed air is then pumped into the pipeline to push out the hydrotest water and debris. It is anticipated that approximately 25 kg of debris will be produced by the dewatering process of the pipework associated with each 32-inch pipeline and corresponding 24-inch pipelines. The dewatering of the entire landfall facilities will produce approximately 100 kg of debris. The debris will be collected from the break tank (if used) and disposed of by an approved waste disposal company or alternatively, the mobile tanker (lorry) will collect the debris directly if a break tank is not used. As each pipeline within the landfall facilities will be hydrotested consecutively, it is possible that the filtered hydrotest water from the first pipeline segments (32-inch and 24-inch) will be collected and temporarily stored on site in tanks for hydrotesting the remaining three pipelines (32-inch and 24-inch segments) within the landfall facilities. If this is not possible, the filtered water (containing no particulates or chemicals) will be discharged by a hose into a sump constructed in an appropriate location within one of the temporary construction sites to allow the water to infiltrate into the ground.

Pumping of dry air into the pipeline segment will continue until the outlet dew point is approximately -50°C. On achieving the dryness criteria a 24 hour soak test shall be performed, followed by a further injection of the equivalent of two line volumes of dry air. A soak test is established industry practice of letting the pipeline soak towards the end of drying i.e. suspend the air injection and close-in the pipeline for 24 hours. Any remaining water will then be picked up by the undersaturated air and become visible when the flow of air is resumed. Drying of each pipeline (both segments) is anticipated to take approximately three days.

The hydrotesting, dewatering and drying of each pipeline (both segments) is anticipated to take approximately 23 days following set up of the pre-commissioning spread.

5.4.3.3 Purging of the Pipelines with Nitrogen

On completion of the drying operations, and prior to the introduction of gas, the pipeline will require purging with nitrogen to a pressure of 0.5 bar to avoid the formation of a potentially explosive gas/air mixture. Approximately 1,500 m^3 of nitrogen will be required for purging the entire landfall facilities pipework. Bottled nitrogen will be brought to the construction site. The nitrogen will be injected into the pipelines in conjunction with the air compressor spread.

When the oxygen level in the pipeline, as measured at each pipeline end, is equal to or less than 5% by volume, nitrogen purging is stopped, and pre-commissioning of the pipeline is finished. Purging of each pipeline (both segments) is anticipated to take approximately three days.

The estimated equipment required for the pre-commissioning activities at the landfall facilities are presented in Table 5.32.

Table 5.32 Summary of Equipment Required for Pre-Commissioning of the Landfall Facilities Pipework (both segments for a single pipeline)

Equipment	Number	Engine Power (kW)	Activity dB LAeq,T @10 m	Duration of Use (days)
Diesel flooding pumps	1	50	74	8
Diesel hydrostatic test pumps	1	10	67	6
Primary high pressure compressor	1	300	78	20
Air drying unit	1	300	78	14

5.4.4 Cleaning, Gauging and Drying of Whole South Stream Offshore Pipeline

As described in Section 5.4.1, there will be no hydrotesting of the pipelines between 30 m water depth in Russia and 36 m water depth in Bulgaria. Cleaning, gauging and drying of the South Stream Offshore Pipeline will be undertaken between a temporary PIG launcher/receiver at the fence of the landfall facilities in Russia and a temporary PIG launcher/receiver located at the fence of the landfall facilities in Bulgaria. The temporary PIG launcher/receiver used for each pipeline in Russia will likely be the same ones used for the pre-commissioning of the landfall and nearshore section pipelines. This cleaning, gauging and drying will be undertaken following completion of the pre-commissioning tests of the landfall and nearshore sections of the pipelines in both Russia and Bulgaria and completion of the pipeline tie-ins at the 30 m water depth between the nearshore and offshore pipeline sections. It should be noted that all wastes and discharges associated with cleaning, gauging and drying of the pipelines between Russian and Bulgaria will be collected and disposed of in Bulgaria.

The base case design, described here, assumes the cleaning and gauging PIGs will be transported through the pipelines from the temporary PIG launcher/receiver located at the Russian landfall facilities to the temporary PIG launcher/receiver located at the Bulgarian landfall facilities. However, it is possible that the outcome of the detailed design process and discussions with the appointed contractor may result in the PIGs being transported from Bulgaria to Russia. Should the direction that the PIGs are transported through the pipeline change, the management of change process described in Section 5.11 will be followed if it is deemed that this change may affect the results of the ESIA Report.

Cleaning, gauging and drying of the pipelines will be undertaken simultaneously using PIG trains consisting of cleaning and gauging PIGs and batches of MEG to dry the pipelines. The activities and durations are summarised in Table 5.33.

Table 5.33 Schedule of Pre-Commissioning Operations

Activity	Duration (days)
Pre-packing of pipeline with compressed air (undertaken in Bulgaria)	20
Cleaning, gauging and drying (using MEG) of pipeline	24
Venting of air from pipelines (undertaken in Bulgaria)	6
Purging of pipeline with nitrogen	3
Total	***53***

The dry air compressor package will consist of combined compressor and booster units, air drying units (to ensure there is not excessive moisture in the compressed air), metering, associated piping, spools, hoses and instrumentation. Each combined compressor and booster unit (same design ratings as those shown in Table 5.31) will have a total capacity of maximum pressure of 32 bar and have a maximum air delivery flow rate of 58.6 SM^3/minute at 20°C. The compressor spread will be located within the Landfall Facilities Construction Site and Pre-Commissioning/Commissioning Spread (Site E)

To meet compression requirements, approximately 80 combined compressor and booster units and 20 air drying units will be required at the PIG launching location to transport the PIG trains required for cleaning, gauging and drying activities of each pipeline.

It is anticipated that approximately 800 m^3 of MEG will be required to clean and dry each pipeline. The MEG and debris from the pipelines collected in front and in-between the PIGs, will be captured in temporary onshore tanks located at the temporary PIG launcher/receiver in Bulgaria, to allow the debris to separate from the MEG. The MEG and debris will be disposed of by an approved waste disposal company. It is anticipated that approximately 17-18 tonnes of debris will be collected by the cleaning PIGs for each pipeline.

It is anticipated that 10-20 m^3 of water may form within the pipelines during construction and installation as a result of condensation. Drying of the pipeline will be undertaken as part of the single PIG train launched from Russia that will simultaneously clean, gauge and dry the pipeline. As per the cleaning process described above, for the landfall and nearshore section pipelines, the MEG will be collected in secure tanks at the landfall facilities in Bulgaria and collected by an approved waste disposal company for disposal.

As is the case with the landfall and nearshore section pipelines, on completion of the drying operations of the pipeline, and prior to the introduction of gas, the pipeline will require nitrogen purging to avoid the formation of a potentially explosive gas/air mixture. When the oxygen level is sufficiently low, nitrogen purging is stopped, pre-commissioning of the pipeline is finished and commissioning can commence by introducing gas at the Russian end. Approximately 600,000 m^3 (at atmospheric pressure) of nitrogen will be injected into each pipeline at the Russian landfall facilities using two large electrostatic nitrogen membrane units. This results in 400,000 m^3 (assumed at 1.5 bar) of nitrogen being contained in each pipeline. Each pipeline will take approximately three to five days to fill with nitrogen.

The cleaning, gauging and drying of each of the four pipelines will be undertaken individually as they are completed. It is anticipated that all pre-commissioning activities of each pipeline between the temporary PIG launcher/receivers at the Russian and Bulgarian landfall facilities will take approximately seven weeks.

On completion of all pre-commissioning tests, the remaining pipeline tie-ins will be undertaken. This includes tie-ins to the "Expansion of the United Gas Supply System" upstream of the landfall facilities in Russia and tie-ins to the Receiving Terminal in Bulgaria being developed by South Stream Bulgaria AD (SSB) as part of the project known as "South Stream Pipeline System on the territory of the Republic of Bulgaria".

5.4.5 Summary of Waste / Discharges and Emissions Generated during Pre-Commissioning

5.4.5.1 Waste and Discharges during Pre-Commissioning Activities

A summary of the main wastes/discharges generated during pre-commissioning activities are summarised in Table 5.34. Further information on waste is provided in **Chapter 18 Waste Management**.

Table 5.34 Estimated Pre-Commissioning Wastes / Discharges

Pre-Commissioning Section	Waste / Discharge Type	Total Volume (all four pipelines)	Disposal Method
Landfall and Nearshore Section	Hydrotest water (seawater and oxygen scavenger)	8,000 m^3 including 1,808 litres oxygen scavenger (sodium bisulphite)	Discharged to sea at end of nearshore section in 30 m water depth
	Pipeline cleaning debris (rust, coating and welds)	0.8 tonnes	Collected at landfall facilities in breaker tanks and transported to licensed waste facility
	MEG	120 m^3	Collected onboard pre-commissioning vessel in secure tanks and shipped to shore for recycling or treatment and disposal at licensed waste facility.
	Grey and black water generated by pre-commissioning vessels	2,060 m^3 (grey water) 136 m^3 (black water)	Black water will be disposed of onshore or beyond 3NM from the shore. Disposal of grey water will comply with national regulations if more stringent than MARPOL requirements.
Landfall Facilities	Hydrotest water (freshwater)	500 m^3	Discharged to sump or removed from site by mobile tanker (lorry) to licensed waste handling facility.
	Pipeline cleaning debris (rust, coating and welds)	100 kg	Collected at landfall facilities in breaker tanks or directly in mobile tankers (lorry) and transported to licensed waste facility.

Continued...

Pre-Commissioning Section	Waste / Discharge Type	Total Volume (all four pipelines)	Disposal Method
South Stream Offshore Pipeline (Russian landfall facilities to Bulgarian landfall facilities)*	Batches of MEG for cleaning and drying	3,200 m^3	MEG received in Bulgaria will be collected in secure tanks and transported by mobile tankers (lorry) for recycling or treatment and disposal at licensed waste facility.
	Pipeline debris from cleaning (rust, coating and welds)	72 tonnes	Collected at Bulgarian landfall facilities in breaker tanks and transported to licensed waste facility.

* Waste and discharges collected at Bulgarian landfall facilities.

Complete.

5.4.5.2 Emissions to Atmosphere during Pre-Commissioning Activities

Table 5.35 presents the anticipated GHG and non-GHG emissions in Russia from the pre-commissioning activities to be undertaken for each pipeline.

Table 5.35 Atmospheric Emissions from Pre-Commissioning Activities (tonnes)

Pre-Commissioning Section	CO_2	NO_X	CO	PM	SO_2	NMVOC
Nearshore and Landfall Section (per pipeline)	41	2.2	0.5	0.2	0	0.2
Landfall Facilities (all 4 pipelines)	30	0.4	0.4	0	0	0.1
South Stream Offshore Pipeline (Russian landfall facilities to Bulgarian landfall facilities, per pipeline)	5,364	71	71	4	0	10

Further information on emissions to atmosphere is provided in **Chapter 9 Air Quality**.

5.5 Commissioning

The Project will be brought into service by the introduction of gas from the "Expansion of the United Gas Supply System", only after all control and monitoring systems have been commissioned in facilities upstream of the Project in Russia (Gazprom's Russkaya CS) and downstream of the Project in Bulgaria (SSB's Receiving Terminal).

Each pipeline will be commissioned separately and come into operation separately in line with the schedule set out in Figure 5.7.

The first injection of hydrocarbon gas can be made behind a PIG, or directly, without the presence of a PIG. The objective of the gas injection step is to sweep out the nitrogen or any non-sale gas (if MEG is not allowed in the export gas, for instance). The presence of MEG will depend on whether or not MEG was used for the drying of the pipelines as described in Section 5.4. The volume of nitrogen gas within each pipeline is 400,000 m^3 (assumed at 1.5 bar) and approximately 600,000 m^3 to 800,000 m^3 when vented to the atmosphere via the vent stack at the Project landfall facilities in Bulgaria.

After pre-commissioning is completed each pipeline will contain nitrogen and traces of water (estimated at 1 m^3) and MEG (estimated at 106 m^3) which has been used to dry the pipeline. The small volumes of water and MEG will not be vented but will exist as a thin layer of liquid against the walls of the pipeline. This thin MEG/water liquid film will be gradually entrained by the transport gas during the first days / weeks of gas transport operations. It anticipated that the small traces of MEG will be removed slowly from the pipeline at the Receiving Terminal in Bulgaria operated by SSB. These traces of MEG/water are not anticipated to have an impact on the operations of the Receiving Terminal.

5.5.1 Temporary Gas Heating Requirements

During the commissioning process the pressure in the South Stream Offshore Pipeline needs to be gradually raised from 1.5 - 2 bar (the settle out pressure after pre-commissioning) to 65 - 100 bar (the pressure required for the Receiving Terminal in Bulgaria to start exporting gas to the downstream South Stream Pipeline System).

However, it is anticipated that the initial gas supplied from the Russkaya CS for commissioning purposes will not be supplied at 2 bar and a temperature ranging between -5 and +50°C but at pressure ranging between 100 bar (for the pipeline #1, December 2015) and 283.3 bar for subsequent pipelines (pipeline #2, December 2016; pipeline #3, June 2017, and pipeline #4, December 2017).

Therefore, the gas pressure will have to be reduced at the landfall facilities prior to gas injection. However, by reducing the pressure to 1.5 - 2 bar, this will result in the gas in the pipelines cooling substantially, in the range of 40 - 90°C, due to the temperature reduction caused by the Joule Thomson effect as it is transported across the Black Sea. Thus, to avoid the gas arriving at the Bulgarian landfall facilities below the intended operating temperature of -5°C, a temporary commissioning heater is required to heat the gas at the landfall facilities in Russia prior to it being injected into the pipeline. The requirement for gas heating is only necessary as a result of the low pressures necessary during commissioning and start-up.

To achieve a minimum inlet gas temperature of 0°C at a pressure of 100 bar at the landfall facilities, a 4 MW direct fire heater is required to achieve this level of pressurisation. For the case of a second pipeline (assuming the compressors at the Russkaya CS are already running for the operation of pipeline #1) the same heater duty can be used for compressor discharge temperatures above 35°C. Although for the start-up of pipelines #2, #3 and #4, the gas temperature from the Russkaya CS will be >35°C, the pressure differential is larger (>280 bar) than for the pipeline #1 (approximately 98 bar), which is enough to result in temperature at the pipeline inlet to be below 0°C when the valve is open (due to Joule Thomson effect). Hence, to avoid the temperature dropping below 0°C, the heater is required.

The 4 MW direct fire heater will be mobile and deployed to the landfall facilities when required for commissioning of each pipeline. The heater will occupy a footprint of approximately 12 m by 13 m, and it is anticipated it be connected to the FCV bypass line with double block and bleed isolations to removable flange plates. The heater will be gas powered and is anticipated to consume approximately 400 kg / hour. Emissions to atmosphere from the heater will be via 10 m high, 0.5 m diameter chimney. The heater will require to be in operation for approximately six days (allowing a further four days for the compressors to bring the pipeline pressure and flow up to normal operating conditions as described in Section 5.6.1).

A summary of the characteristics of the heater is shown in Table 5.36 and estimated emissions per pipeline are provided in Table 5.37.

Table 5.36 Temporary Gas Heating Requirements per Pipeline

Parameter	Value
Power	4 MW
Fuel	Gas
Fuel Consumption	400 kg/hour
Calorific Value of Gas	50,000 kilojoules (kJ)/kg
Chimney Height	10 m
Chimney Diameter	0.5 m
Maximum Noise Level	90 dB
Duration of Operation	144 hours

Table 5.37 Atmospheric Emissions from Temporary Gas Heaters per Pipeline (tonnes)

	CO_2	NO_X	CO	NMVOC
Tonnes	158	0.13	0.04	0.009

5.5.2 Pipeline Gas Injection with a PIG

Injection of gas behind a PIG launched from the Russian landfall facilities will push the nitrogen towards the landfall facilities. Filling of the pipeline with gas is considered complete once the PIG has been recovered from the receiving trap in the landfall facilities.

During the early stages of the commissioning operation, a temporary valve within the Bulgarian landfall facilities is kept open so that the nitrogen is expelled from the pipeline at the receiving PIG trap and vented to the atmosphere via the vent stack as it is pushed through the pipeline by the PIG transported by the gas.

The duration required to sweep out the nitrogen mainly depends on the gas injection rate. Assuming a gas injection rate of 1.9 kilograms per second (kg/s), resulting in an average pigging speed of 3 m/s, it will take approximately five days for the pigging run to sweep out the nitrogen which will be vented from the vent stack within the Bulgarian landfall facilities. This will result in a venting release rate to atmosphere (at normal conditions) of 0.12 to 0.16 Million Cubic Metres per day (MMCM/day) from the vent stack.

5.5.3 Pipeline Gas Injection without a PIG

Alternatively, the gas could be injected directly into the pipeline, if the water dew point and the oxygen content requirements are met. The gas will displace the nitrogen, but a mixture of gases will form at the interface between the gas and nitrogen, forming what is commonly referred to as a mixing zone. The length of the mixing zone is estimated to be approximately three kilometres.

Assuming a gas injection rate of 14 kg/s, resulting in an average gas velocity of 22 m/s, it will take approximately two days to vent the nitrogen from the vent stack. This will result in a venting release rate to atmosphere (at normal conditions) of 0.3 to 0.4 MMCM/day from the vent stack located in the Bulgarian landfall facilities.

5.5.4 Pipeline Pressurisation

When the non-sale gas is swept out of the pipeline and the gas quality meets export conditions, the ESD valve at the Bulgarian landfall facilities end will be closed and pipeline pressurisation can commence. This pressurisation step will fill the pipeline up to an equalisation pressure of 65 bar (summer conditions) or 87 bar (winter conditions), making the South Stream Offshore Pipeline ready to start supplying gas to the Receiving Terminal. It is anticipated that each pipeline will take approximately ten days to fill with gas and commissioning activities will take approximately two weeks to complete.

During pipeline pressurisation quality control measurements will be carried out at the landfall facilities. Checks will be performed on all equipment used for detecting and sealing any gas leaks. In order to detect any leakage during start-up, there will be continuous metering of the pipelines for which the internal pipeline pressure exceeds the external pressure. Once the gas composition meter confirms that the gas at the landfall facilities meets the export gas specification, the South Stream Offshore Pipeline is ready to commence normal operation and gas transportation.

The entire filling and pressurisation operation will be documented in detailed work procedures prior to commencement of this activity. These procedures will be developed during the detailed design phase and will include all activities necessary to complete commissioning and achieve start-up status.

5.6 Operational Phase

5.6.1 South Stream Offshore Pipeline Operating Philosophy

The pipelines will have a maximum operating pressure of approximately 284 bar at the inlet to the landfall facilities. However, when the gas makes landfall in Bulgaria the operating pressure of the pipeline will have fallen to between 65 and 87 bar and the temperature of the gas will be approximately -5°C. The maximum daily capacity of each pipeline under normal conditions will be 47.9 MMSCM/day and a maximum of 63 BCM of gas will be transported by all four pipelines each year. The pipelines will be operated seven days a week, 24 hours per day.

The operating philosophy of the South Stream Offshore Pipeline is based on the principle of having a constant gas inventory (i.e. there is always gas stored in the pipelines) within the pipeline system. During normal operations, the gas inventory in each South Stream Offshore Pipeline is evaluated to range between 104 and 111 MMSCM with a pipeline throughput of 47.9 MMSCM/day.

The principle of a constant gas inventory relies on the proper, and synchronised, operation with the Russkaya CS in Russia and the Receiving Terminal in Bulgaria. The Russkaya CS and the Receiving Terminal in Bulgaria will determine the flow, pressure and temperature of the gas in the South Stream Offshore Pipeline during normal operation. The four individual pipelines will effectively be operated as a single pipeline and there will be no control system specific to each pipeline at the Russkaya CS or at the Bulgarian Receiving Terminal.

The South Stream Offshore Pipeline must operate within the pipeline inventory limits to maintain a safe and reliable system. A constant gas inventory guarantees that daily contractual gas transportation volumes (known as nominations) can be met when accurate flow measurement and reliable valve control are combined. The constant gas inventory also ensures that the time required to alter the gas supply rate in response to a decrease or increase in demand for gas can be met in the shortest time possible. This can be achieved by decreasing or increasing the pressure in the pipelines. The gas inventory of each South Stream Offshore Pipeline for various flow rates is summarised in Table 5.38. If for example, the flow rate was reduced to 60% of the maximum flow rate, it would take approximately three to five days for the flow rate to be ramped back up to 100%.

Table 5.38 South Stream Offshore Pipeline Gas Inventory

% of Maximum Flow Rate	Flow Rate (MMSCM/day)	Gas Inventory per Pipeline (MMSCM)	
		Average Winter Conditions	Average Summer Conditions
20	9.6	42.6	42.5
40	19.2	57.1	57.1
60	28.7	73.7	73.7
80	38.3	89.5	89.5
100	47.9	106.5	103.7

All four offshore pipelines will be operating at the same daily nomination, provided the discharge pressure of each offshore pipeline is the same. However, if necessary (for example due to a fall in demand for gas) it is possible to reduce the number of pipelines in operation as an alternative to reducing the flow of gas across all four pipelines.

The main process valves at the landfall facilities will be open during normal operations, and the landfall facilities will effectively only transport the gas from inlet to outlet. The landfall facilities will include customised containers with monitoring metrology equipment, which will effectively act as the local control room. During normal operation there will be no workers based at the landfall facilities, however some workers will be required during pigging activities, start-up (following a shutdown), and maintenance activities.

5.6.1.1 South Stream Offshore Pipeline Parameter Monitoring

Pressure, temperature, flow, and gas composition (including water and hydrocarbon dew point) will be monitored by equipment at the landfall facilities and remotely in the CCR and BUCR by continuous real time monitoring of process conditions via the Supervisory Control and Data Acquisition (SCADA) system. The aforementioned parameters will be monitored by the SCADA system to estimate the gas inventory in each of the four pipelines (or however many are in operation) on a real time basis through the Pipeline Performance System (online simulator). There is no control system at the landfall facilities or, more generally, within the South Stream Offshore Pipeline to manage gas flows, pressures etc. Control of gas flows will be carried out at the upstream Russkaya CS and the downstream Receiving Terminal in Bulgaria.

However, as the South Stream Offshore Pipeline (including landfall facilities) is operated by a different organisation from the Russkaya CS (Gazprom Invest) and Bulgarian Receiving Terminal (SSB), it is necessary that certain process isolation, vent and blow down features are included in the landfall facilities. This is to ensure that South Stream Transport has independent means to stop gas from entering / leaving the pipeline, or to vent gas, as and when required (for example in the case of an emergency situation such as a pipeline leak). The vent system also allows for the pipelines to be depressurised for maintenance activities to take place if necessary.

To ensure that the gas inventory requirements do not deviate from the low and high band volumes (for example 104 and 111 MMSCM at maximum throughput), low and high alarms will be installed at the landfall facilities. Should there be an irregularity (or deviation), this information will be transmitted to the CCR, the Russkaya CS, and the Receiving Terminal in Bulgaria where the operators can carry out balancing operations (i.e. increasing or decreasing the gas inventory), which, in turn, may lead to an operational decision to shut down the gas supply to the Pipeline. Alarms will also be installed to detect changes in the gas pressures and temperatures.

Further to the alarm systems, trip systems will be installed at the landfall facilities. The trip systems will be designed to automatically shut down the South Stream Offshore Pipeline if minimum or maximum design standards (for gas pressure, temperatures or flows) are detected by the SCADA system. The automatic (emergency) shut down will ensure that the South Stream Offshore Pipeline is protected from damage.

The safeguarding features to be installed at the landfall facilities for normal operating conditions are shown in Table 5.39. In general, alarms will initially inform the operator of a problem to allow them to take the necessary operational activities to address the issue; the alarm would not however initiate a shutdown of the pipelines. If the problem persists, and a calculated trip setting is reached, the pipelines will be shut down automatically via the SCADA system.

Table 5.39 Project Safeguarding Alarm and Trip Systems

Abnormal Pipeline Condition	Cause of Abnormal Pipeline Condition	Safeguarding Feature
High Pressure	High operating pressure	Alarm and trip system - alarm will be raised when the pipeline pressure reaches an operating pressure of 290 bar and the trip will occur if the pressure reaches the design pressure of 300 bar.
Low Pressure	Low operating pressure Leakage and/or rupture	Alarm and trip system - alarm will be raised when the pipeline pressure drops to 10 bar above the minimum operating pressure of 65 bar (i.e. 75 bar) and the trip will occur if the operating pressure drops to the minimum pipeline system pressure (i.e. 65 bar).
High Temperature	High ambient temperatures High operating temperatures	Alarm and trip system - alarm will be raised if the gas temperature reaches 5°C below the maximum design temperature of 55°C (i.e. 50°C) and the system will trip if the gas reaches the maximum design temperature.
Low Temperature	Low ambient temperatures Low operating temperatures High pressure drop (Joule-Thomson effect)	Alarm and trip system - the minimum design temperature of the landfall facilities is -40°C with the exception of the pipelines within the landfall facilities and vent system, which has a minimum design temperature of -25°C and -150°C, respectively. Alarms will be sounded if the temperature drops to 5°C above the minimum design temperature (-35°C landfall facilities and -20°C pipelines). The system will trip if the landfall facilities and pipelines temperature fall to the minimum design temperature of -40°C (landfall facilities) and -25°C (pipelines.) The minimum design temperature of the pipelines downstream of the landfall facilities is -10°C. The alarm will be raised and if the temperature drops to -5°C and the system will trip if the temperature falls to -10°C.

Continued...

Abnormal Pipeline Condition	Cause of Abnormal Pipeline Condition	Safeguarding Feature
High Flow	Abnormal operating condition Downstream pipeline leak / rupture	Two types of high flow alarms will be installed at the landfall facilities: Main flow meter - the maximum daily capacity of each individual pipeline is 47.9 MMSCM/d. The alarm will activate if a flow rate of 5% greater than the maximum capacity (50 MMSCM/d) is detected. FCV control loop - An FCV is installed for the operational pigging process. Operational pigging requires a reduced flow rate of approximately 28.7 MMSCM/d. A too high flow rate results in the PIGs being transported through the pipelines too fast, thus a high flow alarm is provided. The alarm set point will be at 10% above the required pigging flow rate (32 MMSCM/d).
Low Flow	Reduced / no flow at the Russkaya CS Accidental valve closure Hydrates Pipeline rupture Pipeline blockage (hydrate, PIG, flooding due to leak).	Two types of low flow alarms will be installed at the landfall facilities: Main flow meter - The alarm will activate if the flow rate falls to 10% of the daily flow rate capacity (approximately 5 MMSCM). FCV control loop - A low flow rate is an indication of an abnormal operating condition such as FCV controller failure or stuck pig. The alarm set point will be set at 10% below the required pigging flow rate (26 MMSCM/d).

Complete.

Leak Detection

The South Stream Offshore Pipeline will be monitored by a Leak Detection System that operates on the basis of flow, pressure and temperature monitoring, thereby detecting gas losses on an automatic basis. These parameters are measured in continuous real time via the SCADA system. If the system detects a potential leak by detecting changes in the aforementioned parameters it will automatically alert the operators at the CCR and BUCR, however, it will not necessarily initiate an automatic shutdown.

It will be possible to detect leaks down to approximately 1-2% of gas throughput. Very small leaks offshore might not be detected by the system when they are smaller than the accuracy of the measurement and calculations. Both will be fine-tuned constantly during operation so the accuracy will increase with time and operating experience.

Information on emergency shut downs as a result of a confirmed leak is provided in Section 5.6.2. The location of a leak may be calculated to within an accuracy of approximately 100 m using the measured flow, pressure and temperature data recorded at the landfall facilities.

5.6.2 Pipeline Shut Down and Restart Process

5.6.2.1 Pipeline Shut Down

During the operation of the South Stream Offshore Pipeline there may be a requirement to shut down the pipelines from time to time. Different types of pipeline shut down exist. These are:

- Process Shut Down (PSD), which corresponds to a stop of flow (closure of external ESD valves); and
- Emergency Shut Down (ESD), which applies to a F&G detection scenario (closure of external and internal ESD valves).

The shut down philosophy is based on the following principles:

- A constant gas inventory is to be maintained as much as possible so as to meet contractual requirements and also to allow a fast restart of the gas transport operations;
- Shut downs are to be performed in such a way so as to minimise the need for manned intervention for a restart;
- Best efforts will be used to minimise the need for shut downs for maintenance or modifications; and
- Gas will be vented only when a release is an absolute necessity.

The process safeguarding elements are used to shut down the South Stream Offshore Pipeline and, possibly, isolate the landfall facilities when there is an absolute necessity to do so. Some or all of the ESD/FCV valves which are not normally in use and are in the open position (or bypassed for the FCV) will close when a shut down occurs.

Process Shut Down

A PSD of the pipelines may be necessary during the lifetime of the South Stream Offshore Pipeline to carry out scheduled repairs or inspections. This is a planned event and will be undertaken under controlled conditions. The PSD will be carried out by operations at the Russkaya CS and at the Bulgarian Receiving Terminal. Normal shut down and ramp-down of gas flow is done by reducing the flow progressively to the required flow rate or by completely shutting down the flow in and out of the South Stream Offshore Pipeline at the Russkaya CS and Bulgarian Receiving Terminal.

Emergency Shutdowns

The landfall facilities will have local ESD and safety systems. Should there be an incident (unplanned event) such as those described in Table 5.39, the ESD system will be triggered and the pipelines will isolate themselves. The gas volume in the pipelines will then be automatically isolated from the landfall facilities, by closing the landfall facilities inlet and outlet ESD valves, thereby maintaining a constant gas inventory within the offshore pipeline.

During an ESD, the inlet ESD valve connected to the incoming 32-inch pipelines from the “Expansion of the United Gas Supply System” (within the landfall facilities), as well as the outlet ESD valves installed in the outgoing 32-inch pipelines are closed. The landfall facilities are kept pressurised during an F&G event to prevent further gas being potentially supplied to the location of the fire through venting.

The underlying principle is to stop the supply of gas to a fire (should there be one), and at the same time maintain a constant gas inventory within the pipeline. The inlet ESD valves in the incoming pipelines from "Expansion of the United Gas Supply System" as well as the outlet ESD valves in the outgoing pipelines from the landfall facilities will be closed.

Information on emergency pipeline repairs is provided in Section 5.6.5.

5.6.2.2 Restart Procedure

The restart procedure after a PSD or an ESD will depend on the pressure levels within the isolated systems. Pressure equalisation across the systems is planned to be achieved using bypass systems installed within the landfall facilities. The bypass systems consist of cast line heater (electric, in line circulation heaters that are designed to quickly and safely heat liquids and gases) to balance the temperature drop in the gas caused by choking, and a TCV that regulates the flow rate passing through the bypass line.

The restart can proceed if the following conditions are met:

- The cause of the ESD has been detected;
- The remedial actions have been completed (including eventual repairs and acceptance testing); and
- All safety related conditions have been met or exceeded.

After an ESD, the offshore pipelines settling out pressure is significantly lower than the pressure at the Russian landfall facilities and/or at the upstream Russkaya CS and is significantly higher than the pressure at the Bulgarian landfall facilities and/or at the downstream Bulgarian Receiving Terminal.

Before the gas transportation can be restarted by the upstream Russkaya CS in Russia and the downstream Receiving Terminal in Bulgaria, the ESD valves at the landfall facilities in Russia and Bulgaria will need to be reopened. The pressure equalising provisions (bypass system) are installed across each of the ESD valves (three per pipeline) for a quick restart. It is considered that it will take three days for pressure equalisation and ESD valve reopening at the landfall facilities in Russia and Bulgaria to be completed.

The general steps to be followed for a restart of the South Stream Offshore Pipeline for each shut down type are summarised in Figure 5.38. The restart procedure of the South Stream Offshore Pipeline will be completed when the pressure throughout the pipeline has equalised and when the ESD valves at the landfall facilities (both in Russia and Bulgaria) have been reopened.

Normal ramp-up of gas flow rate will be achieved by increasing the flow gradually until the targeted supply rate is reached. Such operation will be initiated and/or performed at the Russkaya CS and the Bulgarian Receiving Terminal simultaneously in order to maintain a constant gas inventory in the offshore pipelines. Such ramp-up will be driven by daily contractual supply requirements at the time.

5.6.3 Maintenance

5.6.3.1 External Pipeline Surveillance

Landfall Section Pipelines

Onshore cathodic protection monitoring will be undertaken manually with the monitoring undertaken at test posts distributed along the route of each pipeline at approximately 500-600 m intervals. The test stations will be on the centre line of each buried pipeline. At these test stations, a trained technician using a high impedance meter and copper sulphate half-cell will measure the cathodic protection potential. There will also be current measurement spans on each pipeline to measure current flow and direction for system balancing. At the transformer rectifier locations information on voltage and current may be collected manually or they may be connected to the Remote Terminal Unit (RTU) and SCADA.

Figure 5.38 Pipeline Restart Procedure

Restart Procedure from PSD

- Close the FCV, including the block valve parallel to this valve
- Turn on the heater in the bypass of the inlet ESD valve and wait for its temperature to reach 55 °C
- Open the ESD valve in the bypass of the inlet ESD valve
- Fill the piping section between the inlet ESD valve and the FCV with process gas through the TCV in the bypass
- Once the pressure has equalised, open the inlet ESD valve, turn off the heater and close the bypass
- Gradually increase the opening of the FCV until fully open and the pressure drop is minimised
- Open the block valve parallel to the FCV, and subsequently close the FCV

Restart Procedure from an ESD

Reopening of the Outlet ESD Valve

- Check the pipeline settle-out pressure
- Check that the FCV, including the block valve parallel to this valve are closed
- Open the BDV downstream of the FCV until the pressure has reduced to pipeline settle-out condition
- Once the pressure has equalised, close the BDV
- Open the outlet ESD valve
- Gradually increase the opening of the FCV until the pressure is equalised
- Open the block valve parallel to the FCV, and subsequently close the FCV

Reopening of the Inlet ESD Valve

- During ideal conditions, the inlet ESD valve does not need any equalisation. In this situation the inlet ESD valve can be reopened as soon as the outlet ESD valve is opened allowing the pressure differential to be held by the FCV
- Realistically, the 24-inch inlet ESD valve will close faster than the 32-inch outlet ESD valve, hence the pressure upstream of the inlet ESD valve will be slightly higher than the pressure downstream of the inlet ESD valve. The procedure presented to restart from a PSD is the basis for this situation

Nearshore and Offshore Pipeline Sections

The external condition of the subsea pipeline, including the condition of the cathodic protection system, will be monitored on a regular basis as set out in Table 5.40 using ROV or Autonomous

Underwater Vehicles (AUV) and inspection technologies including sonar scans to visual (camera) inspections.

In accordance with the requirements of the concession granted by DNV to waive the need for hydrotesting the South Stream Offshore Pipeline in water depth deeper than 30 m, an initial ROV subsea leak inspection survey will be carried out along the pipelines as soon as practicable once the pipelines become operational and sufficient gas flow rates are achieved.

Critical sections of the pipeline route will be surveyed at more frequent intervals, initially on an annual basis and subsequently more or less frequently, depending on actual findings (e.g. growth of free span). Critical sections of the pipeline route may include:

- Steep slopes;
- Continental shelf break;
- Buried or trenched sections of the pipelines; and
- Any areas where free spans or other seabed anomalies may occur (based upon earlier inspections).

Table 5.40 Proposed External Inspection Surveys of the Nearshore and Offshore Section Pipelines

External Inspection	Inspection Method	Proposed Frequency of Inspection	Survey Duration per Pipeline
Critical Pipeline Sections Survey	ROV	Annually	Approximately five days (allows for operational downtime and weather standby etc.)
Entire Pipeline Route Survey	ROV	Before start up or within one year of operation commencing	Approximately 30 days (allows for operational downtime and weather standby etc.)
	AUV	Every five years thereafter	Approximately 11 days (allows for operational downtime and weather standby etc.)
Cathodic Protection Survey	ROV	Before start up or within one year of operation commencing After five years of operation Every ten years thereafter	Approximately 30 days (allows for operational downtime and weather standby etc.)

It is anticipated that the offshore surveys would involve vessels of characteristics such as the GSP Prince. Details of this vessel are shown in Table 5.18

5.6.3.2 Internal Pipeline Surveillance

Following the completion of pipeline gauging during pre-commissioning tests, further internal inspections of the pipelines using PIGs are not expected to be required until approximately five years after initial start-up and operation. The frequency of testing can be increased or decreased depending on the results of previous inspection runs, survey information and regulatory requirements. The proposed frequency of internal pipeline inspections is shown in Table 5.41.

Table 5.41 Proposed Internal Pipeline Inspection Surveys

Internal Inspection	Inspection Method	Proposed Frequency of Inspection
Wall thickness measurement	Intelligent PIG	Before start up or within 1 year of operation commencing Every 5 years thereafter
Pipeline position	XYZ Mapping PIG	Before start up or within 1 year of operation commencing Every 5 years thereafter
Pipeline geometry	Gauging PIG	Before start up Prior to running calliper or intelligent PIGs
	Calliper PIG	Before start up Every 5 years thereafter

Internal pipeline cleaning is not anticipated to be required due to the composition of the dry gas that will be transported through the pipelines. However, any cleaning that may be required will be undertaken using cleaning PIGs transported using gas. Gas flow rates in the pipeline will be reduced to approximately 60% of the maximum flow rate during pigging activities. Furthermore, a Pipeline Integrity Management System (PIMS) will be developed to control on-going monitoring / maintenance during system operation, with a specific focus on corrosion control.

5.6.4 Landfall Facilities

Maintenance for the landfall facilities is equipment / vendor specific and therefore will not be confirmed until the detailed design phase is complete and contracts have been awarded for the provision of equipment. However, examples of the typical maintenance and frequency of maintenance and inspections is provided in Table 5.42.

Table 5.42 Typical Landfall Facilities Equipment Maintenance and Inspections

Maintenance Activity	Indicative Frequency of Inspection
Recalibration of safety metering system	Annual
Calibration of gas metering system	Monthly
Maintenance / replacement of main hydraulic packs / pumps	Two years (or as necessary)
Test of fire fighting systems / equipment	Monthly
Inspection of security systems (CCTV)	Monthly
Inspection of start-up heating system	Monthly

5.6.5 Emergency Pipeline Repair

Although the probability of failure of a properly designed and installed deepwater pipeline is negligible, South Stream Transport will employ an Emergency Pipeline Repair Strategy (EPRS) for the South Stream Offshore Pipeline to be utilised in the event of damage to any of the pipelines. A repair philosophy has been prepared by South Stream Transport, which has led to the planned development of the EPRS by the pipe-lay contractor. The pipe-lay contractor will make available procedures and undertake emergency pipeline repair (permanent and temporary works) during the execution of the Construction and Pre-Commissioning Phase and into the first two years of the Operational Phase (up to a maximum of three years in the event of a repair) warranty period. From the end of the warranty period the EPRS will be controlled by South Stream Transport. This will either be done using the same EPRS or a different one that South Stream Transport may choose to adopt.

A key objective of the EPRS is to have a Repair Plan in place which reinstates the pipeline integrity and ensures the earliest possible and safe commencement of gas throughput. The Repair Plan has been prepared to provide a high level overview into recommended repair procedures and the relevant hardware and tools.

Repairs

For different types of damage, different types of repair and re-commissioning methods are applicable. Preparation of a pipeline for repair will be aimed at minimising or avoiding any impact on pipeline integrity, therefore avoiding water ingress. If water ingress is inevitable, or has already occurred, then dewatering/replacing salt or contaminated water with chemically treated water will be essential to stabilise the pipeline condition and to minimise corrosion whilst a case specific Repair Plan is developed and executed. The preferred approach will be to isolate the defected area (using plugs if pigging is feasible) and create a safe work environment for repair. Prior to re-commissioning a repaired pipeline, the pipeline must be cleaned, dewatered and/or conditioned to ensure the pipeline is clean, without defect and free of water. After a repair is made, whether it is offshore or onshore, the pipeline will be commissioned through pigging and drying and then gas can be re-introduced into the pipeline, thereafter resuming normal operating conditions.

The unplanned events and potential associated damage, which may occur to the pipelines is described in more detail in **Chapter 19 Unplanned Events**.

5.6.6 Land Use during the Operational Phase

Land will be acquired for Project infrastructure and to allow for operations, maintenance and emergency access during the operational life of the Project. The land take is summarised in Table 5.43.

Table 5.43 Permanent Land Use during the Operational Phase

Component	Permanent Land Take Area (ha)
Landfall Facilities	4.85
Pipeline RoW	23.75
Engineered cut and fill slopes (surrounding Landfall Facilities)	4.83*
Varvarovka bypass road (used only during the Construction Phase of the Project)	2.6
Anode bed	0.05

* 1.3 ha of the engineered cut and fill slopes area is located within the Pipeline RoW, therefore the area of engineered cut and fill slope that adds to the total permanent landtake is 3.53 ha.

The permanent RoW will be approximately 95 m wide (19 m either side of the centreline of the outermost pipelines) and 2.5 km long (0.1 km upstream and 2.4 km downstream of the landfall facilities) and will result in a permanent land take of approximately 23.75 ha, of which 1.3 ha is also part of the engineered cut and fill slopes required for construction of the Landfall Facilities. The permanent RoW is illustrated in Figure 5.39 and shown in Figure 5.40.

The pipeline permanent RoW will be indicated by land and aerial markers. Warning signs to indicate the presence of the pipelines will also be erected at specific locations along the pipeline route. Deep rooting trees or permanent crops will not be allowed to grow, however bushes and other shallow rooted vegetation will be allowed to grow naturally or will be planted. A track suitable for 4x4 vehicles only, will be present within the RoW for inspection purposes of the pipelines.

5.6.6.1 Onshore Safety Exclusion Zones

In addition to the permanent RoW there will be three Safety Exclusion Zones for the protection of public health and infrastructure from the centreline of the outermost pipelines in line with the requirements of Gazprom Standard STO 2-2.1-249 – 2008 for Main Gas Pipelines and in accordance with the regulatory requirements set out for the Proekt (see **Chapter 2 Policy, Regulatory and Administrative Framework**). The proposed exclusion zones are as follows:

- Between 19 and 260 m from centreline of outermost pipeline: C- and E-class: no isolated buildings (1-2 levels), dachas, agricultural farms;
- Between 260 and 345 m from centreline of outermost pipeline: B-class: no cities, settlements, apartments of three levels or more, no developments / buildings with less than 100 people; and
- Between 345 and 410 m from centreline of outermost pipeline: A-class: no airports, railways station, no developments/buildings with population of more than 100 persons.

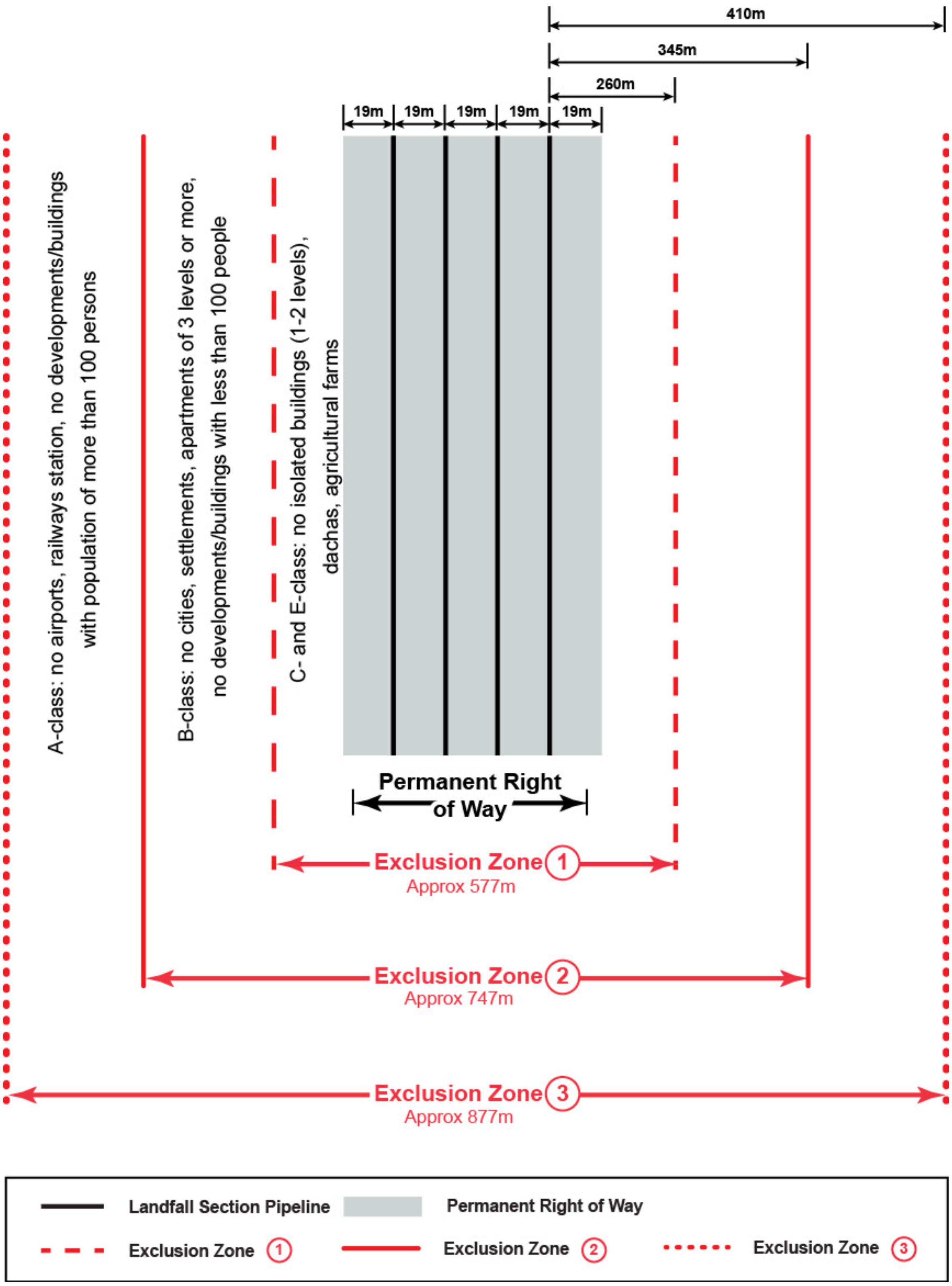
Operational environment and safety issues will be managed and monitored as part of the overall South Stream Offshore Pipeline Health, Safety, Security and Environmental Integrated Management System (HSSE-IMS). Further information on the HSSE-IMS is provided in **Chapter 22 Environmental and Social Management**.

5.6.7 Offshore Exclusion Zones

To ensure that the subsea pipelines are not damaged by third party activities (e.g. dragged anchors, fishing gear, etc.) during the Operational Phase, exclusion zones will be put in place along the pipeline route to restrict activities that may damage the pipelines. These exclusion zones will reduce the potential impact on that part of the seabed, thereby they are a type of avoidance measure.

The proposed offshore exclusion zones will be agreed in consultation with the appropriate authorities. It is anticipated that the exclusion zone will extend to 0.5 km (0.3 NM) either side of the outermost pipelines from the microtunnel exit pit until the Russian / Turkish EEZ boundary (except for a section on the Russian continental slope where the pipelines diverge into two groups of two) as illustrated in Figure 5.41.

Figure 5.39 Permanent RoW and Safety Exclusion Zones, Russian Sector Operational Phase



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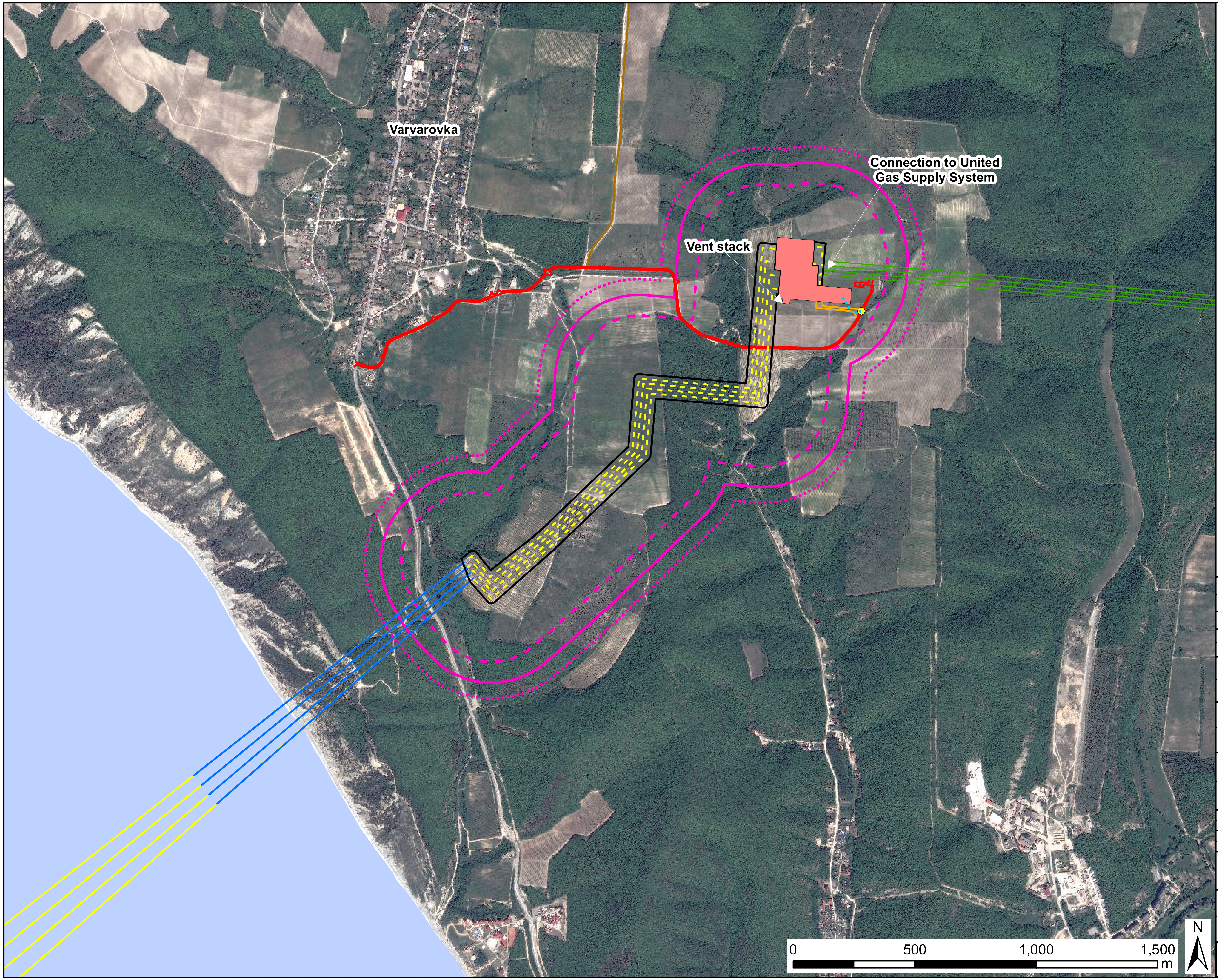

LEGEND

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Landfall facilities
- Anode ground bed for cathodic protection of pipelines
- Proposed microtunnels
- Proposed offshore pipelines
- Right-of-Way
- Anode ground bed connection to landfall facilities
- Permanent access road to be constructed by SSTTBV
- Varvarovka bypass road (used by Project during construction only)

Safety Exclusion Zones

- C- and E-class: no isolated buildings (1-2 levels), dachas, agricultural farms
- B-class: no cities, settlements, apartments of 3 levels or more, no developments/buildings with less than 100 people
- A-class: no airports, railways station, no developments/ buildings with population of more than 100 persons

United Gas Supply System

- United Gas Supply System pipelines
- Permanent access road to be constructed by Gazprom Invest

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Revision Details	By / Check	Check / Date	Suffix

Purpose of Issue
For Information

Client
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Offshore Pipeline
ENERGISING EUROPE

Project Title
SOUTH STREAM OFFSHORE PIPELINE

Drawing Title
PERMANENT RIGHT-OF-WAY AND SAFETY EXCLUSION ZONES – PROJECT OPERATIONAL PHASE

Drawn	Checked	Approved	Date
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URS Internal Project No.	Scale @ A3
46369082	1:15,000

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Figure 5.40

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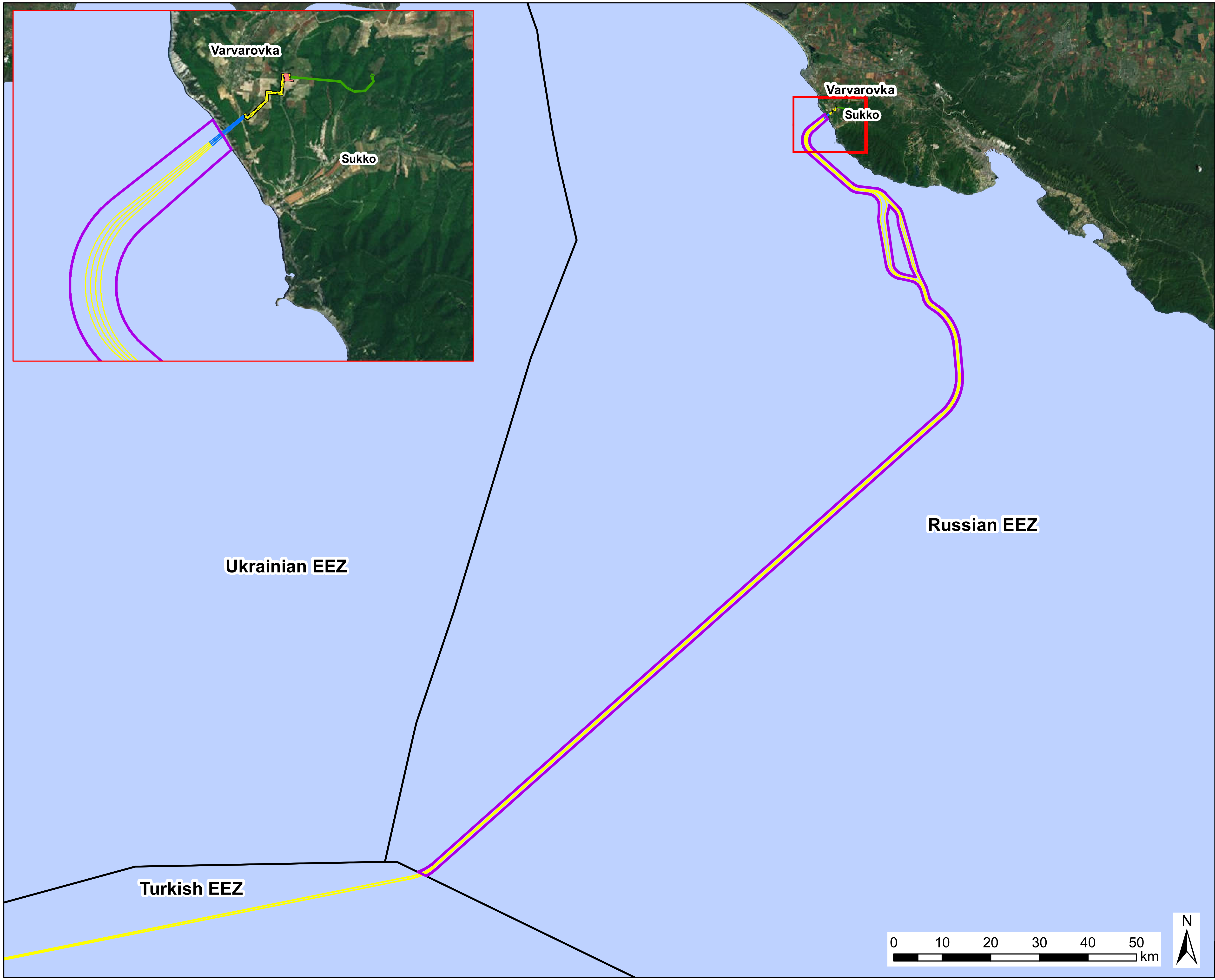
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 5 Project Description\Figure 5-40 Permanent RoW and Safety Exclusion Zones – Project Operational Phase.mxd



LEGEND

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Proposed offshore pipelines
- Landfall facilities
- Proposed microtunnels
- Right-of-Way
- Offshore safety exclusion zone

United Gas Supply System

- United Gas Supply System pipelines
- Exclusive Economic Zone boundary

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Drawing Number

Figure 5.41

Rev

5.7 Pipeline Design Safety and Risk Assessment

An integrated HSSE-IMS has been developed in accordance with GIIP and in line with the requirements of ISO 14001:2004 (environmental management system) and OHSAS 18001:2007 (health and safety management system), as well as the Environmental and Social Management System requirements of the Project standards (principally the Equator Principles and the IFC Performance Standards). The main objective of the HSSE-IMS is to provide a robust framework for meeting the Project's HSSE objectives during the entire Project lifecycle. The following section describes the approach to safety issues, a key component of the HSSE-IMS relating to the installation and operation of the South Stream Offshore Pipeline.

5.7.1 Construction, Installation and Operational Safety

Safety is a key priority for the Project during construction, installation and operation. Accordingly, a Health and Safety Plan will be prepared in order to reduce all risks to "as low as reasonably practicable" (ALARP).

Design hazards have been identified and assessed using internationally recognised tools throughout the FEED process. These tools include:

- Hazard Identification (HAZID);
- Environmental Issues Identification (ENVIID);
- Quantified Risk Assessment (QRA);
- Hazard and Operability (HAZOP);
- Hazard Construction (HAZCON); and
- Bowtie Analysis.

HAZID is a tool for safety hazard analysis used at an early stage of the Project to inform the FEED study. Risk workshops and HAZID studies have been held covering different aspects of the Project. The risks that have been identified have been addressed through design measures aimed at reducing either the likelihood or the consequences (or both) of the risks. Such measures have been developed during FEED and will be further developed during the detailed design phase of the Project. The HAZID is updated as the design evolves and develops, and when key design decisions are made and/or technology is selected. The risks identified as a result of the workshops and studies have been assessed qualitatively and this assessment will be followed by an overall risk assessment that will cover design, construction, installation, operations and simultaneous operations (SIMOPS), as required.

ENVIID is a tool for environmental issues identification and analysis used at an early stage of the Project to inform the FEED study. The ENVIID process aids the FEED study in identifying any significant impacts of the Project and the associated controls and mitigation measures to be implemented into the design to remove or reduce the impact.

QRA is a tool for calculating the individual and societal/group risks from major accidents or adverse events. QRA is used to establish the potential consequences of catastrophic events, such as fires, explosions and gas releases, and the dimensions of exclusion zones and/or restricted areas where construction/building and occupation of land needs to be controlled.

HAZOP is a tool for the identification of process hazards in the design and operation of a facility or infrastructure. The HAZOP process comprises the systematic application of combinations of parameters (e.g. flow, pressure, temperature) and guide words (e.g. no, more, less) to produce deviations (no flow, less pressure) from the design intent or intended operational mode of the installation. Credible causes of these deviations are identified for each process section (node) and consequences of the deviations are assessed. The assessment consists of an examination of the pipeline design to determine whether the safety measures included in the design are sufficient to ensure that the pipelines are safe to operate, even under extreme or unusual conditions.

HAZCON is a safety study to identify and assess hazards before start of construction works. HAZCON 1 is generally carried out early in the project, prior to construction, to identify major hazards to client and contractor personnel, site visitors or the general public. HAZCON 2 is carried out to provide a detailed assessment of construction hazards, based on a significant completion of engineering design, engineering drawings, details of the RoW, construction implementation plan, landfall layout drawings and details of the marine/diving spread.

Bowtie analysis is part of the identification and management of key risks, and is used to identify risk controls, their effectiveness and corrective actions required. Before defining where to focus effort within the analysis, key risk areas are identified via other risk assessments and risk registers. The understanding of key risks highlights areas for which Bowtie analysis will be developed.

During the FEED process, design approaches and methods that minimise risk to personnel (construction, installation and operations personnel) as well as to the local community have been developed based on the results of the various risk assessment studies.

A FEED/Technical Risk Register is used to record all significant design HSSE risks, as well as technical risks related to construction and operations identified by the FEED study. The FEED/Technical Risk Register is established, managed and maintained by South Stream Transport, utilising inputs related to FEED risks from the FEED Contractor, and forms part of the overall Project Risk Register.

Major accident hazards (MAHs) during construction, installation and operation of the Project, in relation to the local community are addressed in **Chapter 14 Socio-Economics**. Plans for dealing with the effects on the community of construction, installation and operation of the Project such as increased traffic, transportation of hazardous substances, waste water discharge; solid waste disposal etc. will be managed by South Stream Transport and the respective contractors through a number of CMPs. Further information on the various Project CMPs to be implemented can be seen in **Chapter 22 Environmental and Social Management** of this ESIA Report.

5.7.1.1 Security of the Operational Facilities

As the landfall facilities are unmanned during the Operational Phase, security of the landfall facilities is primarily provided by perimeter security fencing, intruder alarms and the surveillance of the real time CCTV by staff based in the CCR. The CCR will also have a constant and secure communication link with operational staff located at the Russkaya CS to be operated by Gazprom who may be alerted to an incident if necessary.

A Security Plan is currently being developed by South Stream Transport and a specialist company will be employed to advise South Stream Transport on a corporate level on security matters. South Stream Transport will appoint a security coordinator within the South Stream Transport Operations Team. The Security Plan will define the management and security measures to be employed for the Project. Further information on the management plans to be employed for the Project is provided in **Chapter 22 Environmental and Social Management**.

5.8 Labour and Procurement

5.8.1 Construction Phase

At the time of preparing this ESIA Report it was not possible to estimate the exact numbers of workers that will be employed during the construction of the Project. This information will become available when the detailed design of the Project has been completed. However, the maximum numbers of workers anticipated (at this present time) to be working on the Project during the peak of construction activity is presented in Table 5.44.

Table 5.44 Estimated Employment Levels during the Construction Phase

Project Section	Peak Worker Numbers
Landfall	330
Nearshore	544
Offshore	1,211

5.8.1.1 Hours of Working

In the landfall section it is anticipated that the standard working hours will be 0700 – 1900 Monday to Friday and 0700 – 1400 on Saturdays. However, for certain activities (for example pre-commissioning, commissioning and microtunnelling) there will be periodic requirements to work outside of these hours. Careful consideration will be given to the impacts of noise and vibration for any activities planned outside the normal working hours and no work will proceed without the necessary permits.

For construction and installation of the nearshore and offshore sections of the pipeline it is anticipated that work will be carried out 24 hours per day, seven days per week.

The majority of the construction work force required will be highly skilled and is anticipated to come from outside the local area. They will be lodged in the nearby towns and villages or on the vessels that they work. Further information on the proposed workforce is provided in **Chapter 14 Socio-Economics**.

Workers will be transported to the landfall section construction sites by mini buses if required to reduce traffic movements and routes will be coordinated with local authorities. A number of cars and vans are also anticipated to be utilised to transport workers. These traffic movements are included in Table 5.8. The transport routes and potential impacts of traffic travelling to the landfall construction site will be managed through the Russian Landfall CMP, which will form part of South Stream Transport's ESMP.

5.8.1.2 Worker Health and Safety

Occupational Health and Safety (OHS) for procurement, construction, installation and operations will be managed by South Stream Transport and their respective contractors. Internationally recognised procedures to assure the OHS of the workforce will be adopted along with the necessary equipment and training to make these effective.

The health risks to which workers are exposed are determined by a Health Risk Assessment (HRA). The HRA is the Hazards and Effects Management Process (HEMP) for health hazards, and identifies the health hazards and risks (physical, chemical, biological, ergonomic and psychological) in the workplace, and facilitates an occupational health needs analysis. The HRA determines if medical health surveillance is required for a job position that includes exposure to potentially harmful conditions or risks.

OHS procedures to be adopted by the Project include:

- Fitness-to-work Assessment;
- Management procedures; and
- First aid and medical emergency response.

Further information on OHS of the workforce is provided in Appendix 15.1 Occupational Health and Safety.

5.8.2 Operational Phase

There will be no full time workers employed for the Project during the Operational Phase of the Project, other than a workforce stationed permanently at the CCR and BUCR to operate the South Stream Offshore Pipeline. There will also be occasional periods when workers will be onsite during pigging operations and maintenance. Pigging operations will be undertaken by specialist contractors, whilst more general maintenance of electrical and monitoring systems is anticipated to be undertaken by employees based at the Russkaya CS being developed by Gazprom as part of the "Expansion of the UGS to provide gas to South Stream pipeline". The operational performance of the South Stream Offshore Pipeline (including the Project pipelines and landfall facilities) will be monitored in real-time using SCADA from the CCR and BUCR in Amsterdam as described in Section 5.6.1.1.

5.9 Decommissioning

The expected service lifetime of the South Stream Offshore Pipeline is 50 years. The decommissioning program will be developed during the Operational Phase of the Project. It is likely that the technological options and preferred methods for decommissioning of such gas transportation systems as the South Stream Offshore Pipeline will be different in 50 years' time. The decommissioning program will be developed during the Operational Phase of the Project. The status of the South Stream Offshore Pipeline at the time of decommissioning will also impact on the chosen decommissioning methods.

Under all circumstances, decommissioning activities will be undertaken in accordance with the international and national legislation and regulations prevailing at that time, and in liaison with the relevant regulatory authorities.

A review, and relevant studies if necessary, will be undertaken during the Operational Phase to confirm that the planned decommissioning activities utilise GIIP and are the most appropriate to the prevailing circumstances and future land use. The review will outline management controls and demonstrate that the decommissioning activities will not cause unacceptable environmental and social impacts. The decommissioning activities will also require all relevant approvals and authorisations from the Russian Government departments responsible at the time.

5.9.1 Decommissioning of the Landfall Section of the Project

During the Decommissioning Phase, activities on site associated with the removal of infrastructure will increase in intensity relative to those occurring during the Operational Phase of the Project. Of particular note are the potential environmental and social impacts associated with the following activities:

- The demolition of facilities and infrastructure;
- Equipment and vehicle movements; and
- Earthworks.

An environmental assessment will be conducted before decommissioning commences in order to confirm that the planned activities are the most appropriate to the prevailing circumstances. This assessment would aim to demonstrate that the decommissioning activities would not cause unacceptable environmental and social impacts and would lead to the development of specific management controls. Potential impacts associated with decommissioning activities may include the following:

- Erosion and sedimentation;
- Dust generation;
- Increased pressure on waste disposal facilities;
- Spills of hazardous substances;
- Disturbance to habitats; and
- Noise disturbance.

To what extent the following activities are undertaken will depend upon the agreed final use of the landfall section development areas, which will be defined in consultation with the relevant national and local authorities:

- Landfall facilities shall be removed;
- Access roads may be left in place depending upon the subsequent use of the land;
- Shallow foundations for infrastructure may be excavated, demolished and disposed of;
- Where piled foundations exist, these may be excavated to a depth of 1 m below the existing ground level and removed;
- Excavations resulting from the removal of foundations will be backfilled;
- Landfall section pipeline sections may be cleaned and re-used in connection with the offshore pipeline sections;
- For the pipelines within the microtunnels; if re-use is not feasible then they will most likely be cleaned, filled with inhibited sea water (seawater that has been treated with additives to inhibit its corrosiveness), sealed and left in place; and
- If re-use of the landfall section pipelines is not feasible then they will most likely be recovered and the steel recycled and the trenches backfilled and reinstated.

Prior to undertaking decommissioning activities, South Stream Transport will undertake a review of historical monitoring data and incidents on site that might have caused contamination.

Depending on the final land use agreed with the authorities for the landfall section area, all or part of the site may need to be rehabilitated. In such circumstances, South Stream Transport will also develop a monitoring program for completion criteria to verify that the sites are being returned to the agreed representative state. Completion criteria will be included for vegetation community composition, extent of weed infestation, erosion control and visual amenity of the site. These completion criteria will be determined in consultation with the local and national authorities.

In the event that the landfall section areas require to be returned to their original state (i.e. before the Project was constructed), stable landforms will be established and the site will be rehabilitated to an agreed level of representation of the pre-project plant communities based on agreement between South Stream Transport and the relevant authorities on these levels.

5.9.2 Decommissioning of the Nearshore and Offshore Sections of the Project

Current practices for the decommissioning of subsea pipelines involve either removing the pipeline or leaving the pipeline on the seabed after cleaning and filling it with water in combination with a program of planned monitoring to ensure safety for other users of the sea. The prevailing opinion is that leaving the pipeline in place results in the least environmental impact as over time the pipelines will become integrated within the seabed environment and their removal would disturb the habitats that have generated in the vicinity of the pipelines. A summary of the activities involved with the two options are described below.

Leaving the pipelines on the seabed will typically involve the following types of activities:

- Filling the pipeline with water;
- Pipeline cleaning by flushing with water and associated water displacement, collection and disposal;
- Sealing of the pipeline ends; and
- Monitoring surveys following decommissioning.

Removal of the pipelines from the seabed will typically involve the following types of activities:

- Vessel operations similar in nature to those required for construction of the pipeline;
- Seabed intervention works;
- Pipeline removal, recycling and disposal;
- Disturbance of the seabed and aquatic environment as the pipeline is recovered; and
- Logistics support offshore and onshore.

Factors to be considered when taking the decision on decommissioning methods for the Project include:

- The potential for re-use of the pipeline in connection with further developments will be considered before decommissioning, together with other existing projects (such as hydrocarbon storage, water outfall). If re-use is considered viable, suitable and sufficient maintenance of the pipeline will be investigated and ensured;
- All feasible decommissioning options shall be considered and a comparative assessment made;
- Any removal or partial removal of a pipeline shall be performed in such a way as to minimise the potential for any significant adverse effects on the marine environment;
- Any decision that a pipeline may be left in place should have regard to the likely deterioration of the material involved and its present and possible future effect on the marine environment; and
- Account shall be taken of other users of the sea.

Where it is proposed that a pipeline should be decommissioned by leaving it on the seabed for natural degradation (referred to as in situ decommissioning), either wholly or in part, the decommissioning program will be supported by a suitable study that addresses the degree of past and likely future burial/exposure of the pipeline and any potential effect on the marine environment and other users of the sea. The study will include the survey history of the pipeline, using appropriate data to confirm the current status of the pipeline, including the extent and depth of burial, trenching, spanning and exposure.

Determination of any potential effect on the marine environment at the time of decommissioning will be based upon scientific evidence. The factors to be taken into account will include the effect on water quality and geological and hydrographical characteristics, the presence of endangered or threatened species, existing habitat types, local fishery resources and the potential for pollution or contamination by residual products from, or deterioration of, the pipeline.

The above serves as an example of general principles that should be applied during the decommissioning options decision-making process. It is foreseen that more directly applicable international or national guidelines are likely to be developed before the end of the lifetime of the Project (approximately 50 years) and that these will specify additional options that may need to be considered. The applicable regulations at the time of decommissioning will be adhered to.

5.9.3 Decommissioning Planning

It is envisaged that the process of developing detailed decommissioning management plans may be staged, initially outlining potential options and studies required for discussion with the regulatory authorities, and finally leading to agreed plans prior to the commencement of decommissioning. The content of the final plans will be dependent on the anticipated future land use. The plans will include methods and activities associated with the decommissioning of the offshore, nearshore and landfall sections infrastructure, including the transportation and final disposal or re-use strategy for Project components and wastes. Completion criteria will be detailed in the management plans. These completions criteria will be determined in consultation with the respective national and local authorities.

Documentation or processes addressing the issues outlined below will be developed to further support the implementation of detailed decommissioning management documentation:

- Incident reporting, recording and investigation;
- Chemical and hazardous substance management;
- Waste management;
- Dust management;
- Traffic management;
- Soils management;
- Health, safety and environmental site induction; and
- Spill contingency.

5.10 Summary of Total GHG Emissions to Atmosphere

Table 5.45 provides the total GHG emissions for the Project, the Turkish Sector of the South Stream Offshore Pipeline and the Bulgarian Sector. The total GHG emissions for the entire South Stream Offshore Pipeline are also shown. The methodology used to estimate these GHG emissions is contained within Appendix 9.4 of **Chapter 9 Air Quality.**

Table 5.45 Total Greenhouse Gas Emissions during Construction and Pre Commissioning Phase for all 4 pipelines (tonnes CO_2e)

Russian Sector	Turkish Sector	Bulgaria Sector	Total South Stream Offshore Pipeline System
674,853	94,061	1,003,787	1,772,701

5.11 Management of Change Process

During the detailed design, Construction and Pre-Commissioning, and Operational Phases of the Project, there may be a requirement to amend design elements or processes which results in a deviation from that presented in this Project Description. The Project has a management of change process to manage and track any such amendments, and to:

- Assess their potential consequences with respect to environmental and social impact; and
- In cases where a significant impact is likely to arise as a consequence of the amendment or change, to inform and consult with relevant parties on the nature of the impact and on proposed mitigation measures, where practical and appropriate.

All design changes will be added to a register of changes, which will summarise the change, the assessment, and the justification for South Stream Transport's actions.

The management of change process will be incorporated into the HSSE Management of Change Procedure, which is an integral part of the HSSE-IMS described in more detail in **Chapter 22 Environmental and Social Management**.

References

Number	Reference
Ref. 5.1	Organisation for Economic Co-operation and Development (OECD) Revised Council Recommendation on Common Approaches for officially supported export credits and environmental and social due diligence (June 2012). Available at: http://search.oecd.org/officialdocuments/. Accessed 24 September.
Ref. 5.2	Expansion of United Gas Supply System for Providing Gas into the "South Stream" Gas Pipeline, Stage 1 (West Corridor) Ensure supply of gas at a rate of 31.5 billion m^3/year, Design Document, Section 7 - Environmental Protection Measures, Part 2 – Environmental Impact Assessment for Compressor Station, Book 7 KS Russian 6976.211.002.21.14.07.02.13(1)-OOC pages 1-323, Volume 7.2.13 by Fedorenko A. V. (Head of Industrial and Environmental Protection Department) et al. 2012.
Ref. 5.3	Gazprom Southern Corridor. Expanding United Gas Suplpy System to Secure Natural Gas Supply to South Stream Gas Pipeline. 2012. Accessed at: http://www.gazprom.com [Accessed on 7 February 2014].
Ref. 5.4	International United Conservation Network (IUCN) 2012. The IUCN Red List of Threatened Species. Version 2012.2. Available at: http://www.iucnredlist.org [Accessed on 17 October 2012]
Ref. 5.5	Red Data Book of the Russian Federation (animals). Moscow. AST; Astrel. 2001. 863 p.
Ref. 5.6	Red Data Book of Krasnodar Krai. Animals. Krasnodar, 2007a. 480 p.
Ref. 5.7	Russian Federation, 2002. Ministerial Order 02/12/2002, No. 786 'On the adoption of the Federal Classificatory Catalogue of Wastes'.
Ref. 5.8	IPIECA (Global Oil and Gas Industry Association for Environmental and Social Issues), 2010. Alien Invasive Species and the Oil and Gas Industry, Guidance for Prevention and Management. Oil and Gas Producers Report Number 436. IPIECA, London
Ref. 5.9	International Maritime Organization (IMO) Maritime Environment Protection Committee, 2009. Ballast Water Management Convention and Guidelines. IMO, London.
Ref.5.10	International Cable Protection Committee (ICPC) Guidelines. Available at http://www.iscpc.org/ [Accessed on 7 February 2014].

Chapter 6: Stakeholder Engagement

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6 Stakeholder Engagement

6.1 Introduction

This chapter describes the South Stream Transport approach to stakeholder engagement, its purpose and the regulatory context in which it occurs. It provides information about engagement activities undertaken to date for the ESIA and those that are planned for the future. This chapter also summarises the comments that have been made by stakeholders to date and how these comments are addressed within the relevant chapters of this ESIA Report.

In this chapter, the Environmental Impact Assessment (EIA) engagement process will also be referred to as this sets important context at the Russian national level and in doing this, shows how South Stream Transport has not only complied with national legislation, but also with Good International Industry Practice (GIIP). Although the national EIA and the ESIA process have been run separately in parallel, engagement activities for both processes are described in this chapter, as South Stream Transport will consider comments from stakeholders from both processes while completing the ESIA process.

This chapter is structured as follows:

- **Section 6.2** describes the national and international framework upon which the stakeholder engagement programme has been developed;
- **Section 6.3** describes the foundation of the stakeholder engagement programme, as well as the supporting documents and processes;
- **Section 6.4** outlines the stakeholder engagement activities for each phase of the Project lifecycle; and
- **Section 6.5** summarises comments, questions and recommendations received to date.

Stakeholder engagement (including dialogue, consultation and the disclosure of information) is a key element of project planning, development and implementation. Effective stakeholder engagement assists good design, builds relationships with local communities, and reduces the potential for delays through the early identification of risks and issues. South Stream Transport is committed to a transparent and respectful dialogue with stakeholders throughout the life of the Project.

The engagement approach for the Project includes a range of activities designed to consult stakeholders, using methods which take into account the varied interests that stakeholders may have in the Project as well as their location, language, culture, their access to information and the different opportunities to participate (e.g. through statutory consultation processes as well as through the ESIA process). The Project's approach to stakeholder engagement includes making best efforts to ensure stakeholders are provided with adequate, timely and culturally appropriate information about the Project, the ESIA and consultation process. It also provides opportunities for stakeholders to ask questions, make comments and suggestions and raise any concerns that they may have. The Project's approach to stakeholder engagement has been developed to align with the national legislative requirements and international standards applicable to the Project, which are summarised in **Chapter 2 Policy, Regulatory and Administrative Framework** and described in further detail in Section 6.2.

Stakeholder engagement is an important element of the ESIA process in that it enables the ESIA Report to be informed by the interests and concerns of stakeholders, and provides opportunities for stakeholders to have those interests and concerns considered in decisions that may affect them. Effective engagement also helps to establish a relationship between stakeholders and the Project Proponent, South Stream Transport, which is based on trust and respect.

South Stream Transport has taken these principles into account in the planning and implementation of stakeholder engagement activities for the Project (Section 6.3).

Terms to Know

Consultation	The process of sharing information, ideas and concerns in a two-way dialogue between project proponents and stakeholders, allowing stakeholders to express their views and for these to be considered in the decisions about project planning and implementation.
Disclosure	The process of making information available to stakeholders. Includes the publication of reports or documentation (in digital and/or paper formats), and announcements related to the disclosure process.
Grievance	Formal complaint by individuals, groups or organisations who feel they have been adversely affected by Project-related activities.
Grievance Procedure	Process of recording and addressing grievances so that they can be tracked through to a resolution.
Mitigation	Measures developed through the ESIA process to prevent, avoid, reduce or offset adverse impacts. Can also include measures to enhance beneficial impacts.
Stakeholder	Any individual, group or organisation potentially affected by a project, interested in, or with influence over, a project.
Stakeholder Engagement Plan	A Stakeholder Engagement Plan (SEP) forms part of the ESIA documentation and provides a plan and implementation strategy to guide stakeholder engagement throughout the Project lifecycle.

6.2 Regulatory Context

This section describes the regulatory framework that applies to the Project. The Project's approach to stakeholder engagement considers both regulatory requirements and principles of Good International Industry Practice (GIIP), and seeks to:

- Meet the legal requirements of the Russian Federation for public consultation and disclosure during the EIA process (described in Section 6.2.1);
- Align with international standards and guidelines for financing (and GIIP), as related to ESIA, that provide a framework for public consultation and disclosure during the ESIA process (described in Section 6.2.2); and
- Align with international conventions and protocols relevant to stakeholder engagement for the Project (described in Section 6.2.3).

The national EIA and international ESIA processes are illustrated in Figure 6.1. Consultation and disclosure requirements for the Russian EIA process have several features in common with stakeholder engagement processes for international ESIA. Both are based on the principle that those who may be affected by a project should be consulted.

South Stream Transport seeks to align the two processes, avoid duplication and ensure that where possible and permissible, the processes inform each other. The regulatory framework is further summarised in **Chapter 2 Policy, Regulatory and Administrative Framework** and the aspects of it that relate to stakeholder consultation are described in further detail in Section 6.2.

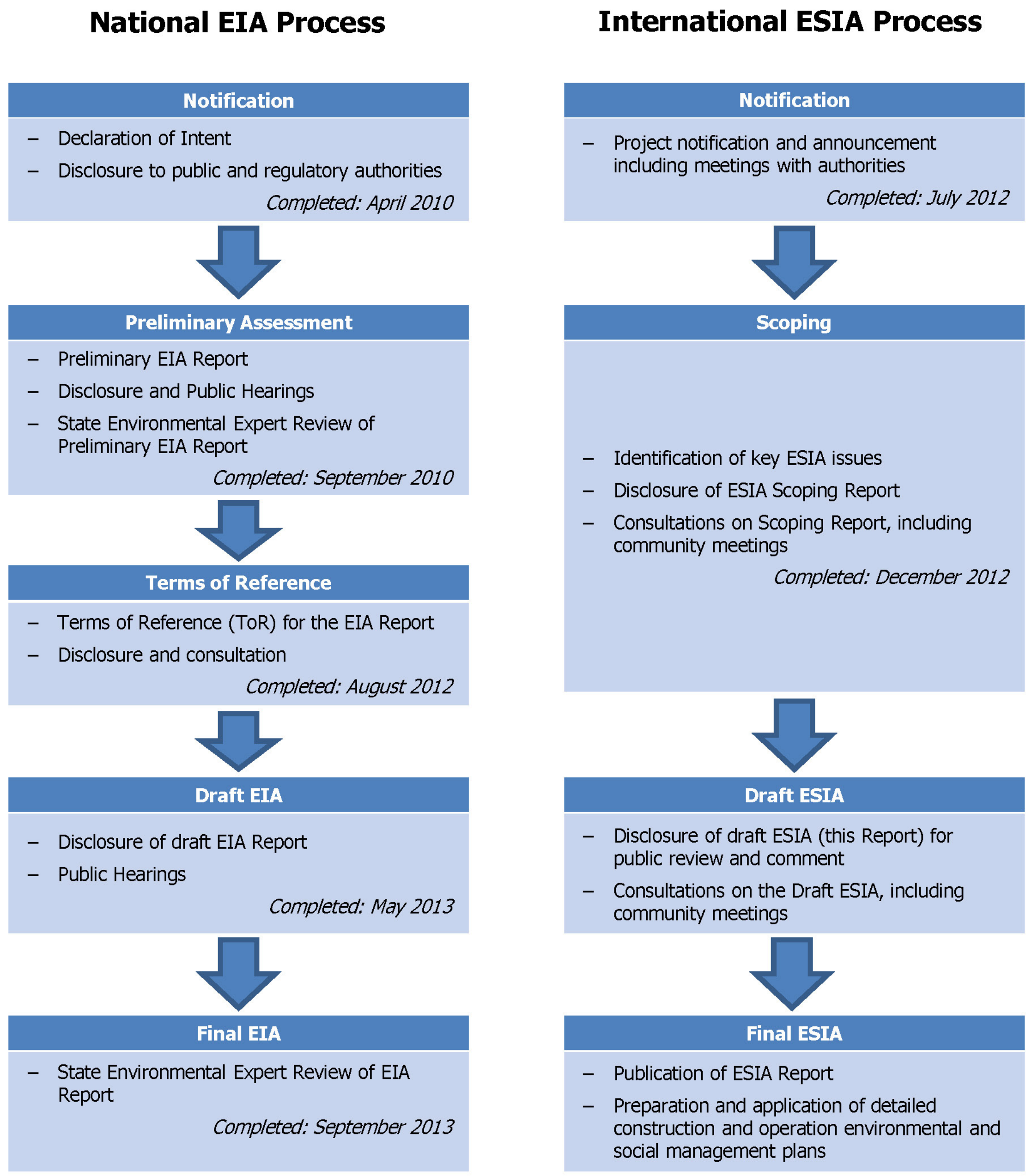
6.2.1 National Requirements

Consultation and disclosure requirements for the Russian national EIA process are outlined in Russia's Federal laws and regulations. The relevant EIA regulation includes:

- Federal Law on Environmental Protection (2002, No.7-FZ);
- Regulation on Impact Assessment of Planned Economic or Other Activity on Environment in Russia Federation (adopted 2000, by Order No.372)[1]; and
- Federal Law on Environmental Expert Assessment (1995, No.174-FZ).

[1] The requirements of Order No. 372 are often read in association with the City Planning Code (2004, No.190-FZ) and with Government Enhancement 'On the structure of design documentation sections and requirements to their contents' (2008, No. 87).

Figure 6.1 National EIA and International ESIA Processes



In Russia, there are no regional or local laws relating to EIA procedure. Russian Federation law requires that an EIA be prepared as part of a package of technical and other information known as the "*Proekt*", or project design. The project proponent then submits the Proekt to authorities for their review and approval. Public consultation is a mandatory part of the EIA process and involves the following main elements:

- **Terms of Reference (ToR) for the EIA** – preparation of the Terms of Reference for the Russian EIA, which is then disclosed for public review and comment (minimum 30 days);
- **Draft EIA** – publication of the draft EIA Report for public review and comment. The draft EIA Report is also the subject of one or more Public Hearings, at least 30 days after the initial publication of the report;
- **Public Hearings** – information about the proposed project and draft EIA is presented to the public. Legislation also states the draft EIA should be available for comments for at least 30 days after completion of Public Hearings; and
- **Final EIA** – the minutes of the Public Hearing are incorporated into the Proekt documentation for State Review, along with all comments, submissions and feedback on the draft EIA considered during finalisation of the EIA.

6.2.2 Standards and Guidelines for Financing

In addition to the EIA requirements described above and in line with international standards and guidelines for financing, the Project is being developed in accordance with financing requirements and GIIP. In relation to ESIA and more specifically, stakeholder engagement, the applicable standards are:

- The Organisation for Economic Cooperation and Development's (OECD) Common Approaches to Environmental and Social Due Diligence (Ref. 6.1);
- The Equator Principles III (Ref 6.2; Ref 6.3);
- Japan Bank for International Cooperation (Ref 6.4); and
- The International Finance Corporation (IFC) Performance Standards (PS) (Ref 6.5).

All the standards and guidelines listed above require compliance with applicable national legislation, including laws implementing national obligations under international law.

Details of these international standards and guidelines as they apply to stakeholder engagement are provided below in sections 6.2.2.1 to 6.2.2.4.

6.2.2.1 OECD Common Approaches

As detailed in Chapter 2, the Common Approaches for Officially Supported Export Credits and Environmental and Social Due Diligence (the 'Common Approaches') of the OECD (Ref. 6.1) provide guidance for considering environmental and social risks in decisions to offer official support for export credits.

In relation to stakeholder engagement, the Common Approaches recommend that:

- ESIA reports and related information should be made available to affected communities in language accessible to them for at least 30 days; and
- OECD member countries should encourage protection and respect for human rights and foster transparency, predictability and responsibility in decision-making by encouraging disclosure of ESIA information.

6.2.2.2 Equator Principles III

The second generation of the Equator Principles (EPII) provided guidance for stakeholder engagement in Principle 5: Stakeholder Engagement. For certain projects[2], the latest update to the Equator Principles (EPIII) provide further requirements for structured and culturally appropriate consultation undertaken with stakeholders (including affected communities; Ref. 6.2 and 6.3). By complying with the EPIII, a Project can ensure the informed participation of its stakeholders and be able to demonstrate how the concerns of affected communities have been considered in project decision-making.

The EP III states that a grievance mechanism should be developed to receive and facilitate resolution of concerns and grievances about the Project's environmental and social performance. The Project must inform the affected communities about the mechanism during the stakeholder engagement process.

6.2.2.3 Japan Bank for International Cooperation

The focus of the Japan Bank for International Cooperation (JBIC) (Ref. 6.4) Environmental and Social Considerations Required for Funded Projects (**Chapter 2 Policy, Regulatory and Administrative Framework**) is generally aligned with that of the IFC Performance Standards. The purpose, according to the guideline, is to demonstrate that project proponents are undertaking appropriate environmental and social considerations, through various measures, so as to prevent or minimize the impact on the environment and local communities which may be caused by the projects for which JBIC provides funding, and not to bring about unacceptable effects.

Specific to Stakeholder Engagement, and in line with IFC standards described below, JBIC requires that projects must be adequately coordinated so that they are accepted in a manner that is socially appropriate to the country and locality in which the project is planned. For projects with a potentially large environmental impact, sufficient consultations with stakeholders, such as local residents, must be conducted via disclosure of information from an early stage where alternative proposals for the project plans may be examined. The outcome of such consultations must be incorporated into the contents of the project plan; and appropriate consideration must be given to vulnerable social groups, such as women, children, the elderly, the poor, and ethnic minorities, all of whom are susceptible to environmental and social impact and who may have little access to the decision-making process within society.

6.2.2.4 IFC Performance Standards

The IFC Performance Standards apply to private sector projects seeking financing from international financial institutions (Ref. 6.5), and also underpin many other financing guidelines

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[2] Category A and, as appropriate, Category B projects located in non-OECD countries, and those located in OECD countries not designated as High-Income, as defined by the World Bank Development Indicators Database. Category A projects are defined as those that have potential significant adverse environmental or social risks and/or impacts that are diverse, irreversible or unprecedented. Category B projects are defined as having limited adverse risks. The Project is considered a Category A Project.

(including the Equator Principles and the OECD Common Approaches). IFC PS 1 – Assessment and Management of Environmental and Social Risks and Impacts – sets out guidance for stakeholder engagement as part of project development.

IFC PS 1 states that project sponsors should promote and provide means for adequate engagement with communities affected by a Project, on issues that could potentially affect them. It also states that relevant information about environmental and social issues should be disclosed and disseminated and that communications (including questions, comments, suggestions and grievances) from affected individuals, groups, communities and other stakeholders should be responded to and appropriately managed.

IFC PS 1 also calls for the development and implementation of an Environmental and Social Assessment and Management System (ESMS) and a Stakeholder Engagement Plan (SEP). It focuses on the need to tailor engagement according to the expected scale and type of impacts and to make it appropriate to communities that may be affected by a project, as well as other stakeholders. This includes allowing disadvantaged and vulnerable groups to participate effectively.

In relation to information disclosure, PS1 requires project proponents to provide affected communities with access to relevant and understandable information about the project and the ESIA process and to provide them with opportunities to express their views on project risks, impacts and mitigation measures, and for the project proponent to consider and respond to these.

The requirement for a Grievance Procedure is also detailed in IFC PS1. A Grievance Procedure should be designed to receive and facilitate resolution of community grievances arising from project activities. IFC PS 1 also calls for periodic reports to be made to affected communities about issues of concern, including those identified through the consultation process or Grievance Procedure.

6.2.3 International Conventions

6.2.3.1 Aarhus Convention

The Convention on Access to Information, to Public Participation in the Decision Making Process and the Administration of Justice concerning Environmental Matters (the Aarhus Convention, adopted in 1998, Ref. 6.6) also includes provisions that relate to stakeholder engagement. It establishes public rights of access to environmental information and aims to promote public participation in decision making about environmental matters. Of the three host countries of the South Stream Offshore Pipeline, Bulgaria is the only one that has ratified the Aarhus Convention.

6.2.3.2 Espoo Convention

The United Nations Convention on EIA in a Transboundary Context (Ref. 6.7), sets out the obligations of signatory countries to assess the environmental impact of certain activities at an early stage of planning and lays down their general obligation to notify and consult each other on all major projects under consideration that are likely to have a significant adverse environmental impact across boundaries.

The Convention entered into force on 10 September 1997. Of the three host countries for the Project, only Bulgaria has ratified the Convention. Therefore, for the South Stream Offshore Pipeline, Bulgaria is the Party of Origin for any transboundary consultation process with neighbouring countries that may be required. Consultation related to Espoo is described in the ESIA report for the South Stream Offshore Pipeline – Bulgarian Sector.

6.3 Approach to Stakeholder Engagement

South Stream Transport's approach to stakeholder engagement is designed to comply with Russian legislation and to be aligned with the international standards and guidelines as described in Section 6.2. Accordingly, it provides a mechanism for stakeholders to be engaged during all phases of the Project. Within each phase of the Project, a range of engagement activities will be undertaken to address the needs of different stakeholders and stakeholder groups.

The main elements of the approach to stakeholder engagement are described in this section. Section 6.3.1 describes the Stakeholder Engagement Plan (SEP), which provides a framework for past, current, and future engagement activities. The SEP is the mechanism by which the principles and processes for stakeholder engagement, outlined in this Chapter, are implemented. Section 6.3.2 describes the process by which various stakeholders have been (and continue to be) identified. Section 6.3.3 discusses the ways in which stakeholders can provide feedback to South Stream Transport about the Project, and Section 6.3.4 presents the Stakeholder and Consultation Database (SCD), which is South Stream Transport's central mechanism for managing and coordinating feedback received throughout the stakeholder engagement process. Finally, Section 6.3.5 introduces the Grievance Procedure for the Project.

6.3.1 Stakeholder Engagement Plan

South Stream Transport's SEP for Russia provides a stakeholder engagement framework for all phases of the Project, including Construction and Pre-commissioning, Operation and Decommissioning. The SEP is a 'living' document and is progressively updated as the Project moves through the various phases of planning and implementation. Further updates will be issued around key Project milestones, such as the disclosure of the ESIA Report, and the start of construction activities.

The SEP describes the way in which South Stream Transport:

- Identifies stakeholders;
- Develops and maintains positive relationships with stakeholders;
- Provides culturally appropriate, adequate and timely information about the Project and the EIA/ESIA process to stakeholders;
- Provides suitable opportunities for stakeholders to express their opinions and concerns in relation to the EIA/ESIA and Project development;

- Enables compliance with Russian Federation regulations and alignment with international standards and guidelines for financing;
- Ensures that Project decisions consider stakeholder priorities, views and concerns and that these are reflected in the EIA/ESIA and Project management decisions where appropriate; and
- Will engage with stakeholders to establish and maintain dialogue.

The SEP provides an overview of the consultation and disclosure activities planned for the Project, including their purpose, timing, and the objectives of the activities. It provides information about consultation and disclosure activities that have already been conducted, as well as a roadmap for planned consultation and disclosure. It is regularly updated as the Project progresses and new information becomes available.

The SEP is published in English and Russian on the South Stream Transport website. The next update to the SEP will include more detailed information on the planned ESIA disclosure and consultation activities. The latest version of the SEP is always available on the South Stream Transport website at www.south-stream-offshore.com.

6.3.2 Stakeholder Identification

It is important to identify the Project's stakeholders and understand how they may be affected, or perceive that they may be affected, so that engagement can be tailored to inform and appropriately address their views and concerns.

Stakeholders with an interest in the Project have been identified in several ways. These include:

- Drawing on the local knowledge of in-country environmental and social consultants;
- Feedback from consultations with stakeholders held to date;
- Desktop research including reviews of previous ESIAs for relevant (by type or location) previous projects; and
- Scoping of anticipated impacts and receptors.

In addition, stakeholder engagement activities also help to identify and engage additional stakeholders and stakeholder groups.

When planning engagement activities, it can be helpful to group stakeholders based on common interests and characteristics. As such, South Stream Transport uses a number of "stakeholder categories" to help structure engagement activities for stakeholders of the Project. Stakeholder categories in the Russian Sector include:

- Landowners;
- Land users;
- Businesses and business associations;
- Fisheries and other marine area users;
- Government authorities (national, regional and local);

- Inter-governmental organisations;
- Community service and infrastructure organisations;
- Non-governmental organisations (NGOs);
- General public (including residents of Local Communities, and visitors to these communities);
- Academic and research organisations; and
- Media.

These stakeholder categories are described in Table 6.1 including a summary of the anticipated interests of these groups with respect to the Project (e.g. potential impacts, benefits, concerns) and how they have been engaged to date. Further detail on stakeholder engagement activities and stakeholder issues and concerns is provided in Section 6.4 and Section 6.5 below, while Appendix B of the SEP provides a full list of all identified stakeholders in Russia.

Table 6.1 Stakeholder Categories and Identification

Interest in the Project	Stakeholders Identified	Summary of Engagement to Date
Landowners		
The Project may require some temporary and/or permanent acquisition of land, which will require agreements with applicable landowners. Additionally, some landowners in the vicinity of the Project may be affected by Project activities, including changes to viewscapes or environmental conditions.	Fond Yug development company and Shingari and Don holiday complexes.	South Stream Transport has engaged with landowners Fond Yug and Agrifirm Kavkaz during the ESIA process. Fond Yug and South Stream Transport have negotiated a land settlement in relation to temporary and permanent land take for the Project (see **Chapter 14 Socio-Economics**). The tourism stakeholders Shingari and Don holiday complexes were invited to participate in the Scoping meetings and a specific meeting to discuss the Project was subsequently held with Shingari Holiday Complex.

Continued...

Interest in the Project	Stakeholders Identified	Summary of Engagement to Date
Land Users		
The Project may require some temporary and/or permanent acquisition of land, and as such may affect access to these areas. People who work on or use areas affected by the Project land take may also be affected by access restrictions. Additionally, Project activities may result in changes to the amenity of certain areas, such as changes to viewscapes or environmental conditions.	Recreational visitors to the Sukko and Shingari beaches, visitors to the Varvarovka Cemetery, Agrifirm Kavkaz vineyard workers and a horse-riding enterprise in Varvarovka.	Engagement with visitors to the local beaches and to the Varvarovka Cemetery included the publication of Project documentation (including the EIA Terms of Reference, ESIA Scoping Report and Draft EIA Report) via the South Stream Transport website, announcements in newspapers and poster campaigns. A public comment period was announced and stakeholders were invited to submit comments to the Project using comment boxes, installed in Local Communities or at public meetings. Specific engagement has also been undertaken with Agrifirm Kavkaz (a subsidiary of Fond Yug) to understand any potential impacts Project land take may have on vineyard workers. Meetings have been held with the horse-riding enterprise in Varvarovka to confirm horse-riding routes in relation to the proposed Project land take.
General Public (including residents of, and visitors to, the Local Communities)		
Local Communities may be affected by impacts related to traffic, noise, and environmental changes. They may also be able to benefit through employment and business opportunities.	Residents of Local Communities (Gai Kodzor, Sukko, Supsekh, Varvarovka, Rassvet) and tourists.	The general public has been engaged through a variety of public disclosure and consultation measures. This has included the publication of Project documentation (including the EIA Terms of Reference, ESIA Scoping Report and Draft EIA Report) via the South Stream Transport website, announcements in newspapers and poster campaigns. A public comment period was announced and stakeholders were invited to submit comments to the Project using comment boxes, installed in Local Communities or at public meetings.

Continued…

Interest in the Project	Stakeholders Identified	Summary of Engagement to Date
Business and Business Associations		
Local businesses may benefit from procurement opportunities related to the provision of goods and services to the Project. Conversely, other businesses may be concerned about potential impacts on business revenues, particularly in relation to the tourism sector.	Tourism businesses, construction-related businesses and related support services (e.g. catering, security, accommodation, environmental management) in Anapa Resort Town Municipal District. Ports and related services in Novorossiyk and Temryuk.	A number of local businesses were identified during the Scoping Stage. These businesses were notified of the publication of the Scoping Report and were provided with a copy of the report and were invited to the Scoping Phase public consultations. A number of one-to-one meetings were held with local businesses to gather information and data and respond to queries.
Marine Area Users		
Fishers and fisheries organisations (including fishing businesses) may be interested in potential Project impacts on fishing activities and livelihoods, including access to fishing areas and changes in fish health, migration, and catch volumes. They may also be concerned about unplanned events (e.g. fuel spills) and how these events could affect fishing activities.	Fisheries in Anapa Resort Town Municipal District, including fishery businesses and cooperatives, and the government research institutes of Azov Black Sea (AzNIIRKH) and of Fisheries and Oceanography (VNIRO-Krasnodar branch).	Fishing organisations were notified of the publication of the Scoping Report (and were provided with a copy of the report) and invited to a roundtable meeting for marine area users and local businesses. Specific meetings were held with local fishing businesses during the EIA process to gather baseline information for the Fishing Study (see **Appendix 14.1 Fishing Study**) and to understand the concerns of fishers in relation to the Project.

Continued…

Interest in the Project	Stakeholders Identified	Summary of Engagement to Date
Businesses, clubs or other groups that use the sea for recreation may be interested in their continued access to these activities, as well as any environmental changes that may arise from the Project.	Local diving clubs and businesses, and recreational marine users.	Diving and recreational boat clubs were notified of the publication of the Scoping Report and invited (by letter and phone) to a roundtable meeting for marine area users and local businesses.
Shipping, telecommunications and offshore oil-and-gas exploration companies also have an interest in accessing and using the marine area, although potential impacts on these companies were considered but have been ruled out (as described in **Chapter 14 Socio-Economics**).	Oil and gas exploration companies, including Rosneft, Exxon Mobil, and RN-Exploration. Shipping terminals/ports, including Temryuk Port and Novorossiyk Port.	Meetings and exchanges of information and data took place regarding the proposed Pipeline route and coordination of activities between the Project and oil and gas exploration and shipping/port companies.
Government Authorities		
National authorities have specific interests in topic areas such as cultural heritage, tourism, transport, shipping and navigation, fisheries, and gasification and community development.	Russian national government e.g. MoNRE, MoFA and various associated ministries and departments.	National government authorities have been informed and consulted as part of the ESIA process, although formal engagement with the authorities is undertaken through the national EIA process. Engagement with various government departments responsible for topics such as environment, culture, tourism, transportation, safety, fisheries, archaeology and natural resources has been on-going throughout the EIA, ESIA and permitting processes.

Continued…

Interest in the Project	Stakeholders Identified	Summary of Engagement to Date
Local and regional authorities have a general interest in the potential impacts and benefits for their respective communities.	Regional government offices in Krasnodar Krai, rural district administrations of Supsekh and Gai Kodzor (which include the Local Communities) and local government offices in Anapa Resort Town Municipal District.	Local and regional authorities have been engaged throughout the course of the Project, as part of both the EIA and ESIA processes. Local authorities have also been interviewed as part of the socio-economic baseline data collection and to further discuss potential mitigation measures.
Community Service and Infrastructure Organisations		
Community service and infrastructure providers are interested in how the Project might impact on community services and infrastructure development plans. This may include direct impacts (e.g. on road infrastructure or water mains) or indirect impacts (e.g. increased strain on local services due to use by Project workforce)	Rassvet School, Russian Federal Road Agency, Anapa City Hospital, Krasnodar Regional Hospital, Outpatient clinics in Gai Kodzor and Varvarovka, medical and obstetric station in Rassvet.	Community service and infrastructure organisations were engaged through the "General Public" engagement measures**. A specific meeting was held with Rassvet School to gain a better understanding of traffic issues in the community. Meetings with local health facilities will be undertaken as part of the Rapid Health Appraisal (see **Chapter 15 Community Health, Safety and Security**).

Continued...

Interest in the Project	Stakeholders Identified	Summary of Engagement to Date
Non-Governmental Organisations (NGOs)		
NGOs (including local, national and international NGOs, as well as other community-based organisations) may be interested in a diverse set of issues, ranging from protection of the Black Sea ecology, to archaeological assets, to potential impacts on tourism and other industries. NGOs are often interested in reviewing and commenting on EIA and ESIA documents, particularly in regard to the identification of environmental and social impacts and the ways that these impacts will be mitigated and managed.	International environmental NGOs based in Moscow, including the World Wildlife Fund (WWF) and Greenpeace. Local and regional NGOs interested in environmental protection and ecosystems, such as Ekurs, Anapa is our Common Home, South Coalition Council of Opposition, and interested in the political situation and risks, such as KD Group Political Consulting.	NGOs were engaged during the Scoping Stage with invitations to review and comment on the Scoping Report, and to participate in meetings. Meetings were held in both Moscow and Anapa with NGO representatives.
Academic and Research Organisations		
Academic and research organisations may be interested in data from the Project's numerous marine surveys, as well as the potential effects on the marine environment or ecology, marine cultural heritage and environmental protection.	Institute of Archaeology, Russian Academy of Sciences in Moscow, Centre for Russian Nature Conservation (CRNC), Utrish Nature Reserve and Terra Viva Ecological Movement.	Research institutes and university departments with a particular interest in issues such as archaeology, the environment and the Black Sea were engaged during the Scoping Stage. Following Scoping, these stakeholders have been engaged for socio-economic and cultural heritage baseline data collection and involved in Project planning and design, and mitigation measures.

Continued…

Interest in the Project	Stakeholders Identified	Summary of Engagement to Date
Media		
Journalists and other representatives of the media are often interested in ensuring that clear and transparent information about the Project is communicated to the population. Interested in general Project information including updates on the EIA and ESIA process.	Russia media at national, regional and local levels.	Engagement with the media has occurred through press releases and announcements during key disclosure events, such as the publication of EIA and ESIA documentation. Three media roundtable meetings were also held, in Moscow and Krasnodar in November 2012 for the Scoping Report, and in Krasnodar in May 2013 for the Draft EIA Report, to enable members of the press to ask specific questions regarding the Project.

The stakeholders listed in Table 6.1 are examples of the groups and types of stakeholders engaged. However, a full list of all stakeholders engaged with the Project to date can be found in Appendix B of the SEP.
** This applies to all stakeholders in Table 6.1.

Complete.

Local Communities

As detailed in Section 6.2.2 (Standards and Guidelines for Financing), international standards and guidelines state that appropriate consultation should be undertaken with affected communities.

For the purposes of this Report and the SEP, certain communities are referred to as 'Local Communities', which have been identified either because they are the closest communities to the Project Area or, in the case of Rassvet and the town of Anapa, because they have the potential to experience impacts associated with construction and accommodation of the Project workforce.

In the Russian Sector of the Project, the Local Communities have been identified as:

- Town of Anapa;
- Gai Kodzor;
- Rassvet;
- Sukko;
- Supsekh; and
- Varvarovka.

The town of Anapa is the largest Local Community and is also the nearest large urban settlement, approximately 10 km to the north of the landfall section of the Project. With the exception of Anapa, the surrounding area is largely rural and includes a number of small- to medium-sized communities near the landfall section of the Project. Of the remaining Local Communities, Varvarovka is the closest to the landfall section; it is located approximately 2 km northwest of the Project Area. All of the Local Communities are situated within the ART municipal district.

Further information on the Local Communities is in **Chapter 14 Socio-Economics**.

Vulnerable Groups

Stakeholder identification and engagement also seeks to identify any potentially vulnerable or disadvantaged individuals and groups in local communities. Vulnerable groups are those who may be differently or disproportionately affected by the Project, or whose situation may mean that special care is needed to engage them in consultation and disclosure activities (e.g. in terms of language, literacy, technology, etc.).

Using guidance provided in IFC PS 1 and in consultation with two social protection bodies in Supsekh and Gai Kodzor, and the Anapa Resort Town (ART) Municipal District administration, the following potentially disadvantaged or vulnerable groups have been identified in the Local Communities:

- Children;
- Elderly;

- Disabled or chronically ill;
- Low-income households (with incomes below the subsistence level);
- Migrants workers; and
- Commercial sex workers.

Where relevant, differential impacts on these groups have been considered in the relevant impact assessment chapters of this ESIA Report (e.g. **Chapter 9 Air Quality**; **Chapter 14 Socio-Economics**; **Chapter 15 Community Health, Safety and Security**).

South Stream Transport has considered the needs of all potentially interested stakeholders, including those for whom special care in consultation may be needed, throughout the stakeholder engagement process. Efforts have been made to disclose information in a variety of ways so as to be accessible to all groups, regardless of socio-economic or other status. For example, printed copies of reports have been provided in central community locations, in addition to on the internet; announcements have been made in local and national newspapers, and through posters in local shops, offices, bus stops, and other community locations; information has been hand-delivered to schools and pensioner groups; and open meetings have been held in the Local Communities. All documents have been provided in Russian.

6.3.3 Receiving Feedback from Stakeholders

South Stream Transport is committed to maintaining an open and respectful dialogue with all stakeholders, supported by the activities and principles of the SEP. Throughout the life of the Project, stakeholders have access to various means and opportunities to submit feedback to South Stream Transport. Feedback may include:

- Questions;
- Comments;
- Concerns;
- Requests;
- Complaints or grievances; and
- Suggestions and recommendations.

Stakeholder engagement activities comprise both 'active' and 'receptive' consultation. Active engagement includes meetings, public hearings and structured comment periods to support report disclosure where South Stream Transport is actively soliciting feedback about the Project. Complementary to these active periods of disclosure and consultation, South Stream Transport is always receptive to feedback, whereby stakeholders may contact the Project at any time (e.g. by email, post, telephone, or in person) to provide their views and ask questions. Feedback may be submitted by any individual or group (e.g. companies, organisations, societies, collectives), either verbally or in writing.

All input received from stakeholders is managed through the Stakeholder and Consultation Database (SCD; Section 6.3.4); through this platform, South Stream Transport centrally stores, analyses and manages comments from stakeholders. If a grievance is communicated to South

Stream Transport, through any means, the communication is documented in the SCD, and the Grievance Procedure (Section 6.3.5) is initiated.

6.3.4 Stakeholder and Consultation Database

South Stream Transport's Stakeholder and Consultation Database (SCD) has been developed to ensure that stakeholder communications are documented, feedback is recorded and resulting actions are tracked and addressed. The SCD also provides a history of engagement with a particular stakeholder, thus helping South Stream Transport build meaningful relationships with stakeholders by understanding their concerns and past involvement with the Project.

The SCD is used to record and analyse feedback received from stakeholders and, in turn, this analysis informs the development of Project design, the identification and management of impacts and the development of the Environmental and Social Management System **(Chapter 22 Environmental and Social Management)**. Throughout the life of the Project, the SCD will be a valuable tool to coordinate information about stakeholders and stakeholder concerns in relation to the Project.

6.3.5 Grievance Procedure

A grievance is a complaint (i.e. an expression of dissatisfaction) stemming from an incident or impact (real or perceived) related to South Stream Transport's business activities. Complaints may stem from commonly occurring and relatively minor problems, or more serious one-off events, or entrenched or repeated problems that may lead to resentment, discontent or unrest.

A Grievance Procedure is the process by which a grievance is received, recorded and managed so that it can be tracked from its original submission through to a resolution. An effective Grievance Procedure is an important aspect of stakeholder engagement, and is a core component of the approach to stakeholder engagement outlined in the standards and guidelines for financing (Section 6.2). The process must be fair, accessible, transparent and properly documented.

The Grievance Procedure for the Project will guide the management of grievances throughout the Project lifecycle, from before the start of construction, throughout the operational life, and into decommissioning. The Grievance Procedure describes the process by which a grievance is documented, investigated, and resolved in coordination with the affected stakeholders.

It will be implemented by South Stream Transport in partnership with its contractors and will ensure that grievances are brought to the attention of the appropriate Project staff and addressed in an appropriate and timely way.

As the South Stream Offshore Pipeline is part of the overall South Stream Pipeline System it must also interface with the upstream and downstream components of the System. The HSSE Integrated Management System (HSSE-IMS) contains a dedicated Interface Procedure to manage the HSSE interface with Gazprom Invest (GPI) and South Stream Bulgaria AD (SSB). This includes coordination, cooperation and agreement on stakeholder engagement and the grievance procedure.

The Grievance Procedure interfaces with the SCD and the general receipt and management of feedback from stakeholders. All communications with stakeholders will be respectfully considered by South Stream Transport, and responses will be provided where appropriate. Where a potential grievance is identified, the Grievance Procedure will be implemented in addition to standard stakeholder engagement procedures, although the two processes will be closely integrated.

Further information regarding the implementation of the Grievance Procedure is provided in the SEP.

6.4 Stakeholder Engagement by Project Phase

Stakeholder engagement activities are an integral part of the Project lifecycle: from the initial notification when the Project is proposed, to the scoping of potential impacts, the EIA and ESIA studies, and throughout the Construction and Pre-commissioning, Operational and Decommissioning Phases of the Project.

The different phases of the Project each require stakeholder engagement that is tailored in terms of its objectives and intensity, as well as the forms of engagement used. In Russia, stakeholder engagement for the Project commenced in the Feasibility Phase (Phase 1) in 2010 with the official Project Notification and preliminary EIA. The Project is currently in the Development Phase, which includes the EIA and ESIA studies. Details of completed and planned engagement activities for the Project are provided in Figure 6.2.

Although the guidelines for stakeholder engagement under the EIA and ESIA processes differ the Project has aligned these processes were possible. As such, the activities for both processes are described in this section.

A discussion of stakeholder feedback obtained through these activities—including a short summary of the comments, suggestions and concerns raised by stakeholders to date, and how they have been addressed as part of the ESIA process—is provided in Section 6.5.

Figure 6.2 Stakeholder Engagement by Project Phase

PROJECT PHASE	ACTIVITIES	ENGAGEMENT OBJECTIVES
Feasibility	<u>Project Notification</u> • Submit the official Declaration of Intent for the Project <u>Preliminary EIA</u> • Prepare Preliminary EIA as part of feasibility studies • Disclosure of Preliminary EIA, public announcement and public meetings	• Stakeholders, including regulatory authorities and the public, are aware of the proposed Project • Start to build and maintain relationships between South Stream Transport and stakeholder groups
Development	<u>Scoping Stage</u> • Ongoing stakeholder engagement to support the planning and development of the Project • EIA Terms of Reference – Disclosure of Terms of Reference (ToR) for the EIA Report for review and comment – Public announcement of ToR disclosure and comment period • ESIA Scoping Report – Disclosure of the Scoping Report for review and comment – Public announcement of Scoping Report disclosure and comment period – Meetings with stakeholders and public	• Stakeholders are informed about the design and location of the project, and anticipated impacts • Stakeholders can comment on the scope and content of the EIA and ESIA, and provide input into studies
	<u>EIA and ESIA</u> • Ongoing stakeholder engagement to support baseline studies, assessment of impacts, and mitigation and management strategies, and Project planning • EIA Report – Disclosure of the EIA Report for review and comment – Public announcement of EIA Report disclosure and comment period – Meetings with authorities – Public hearing • ESIA Report – Disclosure of ESIA Report for review and comment – Public announcement of ESIA Report disclosure and comment period – Meetings with stakeholders, including community meetings – Response to all comments received	• Stakeholders are informed about the Project and anticipated impacts • Stakeholders have input into baseline studies, identification of impacts, mitigation and management measures • Stakeholders' interests and concerns are considered and addressed in the EIA and ESIA, and decision-making processes • Stakeholders have an opportunity to review—and to question and comment on—the EIA and ESIA
Construction and Pre-Commissioning (approx. 4 years)	<u>Construction and Pre-Commissioning Activities</u> • Ongoing disclosure of information relating to Project development, including the timing and progress of construction activities • Implementation of a Grievance Procedure and communication to local stakeholders	• Stakeholders are kept informed about the Project and receive advance notification about activities that may affect them • Stakeholders can submit questions, comments and grievances
Operational (approx. 50 years)	<u>Commissioning and Full Operational Activities</u> • Continue to update stakeholders, particularly any changes or non-routine activities • Continued implementation of the Grievance Procedure	
Decommissioning	<u>Decommissioning Activities</u> • Inform stakeholders about planned decommissioning activities and schedule • Continued implementation of the Grievance Procedure	

6.4.1 Phase 1: Feasibility Phase

With respect to stakeholder engagement, the Feasibility Phase included the official announcement and notification of the Project to the regulators and other stakeholders as part of the national EIA process. In April 2010, prior to establishment of South Stream Transport, Gazprom, the original proponent of the Project, submitted the Declaration of Intent for the Project to the Krasnodar Krai Administration.

Feasibility studies were undertaken, including the Preliminary EIA [3] for the Project, which provided a description of the Project and an initial identification of potential impacts. Announcements were placed in national[4], regional[5] and local[6] press inviting interested parties to participate in discussions on the Preliminary EIA.

Two public meetings were held – in Gelendzhik on 17 May 2010 and in Anapa on 18 May 2010 – as part of the consultation process. The Preliminary EIA was submitted for State Review, and approved[7] on 24 September 2010. Further public discussions were held in January 2011 in Anapa and Gelendzhik to discuss the Terms of Reference (ToR) for the Environmental Impact Study (EIS) and proposed business and other activities in the Gelendzhik Resort Town Municipal District, which were subject to environmental evaluation. These four meetings were attended by Commission Members, Gazprom, representatives from the administrations, public organisations, businesses, environmental organisations and the General Public (including residents from Local Communities and tourists).

South Stream Transport was established in October 2011 and became the proponent of the South Stream Offshore Pipeline[8]. South Stream Transport met with the Krasnodar Krai Administration, ART Municipal District Administration, Gai Kodzor Rural District Administration and Supsekh Rural District Administration in June and August 2012 to present further information about the Project and discuss how these authorities wished to engage with the Project and with the EIA and ESIA processes. Feedback received at these meetings is described in Section 6.5: Stakeholder Comments and Suggestions.

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[3] Prepared by DIEM on behalf of Giprospetzgaz.

[4] In newspaper *Rossiyskaya Gazeta*, April 16th 2010.

[5] In newspaper *Kubanskiye Novosti*, April 17th 2010.

[6] In newspapers *Priboy* April 17th 2010, and *Anapskoye rye* April 17th 2010.

[7] During their review, SEER took into account the findings of the Federal Fisheries Agency No. 4272-VB/U02 dated 19 July 2010 on approval of "Feasibility Study for the Offshore Section of Gas Pipeline 'South Stream', and a letter of ART Municipal District Administration No.103/206-156 dated 27 May 2010.

[8] South Stream Transport A.G. (SSTTAG) was established in Switzerland in October 2011, and was the project proponent prior to the establishment of South Stream Transport B.V. in the Netherlands in November 2012.

6.4.2 Phase 2: Development Phase

6.4.2.1 Overview

At the time of writing, the Project is currently in the Development Phase, which includes both the development of engineering and design, as well as the ESIA and related studies. The Development Phase is an important period of stakeholder engagement as it provides an initial introduction with many stakeholders, and can provide valuable feedback to inform Project design, baseline studies, impact assessment, and mitigation and management planning. Stakeholder engagement during this Phase aims to:

- Source and validate relevant environmental, socio-economic and cultural heritage data;
- Further understand the views and concerns of stakeholders about the Project, its impacts and possible mitigation, management and monitoring measures; and
- Discuss the outcomes of the EIA and ESIA processes, including anticipated impacts and their significance, and mitigation and management measures.

In terms of stakeholder engagement, the Development Phase includes three main activities:

- The **Scoping** process included separate periods of disclosure and consultation related to the Terms of Reference (as the basis for the national EIA Report) and the Scoping Report (as the basis for the ESIA Report). These activities are described in Section 6.4.2.2. Other meetings held as part of the ESIA consultation meetings are presented in Section 6.4.2.3 and engagement with the media is summarised in Section 6.4.2.4;
- The **EIA Report** process included disclosure and consultation related to the draft EIA Report. These activities are described in Section 6.4.2.5; and
- The **ESIA Report** process includes disclosure and consultation related to this Report, in accordance with the standards and guidelines for financing. Planned activities are described in Section 6.4.2.6.

Additional stakeholder engagement activities related to the baseline data collection are described in Section 6.4.2.3.

6.4.2.2 Completed Activities – Scoping Process

During the scoping process, South Stream Transport sought to provide stakeholders with clear information about the Project and its potential impacts and to allow them to provide feedback on the scope of, and approach to, the EIA and ESIA, including the key issues to be addressed as part of both processes. Stakeholders also had an opportunity to give their views about plans for future engagement activities, including any preferences for methods, materials and schedule. The engagement process during the Development Phase also served to source and validate relevant environmental, socio-economic and cultural heritage data and to understand the views and concerns of stakeholders about the Project, its impacts and possible mitigation, management and monitoring measures. Feedback from these activities informed the EIA and ESIA process and Project design.

Consultation on the Terms of Reference for the EIA Report

Based on the outcomes of the Preliminary EIA (completed by Gazprom as the previous proponent), South Stream Transport prepared a Draft ToR for the national Proekt EIA; this document outlined the proposed scope and content of the forthcoming EIA Report. An announcement marking the start of the disclosure and consultation period was published in national[9], regional[10] and local [11] newspapers on 31 July 2012.This 30-day consultation period ran from 1 to 31 August 2012, during which time stakeholders had the opportunity to read and comment on the Draft ToR document.

Printed and bound copies of the Draft ToR document, along with brochures describing the Project and the ESIA process, were made available in the following locations:

- Community Centre in Varvarovka;
- Community Centre in Gai Kodzor; and
- Department of Architecture and Town Planning in Anapa.

Comment forms and comment boxes were provided for stakeholders to submit their comments; comment boxes were securely locked so that only South Stream Transport staff could access the comments. Stakeholders were also able to access the Draft ToR on the South Stream Transport website and submit comments by post, email, or by telephone.

Comments received during this consultation period were considered in the development of the EIA Report, and where relevant also informed the development of the ESIA process (including Scoping Report and ESIA Report).

Disclosure of the Scoping Report for the ESIA

The Scoping Report, including a Non-Technical Summary (NTS), was disclosed on 22 November 2013 and the consultation period ran until 28 January 2013. To ensure the Scoping Report was accessible to all stakeholder groups, efforts were made to disclose information in a variety of ways. All stakeholders had the opportunity to submit comments on the Scoping Report and to attend meetings to discuss the Project and the Scoping Report. Disclosure of the Scoping Report included:

- Publication of the Scoping Report and NTS on the South Stream Transport website[12] on 22 November 2013 along with a Press Release[13] explaining the Project and Report disclosure;

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[9] In newspaper *Rossiiskaya Gazeta*, 31st July 2012.

[10] In newspaper *Kubanskie Novosti*, 31st July 2012.

[11] In newspaper *Anapskoye Chernomorye*, 31st July 2012.

[12] South Stream Transport B.V. was established on 14 November 2012 and became the new proponent of the South Stream Offshore Pipeline.

[13] South Stream Transport Press Release for Russian Sector Scoping Report (22 November 2012) available from: http://www.south-stream-offshore.com/news/press-releases/south-stream-transport-publishes-scoping-report-in-russia-17/.

- Direct distribution of printed and bound copies of Scoping Report and NTS to identified stakeholders by hand, post and email (See Table 6.2);
- Installation of 'comment boxes' in Community Centre in Varvarovka (Figure 6.3); the Community Centre in Gai Kodzor; and the Department of Architecture and Town Planning in Anapa on 20 November 2012 until 28 January 2013 where the public were invited to review a printed copy of the Scoping Report and NTS and submit comments by using the secure box;
- Publication of a Public Announcement in local newspaper Anapskoe Chernomorye on 8 December 2012 including details of the Project, the Scoping Report and planned community meetings (Figure 6.4), as well as the locations of the comment boxes and printed copies of the Scoping Report and NTS; and
- Posters announcing the three open-house style community meetings in the Local Communities and were displayed in public spaces including local shops, offices, bus stops, on information boards and in other community locations from 29 November 2012 until the meetings were concluded.

Information was also hand-delivered to school representatives, representatives of health care facilities, local NGOs, entrepreneurs, shop owners, cafes/restaurants, representatives of religious institutions and representatives of community centres.

Figure 6.3 Comment Box in Varvarovka

The Scoping Report was made publicly available for review and comment for a period of almost two months, which included the normal 30 day disclosure period and an additional month, as some stakeholders were expected to be on holiday over the Christmas and New Year holiday period. Stakeholders submitted comments by post or email, or in person. All comments received (listed in Appendix 6.1 and summarised in Section 6.5) were documented and taken into consideration in this ESIA Report.

Figure 6.4 Scoping Report Public Announcement in Anapskoe

8 СУББОТА, 8 ДЕКАБРЯ 2012 ГОДА АЧ

Футбол

ЧЕСТВОВАЛИ ПОБЕДИТЕЛЕЙ И ЮБИЛЯРОВ

На заседании совета городской федерации футбола были подведены итоги завершившегося открытого чемпионата Анапы. Председатель федерации Александр Рапопорт вручил награды победителям и призерам.

Чемпионом города-курорта стала команда «Понтос» из села Витязево. Второе место у «Алегрии» (хутор Заря), третье – у «Умельца» из станицы Анапской.

Лучшим тренером 2012 года признан наставник «Алегрии» Роберт Кургинян. Лучшим вратарем стал голкипер команды «Ветеран» Василий Андрюков. Защитником – Валерий Демурчан («Умелец»). Полузащитником – Александр Коротков («Алегриа»). Нападающим – Константин Джалалян из «Понтоса».

Лучшим судьей признали Алекснадра Яценко. Лучшим детским тренером – Петра Муратова.

Специальных призов были удостоены наставники «Спартака» и «Просторного»: Дмитрий Полеев и Олег Цапов.

Первый – за большой вклад в развитие анапского футбола. И пусть наших читателей не смущает эта формулировка. Да, Полеев и его команда представляли в турнире станицу Раевскую, территориально относящуюся к Новороссийску. Но анапский чемпионат – открытый, и потому в нем могут принимать участие команды из других городов и районов. И раевский «Спартак» уже давно играет в нем и на протяжении ряда лет входит в группу сильнейших. Немалая заслуга в этом Дмитрия Полеева.

А Олег Цапов получил кубок как прогрессирующий тренер.

В минувшем сезоне небывалых успехов добился витязевский «Понтос», который не только победил в чемпионате города-курорта Анапа, но и завоевал Кубок и Суперкубок Краснодарского края.

За выдающиеся спортивные результаты были награждены тренеры: Агоп Каланджан и Дмитрий Караманов, капитан команды Дмитрий Александров и президент футбольного клуба «Понтос» глава Витязевского сельского округа Леонид Кориофили.

Надо отдать должное городской футбольной федерации: она всегда помнит и тепло чествует ветеранов анапского футбола. Недавно провела турнир, посвященный памяти известного футболиста, детского тренера и судьи Александра Джемиловича Гаджиева.

А в тот вечер чествовали Николая Павловича Милету в связи с его 75-летием. Вклад этого заслуженного человека в развитие футбола в Анапе трудно переоценить. Когда-то был чемпионом Вареникoвского и Анапского районов в составе команды села Юровки. Работал школьным учителем физкультуры, прививал ребятам любовь к спорту. Возглавлял районную детскую спортивную школу, активно развивал детский футбол в Анапе. Практически все известные анапские тренеры и футболисты – его ученики. Работал в команде мастеров. И до сих пор является активным общественником на ниве физкультуры и спорта.

С 50-летием тепло поздравили тренера Николая Касьяна.

В связи со 100-летием кубанского футбола грамотой Краснодарской краевой футбольной федерации был награжден Александр Анатольевич Рапопорт, долгие годы успешно возглавляющий федерацию футбола города-курорта Анапа.

В.МАЛЬЦЕВ

Итоговая таблица чемпионата

М	команды	И	В	Н	П	мячи	очки
1	«Понтос» с. Витязево	26	23	1	2	116:41	70
2	«Алегриа» х. Заря	26	21	1	4	101:47	64
3	«Умелец» ст. Анапская	26	18	2	6	111:55	56
4	«Ветеран» г. Анапа	26	15	3	8	83:62	48
5	«Неско» г. Анапа	26	14	4	8	79:47	46
6	«Спартак» ст. Раевская	26	14	2	10	87:80	44
7	«Олимп» п. Виноградный	26	12	6	8	66:52	42
8	«Ника» г. Анапа	26	11	4	11	71:58	37
9	«Рассвет» х. Рассвет	26	11	2	13	55:66	35
10	«Приморец-Локомотив» с. Цибанобалка	26	9	5	12	61:69	32
11	«Просторный» х. Просторный	26	9	1	16	64:88	28
12	«Эврика» ст. Гостагаевская	26	6	3	17	42:86	21
13	«Луч» ст.Гостагаевская	26	1	0	25	35:138	3
14	«Юровка» с. Юровка	26	1	0	25	20:106	3

South Stream Offshore Pipeline ENERGISING EUROPE

Морской газопровод Южный Поток - Информация о проекте

Возможность больше узнать о проекте и обсудить морской газопровод Южный Поток

Морской газопровод Южный Поток соединит Россию с Европой, пересекая Черное море. Он будет проложен от Черноморского побережья Российской Федерации, примерно в 10 км к югу от г. Анапа, пересечет исключительную экономическую зону Турции в Черном море и выйдет на побережье Болгарии в районе г. Варна.

КОГДА и ГДЕ

Понедельник, 10 декабря 2012 г.
18:30 – 21:30
Средняя общеобразовательная школа №11
с. Супсех, пер. Парковый, 20

Вторник, 11 декабря 2012 г.
18:30 – 21:30
Дом культуры с. Варваровка
с. Варваровка, ул. Калинина,69А

Среда, 12 декабря 2012 г.
18:30 – 21:30
Армянский культурный центр «Арин Берд»
с. Гай-Кодзор,ул. Шаумяна,42

Представители компании South Stream Transport B.V. представят проект и ответят на Ваши вопросы.

Больше узнать о проекте можно на сайте: www.south-stream-offshore.com/ru

На правах рекламы

Птичий грипп

Избегайте контактов

Инфицированию вирусом птичьего гриппа типа А подвержены не только люди и птицы, но и некоторые животные — например, свиньи, лошади, хорьки, тюлени и даже киты. Всего у этого вида гриппа существует около 15 штаммов. Для человека серьезную опасность представляет штамм A(H5N1).

Птицы заражают друг друга вирусом птичьего гриппа при контакте больной особи со здоровой, а также через помет и предметы. Так как остановить эпидемию среди птиц нелегко, единственным эффективным способом остается полное уничтожение всех зараженных птиц и карантин. Птичий грипп у людей передается от зараженной птицы.

Самая большая вспышка в 2004-м году показала, что вирус не только мутировал и стал более заразным, но и преодолел межвидовой барьер — от птицы к человеку. Передача птичьего гриппа у людей от человека к человеку до сих пор не была зафиксирована или подтверждена.

Вирус птичьего гриппа — устойчив во внешней среде. В мертвых инфицированных птицах он может сохраняться до года.

С. ШИРОКОВА

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Перепечатка материалов "АЧ" без согласования с редакцией не допускается.

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обозреватели – 4-66-57, 4-63-55,
бухгалтерия – 4-66-72,
реклама и объявления – 4-65-84.
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The disclosure activities related to the Scoping Report are summarised in Table 6.2 below. All documents were disclosed in Russian, and the website included both Russian and English versions.

Table 6.2 Disclosure of Scoping Report (including NTS)

Stakeholder Group†	Means of Disclosure
All stakeholders and members of the public with internet access	South Stream Transport website (www.south-stream-offshore.com/ru)
Local Communities	Printed and bound copies made available in the Local Communities* together with comment forms and comment boxes
Local businesses, marine area users	Printed and/or digital copies posted, emailed or hand-delivered
Local, regional and national NGOs	Printed and/or digital copies posted, emailed or hand delivered
Local government	Printed copies hand-delivered

† Engagement with the media at the time of the disclosure of the Scoping Report is covered in Section 6.4.2.3.
*Copies of the Scoping Report made available in the Varvarovka Community Centre, the Gai Kodzor Community Centre and the Department of Architecture and Town Planning, town of Anapa.

Scoping Consultation Meetings

In association with the disclosure of the Scoping Report and consultation with the competent authorities (described above), additional scoping consultation meetings were held in December 2012. Meetings included roundtable meetings with specific stakeholder groups, and open-house community meetings in Varvarovka, Gai Kodzor, and Supsekh for anyone interested in the Project. These meetings are summarised in Table 6.3 and the locations of the scoping consultation meetings are shown in Figure 6.5.

The open-house style community meetings were held in the communities that are closest to the Project Area, where interest in the Project was also highest. Initial plans included two community meetings: in Varvarovka (including representatives from Supsekh and Sukko, which are part of the same rural district) and in Gai Kodzor, which is part of a different rural district. However, after discussion with local representatives it was decided that holding a separate meeting in Supsekh would be more appropriate for Supsekh residents; as such, South Stream Transport arranged for a third community meeting, in Supsekh. In order to ensure the open-house community meetings were accessible and locally relevant, these events were held in community centres in Varvarovka and Gai Kodzor, and at a school in Supsekh. The roundtable meetings were held in centrally located hotel conference rooms in Moscow and Anapa.

Table 6.3 Scoping Consultation Meetings

Meeting	Stakeholders invited	Date	Location
1. Roundtable Meeting	Marine users and local businesses	10 December 2012	Hotel Grand Valentina, Anapa
2. Community Meeting	Supsekh community representatives and general public	10 December 2012	Supsekh, School No. 11
3. Community Meeting	Varvarovka and Sukko community representatives and general public	11 December 2012	Varvarovka, Community Centre
4. Community Meeting	Gai Kodzor community representatives and general public	12 December 2012	Gai Kodzor, Community Centre
5. Roundtable Meeting	Local and regional NGOs	13 December 2012	Hotel Grand Valentina, Anapa
6. Roundtable Meeting	National NGOs	14 December 2012	Novotel Novoslobodskaya, Moscow

Invitation letters were sent to stakeholders in advance of the meetings, accompanied by the Scoping Report and NTS, by email, post and by hand. The community meetings were also advertised in the local press in early December 2012[14]. In addition, posters advertising each of the three community meetings were displayed in the Local Communities between 29 November and 10 December 2012.

More than 100 people attended the three meetings that were held in the Local Communities. The community meetings were open to all members of the public and were held in the early evening (after the end of the working day) so as to maximise the opportunities for both working and non-working people to participate. For the roundtable meetings, local, regional and national NGOs were invited to meetings to discuss the Project and the Scoping Report. Local and regional NGOs were invited to a meeting in the town of Anapa, while national NGOs were invited to a meeting in Moscow. All organisations invited were given the opportunity to present their views in writing if they preferred[15]. A meeting was also planned in Anapa with marine space users and local businesses. Six organisations that are marine space users and four local

[14] In newspaper *Anapskoye Chernomorye* on 8 December 2012.

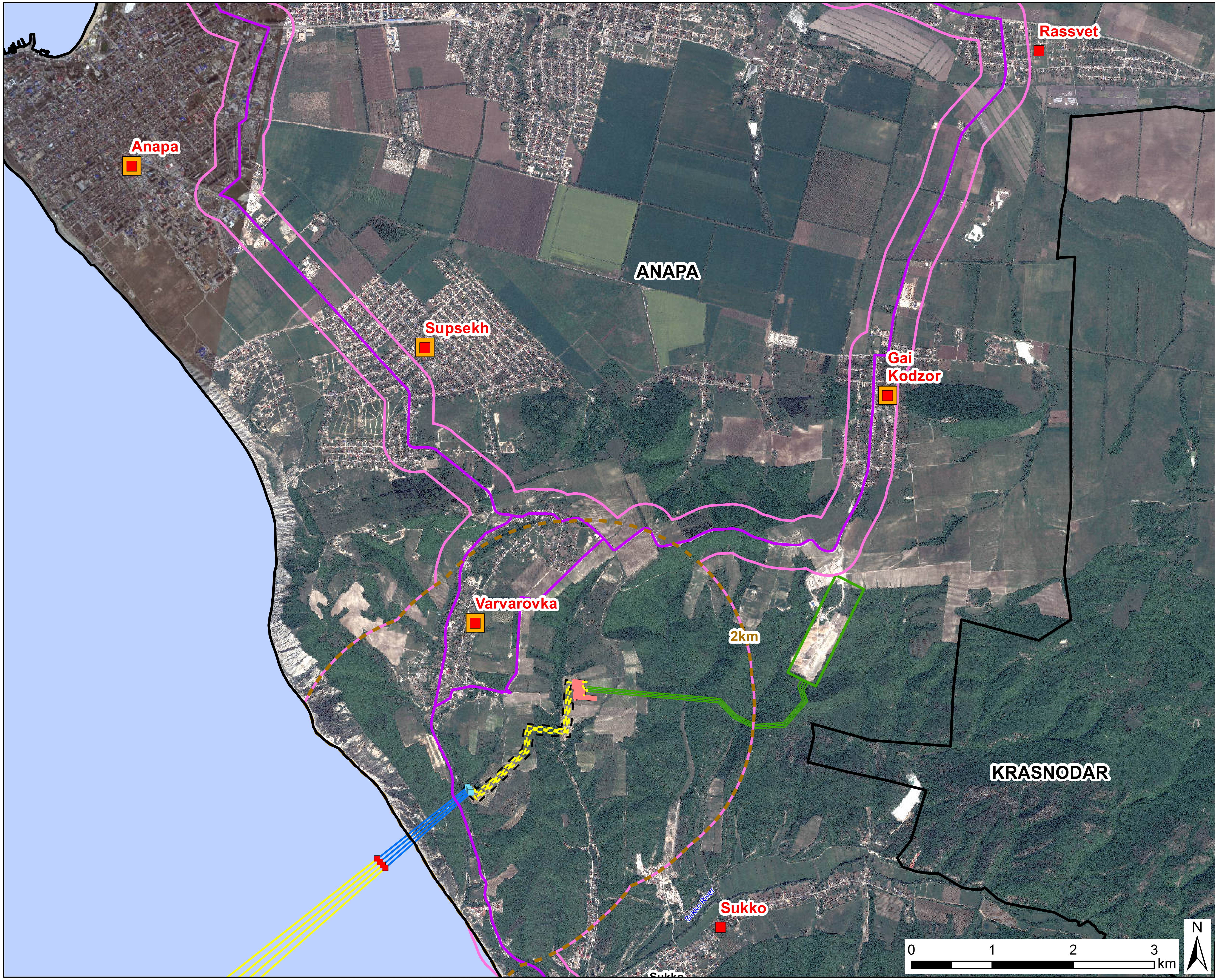
[15] Written feedback was received from a number of Russian NGOs in February 2013.

businesses confirmed their interest in these meetings but no representatives of these groups attended.

The community and roundtable meetings, which took place approximately three weeks after the Scoping Report was disclosed, were organised to facilitate the exchange of information and opinions. At the meetings, representatives of South Stream Transport presented information about the Project, the Scoping Report and the ESIA process. As shown in Figure 6.6, meeting participants were invited to provide comments and suggestions, both in the meeting itself and afterwards; written comments could be submitted at the meeting, or by post or email. Participants also had the opportunity to speak individually with representatives of South Stream Transport after the question and answer sessions were finished.

Visual and printed materials were made available to support the presentations and discussion, including additional copies of the Scoping Report and the NTS, as well as leaflets describing the Project and the ESIA process. Figure 6.6 illustrates the general presentation format of the meetings for both the community and roundtable meetings. The meetings were conducted in Russian, with translation between Russian and English as necessary.

Details of all discussions were documented by South Stream Transport so that they could inform the ESIA and on-going Project planning and design. The issues raised in these discussions are described in Section 6.5.2.2 and Table A6.1.2 shows how they have been considered as part of the ESIA process.



Revision Details	By / Check	Check Date	Suffix

Purpose of Issue
For Information

Client
South Stream — Offshore Pipeline — ENERGISING EUROPE

Project Title
SOUTH STREAM OFFSHORE PIPELINE

Drawing Title
MAP OF LOCAL COMMUNITIES WHERE PUBLIC MEETINGS WERE HELD

Drawn	Checked	Approved	Date
AH	RW	MW	09 Apr 2014

URS Internal Project No.	Scale @ A3
46369082	1:45,000

URS Infrastructure & Environment UK Limited
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Alencon Link, Basingstoke
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Fax (01256) 310201
www.ursglobal.com

Drawing Number	Rev
Figure 6.5	

Plot Date: 09 Apr 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 6 Consultation and Disclosure\Figure 6-5 Russian Stakeholder Engagement Consultations.mxd

Figure 6.6 Consultation Meetings in Supsekh (left) and Varvarovka (right)

Since the disclosure of the Scoping Report, Rassvet has also been defined as a Local Community (section 6.3.2) due to confirmation of the construction traffic access route which will pass through Rassvet (see **Chapter 15 Community Health, Safety and Security**). Although specific engagement was not undertaken in the community of Rassvet for the Scoping Report disclosure and consultation meetings, it will occur for consultation activities associated with the disclosure of the ESIA Report (refer to Section 6.4.2.4 for planned activities).

6.4.2.3 Completed Activities – Other Meetings

In addition to the scoping consultation meetings, meetings have also been held with other stakeholders to engage them with the Project in relation to their activities, provide updates on the Project, discuss technical issues and gather baseline data and information to input into the EIA and ESIA reports. These meetings, which generated comments and feedback of relevance to this ESIA Report, included:

1. Meetings with Krasnodar Krai Regional Administration, ART Municipal District Administration, Supsekh Rural District Administration and Gai Kodzor Rural District Administration, in 2012 and 2013;
2. Meetings with fishing organisations in April and October 2013, and with the development company Fond Yug, the Kavkaz Winery and the Shingari Holiday Complex in October 2013. Meetings were also held with a horse riding company in Varvarovka and an environmental specialist in Anapa; and
3. Meetings with ART Municipal District Administration, Supsekh Rural District Administration and Gai Kodzor Rural District Administration, and Rassvet School, in February 2014.

The purpose of the meetings with the regional and district administrations was primarily to engage and discuss with them the Project and their involvement in the EIA and ESIA processes, and gather information and data where necessary. Representatives of the administrations in the Anapa area were also invited to comment on key EIA and ESIA documents (i.e. ToR, SR and EIA) and given the opportunity to meet with representatives of South Stream Transport to discuss these documents, as well as to attend the community meetings. Comments raised during these meetings are included in Section 6.5.2.1 and Table A6.1.2 in Appendix 6.2.

The purpose of the meetings with the other stakeholders was to discuss the Project and how it relates to their activities, and to gather socio-economic data and information for the EIA and ESIA reports. Comments raised during these meetings are included in Section 6.5.2.3 and Table A6.1.2 of Appendix 6.2.

6.4.2.4 Engagement with Media

The Russian media have been engaged with the Project at key milestones in the ESIA stakeholder engagement process including:

- Distribution of press releases around major milestones including, but not limited to, the disclosure of reports;
- Newspaper advertisements used to communicate with stakeholders disclosure of reports and information about ESIA stakeholder meetings;
- Press events organised around the disclosure of the Scoping and Draft EIA Reports to provide information to journalists and media stakeholders to give them an opportunity to engage with representatives from South Stream Transport and ask questions; and
- Attendance at the EIA Public Hearing.

6.4.2.5 Completed Activities – National EIA Report

Under the national EIA process, the Draft EIA Report was disclosed for comment on 29 April 2013. An announcement marking the start of the Draft EIA disclosure and consultation period was published in national[16], regional[17] and local[18] newspapers in April 2013.

Printed and bound copies of the Draft EIA Report were made available in the same locations as for the Scoping Report:

- Community Centre in Varvarovka;
- Community Centre in Gai Kodzor; and
- Department of Architecture and Town Planning in the town of Anapa.

Comment stations (including comment forms and secure comment boxes) were provided where stakeholders could review the report and submit their comments. Stakeholders were also able to submit comments by post, by email or by telephone.

A Public Hearing was held on 31 May 2013, in the town of Anapa; the details were announced in the local media. At the hearing, representatives of South Stream Transport presented information about the Project, the Draft EIA Report and the EIA process. Participants were invited to provide comments and suggestions. Participants also had the opportunity to speak individually with representatives of South Stream Transport after the question and answer

[16] In the newspaper Rossiiskaya Gazeta, 25th April 2013.

[17] In the newspaper Kubanskiye Novosti, 27th April 2013.

[18] In newspaper *Anapskoye Chernomorye*, 27th April 2013.

sessions were finished. Visual materials were made available to support the presentations and discussion. The hearing was conducted in Russian, with translation between Russian and English as necessary.

An official record of the hearing was prepared by the ART Municipal District and signed by the presenting team and the ART administration representatives. This record included the comments received via the secure comment boxes. The main issues raised are included in the comment summary in Section 6.5.2.2 and Table A6.1.2 in Appendix 6.2.

6.4.2.6 Planned Activities – ESIA Disclosure and Consultation

The consultation programme for this draft ESIA Report has considered the combined outcomes of both EIA and ESIA engagement activities to date. The objectives of the draft ESIA Report engagement programme are presented below, whilst the SEP contains more detailed information on the engagement programme. The SEP is available on the South Stream website, and copies will also be made available during the ESIA disclosure period.

The focus of further engagement activities during the ESIA process is to ensure that Local Communities and other key stakeholders are provided with the opportunity to:

- Access clear and appropriate (i.e. non-technical, local language) information on the Project and its potential impacts;
- Provide feedback on the content of the ESIA including the assessment of impacts, and the proposed mitigation, management and monitoring measures; and
- Provide input regarding plans for future engagement activities, including preferences for methods, materials and schedule.

Whereas the legal provisions for public consultation and disclosure for the national EIA process end with Public Hearings on the Draft EIA, for the international ESIA process, engagement goes beyond ESIA disclosure and consultation and continues during the Construction and Pre-Commissioning, Operational and Decommissioning phases of the Project. This reflects the recognition that relationships with stakeholders are on-going throughout the life of a project and on-going engagement will ensure that stakeholders are consulted about activities that may affect them at any stage of a project.

This draft ESIA Report has been publicly disclosed along with a non-technical summary of the Report. These documents are available online at http://www.south-stream-offshore.com, along with information about upcoming stakeholder engagement activities and the ways in which stakeholders can provide comments on the Project and the ESIA. Announcements have been made through local and national media. Documents and announcements have also been provided directly to the key stakeholders identified to date and are available in the office of the Project Community Liaison Officer.

Alternatively, interested stakeholders can contact South Stream Transport (Table 6.5), either via the Project's Information Centre in Krasnodar or via the Amsterdam Head Office, to request a copy of the ESIA Report, non-technical summary, or other information. Stakeholders can also provide questions and comments via these communication channels.

Table 6.4 Contact Information

South Stream Transport B.V. - Krasnodar Branch	**In Person or by Post:** Komsomolskaya 15, 350000 Krasnodar, Russia **Email:** office.krasnodar@south-stream-transport.com
South Stream Transport B.V. - Amsterdam Head Office	**Email**: esia@south-stream-transport.com **Website:** www.south-stream-offshore.com **Phone**: +31 (20) 262 4500 **Fax**: +31(20)524 1237 **Post**: Parnassusweg 809, 1082 LZ, Amsterdam, Netherlands

Stakeholders have the opportunity to comment in writing and to attend community meetings to discuss the Project, the draft ESIA Report and related documentation. The community meetings will allow stakeholders to express their views and ideas about the Project and the ESIA to representatives of South Stream Transport and the ESIA consultants, as well as to provide additional information or suggestions to assist the ESIA process and Project planning. Roundtable meetings with groups of related stakeholders are also planned; additional meetings with specific stakeholders may also be organised, as appropriate.

Comments received on the draft ESIA Report will be taken into consideration in the preparation of the final ESIA Report. The final ESIA Report will be disclosed on the South Stream Transport website and will inform later phases of the Project.

6.4.3 Construction and Pre-Commissioning, Operational, and Decommissioning Phases

Stakeholder engagement will continue over the life of the Project throughout the Construction and Pre-commissioning, Operational and Decommissioning Phases. With an operational life of 50 years, South Stream Transport is committed to maintaining relationships and communications with stakeholders over this time.

During the Construction and Pre-Commissioning Phase, and in subsequent phases, the emphasis of engagement shifts to focus on consultation and disclosure about activities that are on-going or about to take place, and receiving feedback from stakeholders about on-going activities.

Engagement activities will include published announcements and updates about the progress of the Project. The Grievance Procedure will also be a key element of the Construction and Pre-Commissioning Phase and later phases of the Project. Plans for on-going stakeholder engagement are described in more detail in the SEP, which will be updated as the Project progresses. Engagement activities will be adjusted to reflect evolving stakeholder preferences and concerns over the life of the Project.

6.5 Stakeholder Comments and Suggestions

6.5.1 Overview

This section summarises the general comments and suggestions received from stakeholders during the EIA and ESIA consultation processes to date, how these comments have been considered and responded to in this ESIA Report and, in some instances, how the response from the Project has been communicated to stakeholders in advance of the ESIA Report disclosure process. The feedback received has been divided into that from:

1. National, regional and local authorities i.e. Russian national, regional and local government, primarily gathered during meetings related to the EIA process (summarised in Section 6.5.2); and
2. The public and other non-governmental stakeholders (e.g. residents of Local Communities, fisheries and marine area users, NGOs, Inter-governmental organisations, fisheries unions and cooperatives, academic and scientific organisations) engaged primarily through the ESIA process (summarised in Section 6.5.3).

The following sections present summaries of how stakeholder feedback has been considered and responded to by the Project, through the EIA and ESIA processes. As the EIA and ESIA processes have run in parallel, the disclosure of the EIA documentation, and the EIA public hearing, has served to detail the Project response to some of the issues raised by stakeholders during the scoping consultations. Similarly the feedback from stakeholders on the EIA documentation has further informed the ESIA. A full list of the comments received is provided in Appendix 6.1 of this chapter. A list of all stakeholder engagement activities to date is provided in Appendix 6.2.

6.5.2 National, Regional and Local Authorities

During the Development Phase and since June 2012, a number of meetings[19] were held with the regional, municipal and rural district authorities across the Local Communities of the Town of Anapa, Supsekh, Varvarovka, Sukko, Gai Kodzor and Rassvet, to discuss the Project and gather feedback and information from the Local Communities, for data collection and to discuss key issues and potential impacts of the Project.

Table 6.5 summarises the main comments and issues raised by authorities and related stakeholders during the Project's Scoping Stage engagement activities, and provides a description of how South Stream Transport has considered and responded[20] to these comments through the EIA and ESIA processes.

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[19] Only meetings of relevance to the ESIA process included in this chapter.

[20] Note that the responses provided are intended to be technically correct at the time of writing. Due to the evolution of Project planning, design and schedule, this may not be the same as the response that was provided at the time the question or concern was raised

Table 6.5 Comments Received from National, Regional and Local Authorities

Comments	Consideration and Response
Traffic	
Questions were raised about potential impacts to the quality of existing local roads, especially around Gai Kodzor and as a result of the Russkaya Compressor Station.	A bypass road was constructed to the east and south of Gai Kodzor in early 2013 by Gazprom Invest for vehicles traveling to the site of the Russkaya Compressor Station from the M25. To avoid damage to the main road and impacts on the community in Gai Kodzor, construction traffic related to the Project will also be diverted around Gai Kodzor using this bypass road. Existing damage to the road through Gai Kodzor was repaired in early 2013. Subsequent engagement with the Gai Kodzor local administration (early 2014) has confirmed that the traffic and road quality issues in Gai Kodzor were resolved with the construction of the bypass road and the completion of the repairs. The town of Rassvet has subsequently also been identified as one that will be impacted by Project construction traffic. Site visits and specific consultation with the local authority were undertaken in relation to this issue in early 2014 and mitigation measures proposed (see **Chapter 15 Community Health, Safety and Security** and **Appendix 20.1 Environmental and Social Impacts of Associated Facilities: Russkaya Compressor Station**). In addition, the Project has committed to the construction of a bypass road to divert traffic from the centre of Varvarovka thereby avoiding the main traffic related impacts during construction.
Gazprom and Gas Supply	
Will local communities benefit from the new Project gas supply?	South Stream Transport is a gas transport rather than a gas delivery company and is not involved in the provision of gas to the local population. At the Scoping meetings where this issue was raised, the representatives of South Stream Transport stated that although the supply of gas to local communities is outside the scope of the Project, the questions from the community would be passed to Gazprom. South Stream Transport met with representatives of Gazprom in May 2013 and discussed the issue of gas supply. Gazprom stated that a co-operation agreement was approved by the Governor of the Krasnodar Region and the Chairman of the Management Committee of Gazprom that covered gas supply and gasification of the south-western area of the Krasnodar Krai, including the Anapa region.

Continued…

Comments	Consideration and Response
Community Development	
Will the Project be making any financial contributions to development in the rural districts?	South Stream Transport has a Community Investment Programme. This will guide the company's activities in the Local Communities beyond the direct scope of the Project, and may include support for local development initiatives. Through the Community Investment Programme, South Stream Transport will work with local stakeholders to identify suitable community investment opportunities.
Noise and Vibration	
Questions related to Project-generated noise and how it will be managed.	South Stream Transport conducted a noise impact assessment for the construction and operation of the Project. Due to design changes (the construction of a bypass road to divert construction traffic from the centre of the community of Varvarovka) and the use of the compressors during the pre-commissioning activities, the noise assessment was revised in early 2014 and found that there will be moderate level, short term and temporary noise impacts in some areas of Varvarovka during construction. The mitigation, management and monitoring of noise impacts is detailed in **Chapter 10 Noise and Vibration** and in **Chapter 15 Community Health, Safety and Security**.
Health and Safety	
Questions related to safety, particularly in the event of a gas explosion.	The Project has developed specific design criteria which comply with Russian legislation and European and international pipeline industry standards to minimise the risk associated with gas leakages (and subsequent fires and explosions) and therefore protect members of the public in surrounding areas, the operational workforce and the environment. Information on the Project design and safety issues was contained in the draft EIA Report disclosed for public comment in the second quarter of 2013. The risk of a gas leak or explosion is very small. In any event, the Project will include the preparation of emergency response plans to ensure that emergency response procedures are implemented and understood. Further information can be found in **Chapter 19 Unplanned Events** and **Chapter 22 Environmental and Social Management**.

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6.5.3 Public and Other Non-Governmental Stakeholders

This section summarises the feedback received from the public and other stakeholders (including NGOs, local business, administrations, marine area users, etc.) during the:

1. EIA Terms of Reference disclosure and consultation period;
2. Scoping Report disclosure and consultation period, including community meetings and roundtable meetings;
3. EIA Report disclosure and consultation period, including the EIA Public Hearing; and
4. Meetings and other communications with stakeholders outside of official consultation periods, including data collection meetings.

Feedback from the public and other stakeholders during the Scoping Report disclosure and consultation period was received through a series of scoping consultation meetings (including roundtable and community meetings) and in writing. Feedback received during the EIA Report disclosure and consultation period has also been considered by South Stream Transport in this ESIA Report.

Stakeholders had the opportunity to provide comments and suggestions outside of these formal periods, including at meetings with South Stream Transport, or by contacting South Stream Transport or its consultants by telephone, email or post or in person. The Project organised various meetings with stakeholders (referred to in Section 6.4.2.2) to ensure they were engaged with the Project and to gather baseline data and information, to input into the EIA and ESIA reports.

The most common topics raised included the following:

- Questions regarding Gazprom and gas supply to the Local Communities;
- Potential impact of the Project on the terrestrial environment (including the coastline and onshore valuable habitat areas) and the marine environment (including marine ecology and any restrictions to fishing and shipping activities) and questions raised regarding mitigation measures implemented by the Project to manage impacts;
- Questions about safety of the Project, including potential emergency situations and emergency response measures;
- Questions about how the Local Communities will benefit from the Project and how the Project will manage potential impacts on the coastline and the tourism industry;
- Questions about how the Project is engaging with its stakeholders to ensure public opinion is considered;
- Potential impact of increased project-related traffic on the existing road network and Local Communities in relation to noise and vibration;
- Questions about the routing of the Pipeline and whether alternative options were considered; and
- Questions about the EIA and ESIA processes.

This stakeholder feedback is summarised in Table 6.6, which contains a summary of the main comments, issues and questions raised by stakeholders and how these have been considered and responded to by the Project.

Table 6.6 Summary of Public and Other Stakeholder Comments

Comments	Consideration and Response
Gazprom, Gas Supply and Russkaya Compressor Station	
Gas supply for local communities such as Varvarovka and Sukko.	South Stream Transport is a gas transport rather than a gas delivery company and is not involved in the provision of gas to the local population. At the Scoping meetings where this issue was raised, the representatives of South Stream Transport stated that although the supply of gas to local communities is outside the scope of the Project, the questions from the community would be passed to Gazprom. South Stream Transport met with representatives of Gazprom in May 2013 and discussed the issue of gas supply. Gazprom stated that a co-operation agreement was approved by the Governor of the Krasnodar Region and the Chairman of the Management Committee of Gazprom that covered gas supply and gasification of the south-western area of the Krasnodar Krai, including the Anapa region.
Issues related to the construction of the Russkaya compressor station, including: protection of the environment and restoration of the landscape to its original state following Project activities, and concerns about noise, traffic and road quality.	The Russkaya Compressor Station is not part of the Project, and will be designed and installed as part of a separate project known as "Expansion of the UGS (United Gas Supply System) to provide gas to South Stream Pipeline" which is being constructed by Gazprom Invest. However, the potential for cumulative effects of the Project with the Russkaya Compressor Station has been assessed in **Chapter 20 Cumulative Impact Assessment** and details of the impacts of the Russkaya CS as outlined in the EIA for the development can be found in **Appendix 20.1 Environmental Impacts of Associated Facilities: Russkaya Compressor Station.** South Stream Transport is engaging with Gazprom Invest with the aim of aligning Gazprom Invest's ecological mitigation strategy and mitigation measures as related to the Russkaya CS development with those of the Project. Of particular importance is the avoidance of impacts through the sensitive timings of works (including the herpetiles hibernation period), implementation of herpetile fencing and a programme of translocation, and adherence to good industry practice as well as to develop measures that would enhance biodiversity management within the wider area. In addition, South Stream Transport is liaising with Gazprom Invest with the aim of developing aligned and coordinated traffic management plans. Discussions are on-going at the time of writing.

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Comments	Consideration and Response
Environmental Protection (Onshore)	
Potential adverse impacts on the natural environment, including the marine environment, the coastline, onshore valuable habitat areas (e.g. the mountain area of the Kilberov Canyon, Sukko Beach), juniper trees and local wildlife.	Potential impacts on habitats and ecology have been assessed in **Chapter 11 Terrestrial Ecology** and **Chapter 12 Marine Ecology**. These chapters have considered potential impacts on a range of ecology receptors, including designated sites, natural habitats and protected species of plants and animals. The key impacts relate to habitat loss and fragmentation, severance, habitat degradation, direct mortality and injury to species. These chapters also describe the mitigation, management and monitoring measures that will be implemented in order to avoid and/or minimise these impacts. The landfall section of the Project contains a short section that runs through some areas that serve as a habitat for the protected Nikolski's Tortoise and for protected Juniper along with some other protected species of flora and fauna. The Project will implement special mitigation measures to protect these species during construction of the Project, including the relocation of these species from the construction site to alternative areas. The relocation of Juniperus trees took place in April 2014 with trees being relocated from Varvarovka to Anapa. The relocation process was supervised by Rosprirodnadzor from the Ministry of Natural Resources and Environment to ensure the process complied with the legal permit conditions. In addition, the Project has committed to further reinstate parts of the sea cliff near Varvarovka that were impacted by geotechnical surveys during the Feasibility Phase, including replanting of juniper trees (see **Chapter 11 Terrestrial Ecology** and **Appendix 11.2 Outline Cliff Reinstatement Plan** of this ESIA Report). Before the start of construction activities, South Stream Transport will safely move the tortoises to suitable areas nearby, in accordance with the relevant legislation and when the tortoises are not hibernating. The construction area will also be fenced and tunnels will be installed, to avoid entry of the tortoises into the construction site.

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Comments	Consideration and Response
The Project should follow the relevant environmental protection laws and propose appropriate mitigation measures.	In addition to the relevant Russian laws and regulations, the Project is following the standards and guidelines of financing organisations (see **Chapter 2 Policy, Regulatory and Administrative Framework**). The relevant national laws and regulations in relation to the environment were addressed in the EIA for the Project which was disclosed in the second quarter of 2013 (see Section 6.4.2.4). Members of the public were able to attend the open public hearing on the EIA held in the town of Anapa and to ask questions and make comments on the EIA process and content, including proposed mitigation measures. The EIA was approved by the Russian authorities in late 2013 and early 2014. A newspaper announcement was published in the local press in May 2014 in order to inform stakeholders that the regulatory process had been followed and completed in relation to the EIA. In addition, for each topic in the ESIA, where impacts have been identified, mitigation measures have been proposed and these are detailed under each topic chapter of this ESIA Report which will be publicly disclosed in mid-2014. Some of the proposed mitigation measures have been discussed directly with relevant stakeholders (for example the Utrish Nature Reserve and the Moscow Academy of Sciences), such as the relocation of protected species.
Controls should be put in place to minimise harmful impacts e.g. minimising Project generated waste and other discharges to the environment.	An assessment of waste-related impacts and management measures is provided in **Chapter 18 Waste Management**. Project staff have visited potential waste disposal facilities and discussed the issue of waste management with the local Anapa administration during 2013, in advance of agreeing the final facilities with the construction contractor. An Environmental and Social Management Plan will include measures to minimise waste production and encourage re-use and recycling of materials where possible. The Project will use only existing licensed facilities for waste disposal and all vessel discharges and waste will be compliant with Marine Pollution (MARPOL) Convention, Bucharest Convention and national regulations.
The Project should not impact on ecosystems or disturb the ecological balance.	An assessment of the Project's impact on ecosystems has been undertaken to identify likely impacts and measures to reduce the impact or mitigate against any adverse impacts. Potential ecological impacts and management measures are described in **Chapter 11 Terrestrial Ecology** and **Chapter 12 Marine Ecology**. Additionally, potential impacts (and mitigation) related to potential impacts on the value, function and services of ecosystems on which local communities and/or the Project depend, are described in **Chapter 17 Ecosystems Services**.

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Comments	Consideration and Response
How will the landscape be rehabilitated and restored to its original state after the Project activities?	A Landscape Restoration Plan will be prepared to ensure land is restored with native, original species that will need to be removed to allow construction of the Project. This Plan is based on the outcomes of the assessment in **Chapter 13 Landscape and Visual**. In addition, the Project has committed to further reinstate parts of the sea cliff near Varvarovka that were impacted by geotechnical surveys during the Feasibility Phase, including replanting of juniper trees (see **Chapter 11 Terrestrial Ecology** and **Appendix 11.2 Outline Cliff Reinstatement Plan** of this ESIA Report).
Health and Safety	
Questions on potential emergency situations and emergency response measures, and whether the Project will record any Project-related accidents and comply with relevant safety measures.	The Project will comply with all national and international health and safety requirements, including requirements for documentation of accidents and incidents. Community and occupational health and safety is discussed in **Chapter 15 Community Health, Safety and Security** and **Appendix 15.1 Occupational Health and Safety**. Emergency Response Plans (ERPs) will be prepared to ensure that emergency response procedures are implemented and understood. Further information, including risks and management measures, can be found in **Chapter 19 Unplanned Events** and **Chapter 22 Environmental and Social Management**. At the Russian landfall facilities, Emergency Shutdown (ESD) valves and safety systems will be installed for each pipeline, which will automatically detect any non-standard operating conditions and stop the flow of gas immediately.

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Comments	Consideration and Response
Concerns related to seismic activity such as earthquakes, which could cause changes to soil and seabed and/or impact the Pipeline.	Seismic studies have been undertaken to ensure the Project design is suitable to the ground conditions and is not affected by any potential seismic activities. In order to minimise the effect of potential displacement from seismic activity, each pipeline will be laid in an enlarged trench. In certain sections, the pipelines will be laid on a bed of sand and backfilled with loose sand rather than the previously excavated soils. The combination of the wider trench and backfilling with loose sand allows the pipelines to move in a lateral direction should there be any movement by the fault, thereby lowering the risk of damage to pipeline integrity. Seismic activity and potential risks related to the Project are described in **Chapter 7 Physical and Geophysical Environment**. The information on the seismic studies and the design of the Project design to ensure safety was communicated to stakeholders during the Scoping meetings in December 2012 and safety and design issues were included in the EIA Report which was publicly disclosed in the second quarter of 2013.
Socio-Economic	
How will local communities benefit from the Project? Questions about job creation, local hiring, and procedures for advertising available positions.	Project expenditures will result in demand for local goods and services (particularly during construction). In addition, some direct employment related to unskilled and semi-skilled positions may take place. Both procurement and employment will make a temporary and limited but beneficial contribution to the local economy. The majority of employment related to the construction of the Russian Sector of the South Stream Offshore Pipeline will be highly specialised and managed by the offshore construction contractor. Some, although limited, local employment opportunities may be available through the construction contractor, and South Stream Transport has requested the construction contractor to advertise suitable positions locally and will encourage the contractor to hire local residents where practicable. Further information is provided in **Chapter 14 Socio-Economics**. South Stream Transport is also developing a Community Investment Program. This will guide the company's activities in the Local Communities beyond the direct scope of the Project, and may include support for local development initiatives. Through the Community Investment Programme, South Stream Transport will work with local stakeholders to identify suitable community investment opportunities.

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Comments	Consideration and Response
Potential impacts on the coastline, and therefore on tourism activities. The potential impact on the leisure and recreation industry in Anapa Resort Town Municipal District should be assessed as part of the EIA.	An assessment of potential socio-economic impacts, including impacts on local beaches and tourism activities, is provided in **Chapter 14 Socio-Economics**. The assessment concluded that residual impacts on specific businesses and on the tourism sector from Project activities will be not significant. The Project met with specific stakeholders such as Shingari Holiday Complex in the second half of 2013 and with local authorities, local tourism businesses and the local community in May 2014 to discuss Project activities and potential impacts on beach users and tourists.
Will the Project have a negative impact on Sukko beach, which is a popular tourist destination?	An assessment of potential socio-economic impacts, including impacts on beaches and tourism, is provided in **Chapter 14 Socio-Economics**. During the construction of the Project, although no significant impacts on Sukko beach are expected, it is possible that beach users will be able to see construction vessels working in the sea for short periods of time. There may be a limited and short term (a few days at most) impact on water clarity during nearshore construction depending on the prevailing currents and wind conditions which has been assessed as having a low residual impact as part of the socio-economic assessment (see **Appendix 12.2 Sediment Dispersion Study**).
Stakeholder Engagement	
How is the Project engaging with stakeholders? Stakeholders should be consulted on the need for the Project and emergency plans.	South Stream Transport has carried out stakeholder engagement in accordance with national regulatons and following the standards and guidelines of international financing organisations along with Good International Industry Practice. Engagement activities to date have included the disclosure of various Project documents, community meetings, roundtable meetings, public hearings, and other meetings. Stakeholder engagement activities are described in this chapter (**Chapter 6 Stakeholder Engagement**) and in the Stakeholder Engagement Plan (www.south-stream-offshore.com).
Public opinion must be considered prior to Project implementation, as well as the cooperation and involvement of the press and administrative officials.	South Stream Transport values feedback and opinions from all stakeholders. Anyone interested in the Project can submit comments via email, post, or in person. South Stream Transport also regularly reviews media and other articles reflecting public opinion, concerns and perceptions, and engages with local administrations on issues related to the communities and regarding updates about the Project. **Chapter 6 Stakeholder Engagement** describes stakeholder engagement to date, including engagement with media, local officials and communities and the public, and the comments that have been received.

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Comments	Consideration and Response
All feedback should be addressed and included in the EIA Report.	All feedback, questions and comments received from stakeholders regarding the Project has been documented in the EIA and ESIA Reports. The EIA Report contains a record of the comments submitted during the EIA Report discosure period along with questions asked at the EIA public hearing. The ESIA Report contains a summary of the main issues raised by stakeholders during both the EIA and ESIA processes and a list of comments made by stakeholders can be found in **Appendix 6.1 Comments received during the Feasibility and Development Phases.** Feedback, questions and comments received from stakeholders regarding the Project have also been considered in the development of both the EIA and ESIA reports. The development of design controls and proposed mitigation measures has considered stakeholder feedback, for example the construction of road bypasses around the communities of Gai Kodzor and Varvarovka to reduce traffic and road safety impacts; the restriction on nearshore construction to avoid fish spawning season; the lift of the amphora from the seabed in order to prevent damage to the cultural heritage object from pipelaying activities.
Residents should be informed about the schedule for Project works, so that they can know when they will be taking place. This schedule should be presented and discussed at any meeting with local residents.	A schedule of works is included in the EIA, ESIA, and Non-Technical Summary which are disclosed to the public. Current schedules are also shared at meetings with stakeholders, including public meetings in the communities. **Chapter 1 Introduction** provides the schedule for the development of the Project, with additional details in **Chapter 5 Project Description.**
Environmental Protection (Marine)	
Potential adverse impacts on the marine environment.	Potential impacts on the marine environment have been assessed in **Chapter 12 Marine Ecology**, which has identified potential impacts related to underwater noise, dredging and other impacts. A series of mitigation and management measures are identified in this chapter, and no significant residual impacts are anticipated.

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Comments	Consideration and Response
Will there be prohibited access for fishing and shipping?	During construction, a marine safety exclusion zone of between 2 and 3 km radius (depending on the location of the pipe-lay spread) around the pipe-laying vessel during pipe-laying will be required to avoid interactions between the Project's activities and existing marine traffic and fishing vessels. This exclusion zone will move with the pipe-laying vessel, and will restrict access for fishing or other activities. These construction restrictions will be lifted behind the pipe-laying spread as the spread moves forward. **Appendix 14.1 Fisheries Study** examined potential impacts on fishing grounds, access, and fish stocks and concluded there will be no significant impact.
Questions about potential impacts on fish migration routes and spawning areas, including impact from underwater noise.	An international specialist company from the UK prepared a separate fisheries study for the Project which can be found in **Appendix 14.1 Fisheries Study**. Local fishing companies and government institutions, were consulted during the ESIA process to assess fishing and migratory issues. The potential interaction between the construction schedule and activities and fish migration routes and spawning areas has been considered in both the EIA and ESIA Reports. No significant impact on fish migrations, or fisheries activities, in Russian waters is expected. Impacts on fishing are assessed in **Chapter 9 Socio-Economics**, while impacts on fish are assessed in **Chapter 12 Marine Ecology.** In order to avoid impacts during the sensitive spawning season, coastal construction will not be undertaken in May, when spawning takes place. Regarding noise, an acoustic impact analysis showed that sound levels generated by pipe-laying and trenching in the Black Sea will not cause mortality or injury to fish. To further reduce the impact of noise on marine species, mitigation measures will be implemented, including the gradual ramping up of vessel engines to allow fish to move away from noise sources. Fish monitoring will take place during construction. Overall, both **Chapter 12 Marine Ecology** and **Appendix 14.1 Fisheries Study** conclude that no significant impacts on fish or fisheries are anticipated. Further to the meetings undertaken as part of the preparation of the fishing study report, Project representatives met with fishing companies again in May 2014 to communicate the results of the study in advance of the disclosure if this ESIA Report.

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Comments	Consideration and Response
Traffic	
Increased Project traffic will impact on existing road network and local communities e.g. leading to the generation of dust and concerns over pedestrian safety.	A traffic assessment was conducted and is provided in **Appendix 9.1 Traffic and Transport Study**. The assessment concluded that the presence of the temporary bypass roads around Gai Kodzor and Varvarovka (see Table 6.5) will mean that construction vehicles will no longer travel through Gai Kodzor and Varvarovka, leading to less dust, traffic noise, traffic congestion and road safety issues for local communities. South Stream Transport will ensure that vehicles are clean, well maintained and follow designated construction routes to ensure disturbance and the risk to pedestrian safety is minimised on all Project access routes. Meetings with the Gai Kodzor local administration in early 2014 confirmed that the traffic and road quality issues in Gai Kodzor were resolved with the construction of the bypass road and the completion of the related road repairs. The bypass road around Varvarovka will result in some noise impacts for some residents of North East Varvarovka living near the proposed bypass and mitigation measures have been proposed to address this impact (see **Chapter 10 Noise and Vibration**). Site visits and specific consultation with the local authority have been undertaken in early 2014 in relation to potential road impacts in the community of Rassvet and mitigation measures proposed (see **Chapter 15 Community Health, Safety and Security** and **Appendix 20.1 Environmental Impacts of Associated Facilities: Russkaya Compressor Station**).
Will additional roads be constructed for the Project?	A number of permanent and temporary (i.e. construction) roads will be constructed and used for the Project, including: the Gai Kodzor bypass road (already constructed by Gazprom Invest); the Varvarovka bypass road (which will be a permanent road but will only be used by the Project during the Construction Phase and not during the Operational Phase); a permanent access road to the landfall facilities (2.6 km constructed by Gazprom Invest and a short 200 m spur to the landfall facilities constructed by South Stream Transport); and a temporary access road from the permanent access road to provide access to the microtunnel construction site. Roads and other facilities are detailed in **Chapter 5 Project Description**.

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Comments	Consideration and Response
Project Location, Routing and Alternatives	
Have other alternative options been considered? Why was Anapa selected, instead of Novorossiysk, Sochi, Gelendzhik or Temryuk?	When defining the route, the technically and financially feasible alternatives were considered along with the related environmental and social characteristics and issues. This process is described in **Chapter 4 Analysis of Alternatives**. These studies concluded that the selected landfall location in Anapa provided the optimal solution along the Russian Black Sea coast. Information about Project alternatives, the selection of the landfall location, safety standards, and impacts on communities have been discussed in previous meetings, including community meetings during the Feasibility Phase, meetings related to the Scoping Report and to the draft EIA Report. Potential impacts on residents of nearby communities, and how these will be mitigated, are described in **Chapter 9 Socio-Economics.**
EIA/ESIA Processes and Reports	
How is the Project managing impacts?	Potential impacts from the Project have been assessed in accordance with national legislation and following the standards and guidelines of international financing organisaitons. In each chapter of the impact assessment, design controls and mitigation measures are identified to manage, reduce or avoid adverse impacts. These measures will be incorporated into the management plans which will be put in place to manage and monitor impacts and ensure the mitigation measures are implemented in accordance with the EIA and ESIA Reports during the Construction and Operational Phases of the Project. Further details are set out in **Chapter 22 Environmental and Social Management** and in each assessment chapter (chapters 7 to 18).

Continued…

Comments	Consideration and Response
There should be one single EIA that meets both Russian and international requirements and covers both the South Stream Offshore Pipeline and the Russkaya Compressor Station. Carrying out both EIA and ESIA processes in Russia complicates assessment and creates confusion, especially two stakeholder engagement processes.	The entire South Stream Gas Pipeline System spans over 2300 km, crossing a number of countries and different geographies to transport natural gas from Russia to the countries of Central and South-Eastern Europe. It is not unusual for a project of this size to be divided into separate elements due to the fact every country has its own regulations in which the Project must comply. In addition, the offshore component of the Pipeline System through the Black Sea is very different from the onshore sections in terms of technical design, engineering and construction methods, as well as with respect to the surrounding environment. As such, it made sense to evaluate the offshore section separately. With respect to the EIA and ESIA, these two documents are designed to meet different requirements are often different in methodologies and approach, as well as content. South Stream Transport is making efforts to ensure that stakeholders understand the differences and similarities between these two processes. All feedback received as part of both processes has been considered in the development of this ESIA Report.
How will information collected during the assessment process influence decision-making and the ESIA Report?	Baseline information has been collected through a wide range of methods including through scientific surveys, consultation with authorities, administrations and other organisations, local communities and site visits. This information is analysed and used to carry out the impact assessments. All data and feedback collected is considered in the ESIA Report, informing the understanding of the baseline, potential impacts and receptors, and the development of mitigation and management measures. This process has been explained at all public meetings related to the Project and is also explained in the introduction to other stakeholder meetings that have been held as part of the baseline data collection and stakeholder engagement for the Project.
Noise and Vibration	
Project generated noise and vibration, particularly during construction, could adversely affect communities e.g. Varvarovka and Sukko. Noise and vibration from increased traffic will impact houses causing cracks and wear.	**Chapter 10 Noise and Vibration** assesses the potential impacts on local communities and residences. With mitigation, including the Gai Kodzor and Varvarovka bypass roads which will reduce the number of heavy goods vehicles travelling through both communities, no significant impacts on residences in these communities are expected from traffic generated noise and vibration.

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Comments	Consideration and Response
Visual Amenity and Viewscapes	
Visual impact of Project vessels in the nearshore section of the Project.	An assessment of potential visual impacts has been undertaken to include vessels up to 10 km away from the Russian shore (see **Chapter 13 Landscape and Visual** for more detail). There will be views of construction vessels experienced by the residents and visitors of Sukko, Anapa, and the private beach at the Shingari and Don holiday complexes. These impacts will be temporary and short-term and measures will be put in place to reduce impacts, including shielding of night time lighting on board vessels.
Cultural Heritage	
Cultural heritage along the Pipeline route should be protected.	A cultural heritage assessment has been undertaken (**Chapter 16 Cultural Heritage**) to ensure that impacts on cultural heritage objects and sites appropriately avoided or mitigated. Consultation was undertaken with a number of cultural heritage experts and organisations in 2013 to discuss potential impacts and these discussion informed the design control and mitigation measures outlined in this document. The approach to the protection of cultural heritage was also outlined in the EIA documentation which was publicly disclosed in the second quarter of 2013.

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A number of stakeholders also highlighted benefits that the Project will bring, including anticipated investment in the local area and the development of infrastructure in Sukko and Varvarovka. In addition, some stakeholders thought that the Project could generate new jobs and felt positive that the EIA and ESIA processes would ensure that the opinions and suggestions of stakeholders would be considered.

6.6 Conclusions

Comments received from stakeholders to date, whether verbally or in writing (and irrespective of whether or not the primary purpose of the meeting was to seek comments on the scope of the ESIA) have been considered and addressed, where relevant, in this ESIA Report. Comments from stakeholders have informed the baseline studies, the identification and assessment of impacts, and the definition of mitigation and management measures.

Feedback from stakeholders over the impacts of Project traffic on safety, road condition and dust in Varvarovka led South Stream Transport to investigate the potential to construct a bypass road to avoid having to send large amounts of project Heavy Goods Vehicle (HGV) traffic through Varvarovka. This investigation involved surveys and consultation with landowners. Following this survey and consultation work, a suitable bypass route was chosen that will significantly reduce the concerns of stakeholders. This example demonstrates how stakeholders have informed the ESIA processes and influenced Project design.

Stakeholders have also emphasised the need to ensure an effective, transparent and inclusive stakeholder engagement process, including regular updates about Project activities. Stakeholders have been engaged for data collection, and to validate and gain further understanding of the baseline conditions.

The Project is committed to on-going stakeholder engagement and welcomes feedback and comments from stakeholders over the life of the Project. The Stakeholder Engagement Plan will be periodically updated as the Project progresses through, and beyond, construction.

References

Number	Reference
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Chapter 7: Physical and Geophysical Environment

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7 Physical and Geophysical Environment

7.1 Introduction

This chapter provides a description of the physical and geophysical environment associated with the South Stream Offshore Pipeline – Russian Sector (the Project). The chapter provides context and background to the detailed baseline studies contained within the environmental and social assessment chapters which follow.

Attributes discussed in this chapter comprise:

- Physical Environment:
  - Meteorological conditions;
  - Electromagnetic fields;
  - Radiation;
  - Oceanography; and
  - Marine Water Quality.
- Geophysical Environment:
  - Tectonic setting and geology;
  - Seismicity (including terrestrial and marine geohazards);
  - Terrestrial and Marine Geomorphology; and
  - Marine Sediments.

Where possible, the physical characteristics described in this chapter apply to the overall Project. However, where specific characteristics were observed to be variable across the landfall section, nearshore section and offshore sections of the Project, this is specified.

Receptors sensitive to the terrestrial environment include soil, groundwater, surface water and landscape. These receptors are discussed in detail in **Chapter 8 Soils, Groundwater and Surface Water** and **Chapter 13 Landscape and Visual**. The terrestrial physical environment may also influence ecological receptors; these receptors are discussed in **Chapter 11 Terrestrial Ecology.**

The receptors sensitive to the changes in the marine environment are, for the most part ecological ones, and the significance of any such changes are discussed in detail in **Chapter 12 Marine Ecology**.

Potential environmental issues associated with geohazards and seismicity are discussed further in **Chapter 19 Unplanned Events**.

7.2 Spatial and Temporal Boundaries

7.2.1 Project Area

The Project Area (as described in **Chapter 1 Introduction**) is subdivided into three sections: the landfall, nearshore and offshore sections. This chapter considers all three sections.

7.2.2 Study Areas

The Terrestrial Study Area is a zone extending up to approximately 1.5 km either side of the centreline of the pipeline route and landfall facilities boundary. The Terrestrial Study Area has been assessed within a regional context with respect to the geology. The Terrestrial Study Area is bounded to the southwest by the coast.

The Marine Study Area is a zone of variable extent either side of the centreline of the pipeline route. The Marine Study Area is wider in the coastal waters and on the continental shelf and slope than it is in the deep waters of the abyssal plain. The Marine Study Area is bounded to the northeast by the coast and to the west by the edge of the Russian EEZ.

7.2.3 Survey Areas

The Terrestrial Survey Area for the physical environment is the same as the Terrestrial Study Area. The Marine Survey Area is typically the same as the Marine Study Area. The Marine Survey Area has varied over time as the pipeline routing has been refined.

7.3 Baseline Data

7.3.1 Methodology and Data

In order to provide context for the assessment of environmental impacts (discussed in subsequent chapters), baseline information on the physical environment, geology and oceanography of the region has been collected.

Secondary (i.e. existing data based on desk-based research) and primary data regarding the relevant baseline characteristics have been identified and assessed. Primary data was then collected during field surveys.

7.3.2 Secondary Data

Contextual information on the regional setting was obtained through literature review. Meteorological data for the region was sourced from published datasets.

Published geological, seismological and topographical maps were reviewed to characterise the regional tectonic setting, geology and geomorphology.

Background information on the oceanography and hydrography of the Black Sea has been based (Ref. 7.1) on the hydro-environmental database of the Southern Branch of the Institute of

Ocean Sciences of RAS (Gelendzhik City) (Ref. 7.2). This dataset includes results from 82 survey voyages (1756 stations) undertaken between 1924 and 2012 in the area from 43° to 44.5°N and from 38° to 39.5°E. Background information is available on contamination of marine waters and sediments based on previous surveys (Ref. 7.1).

Additionally, the Black Sea Commission State of the Environment report (Ref. 7.3) was used to provide additional baseline data on the region.

7.3.3 Baseline Surveys

A number of onshore and offshore engineering and environmental surveys have been undertaken to aid the engineering design and the ESIA process. These surveys are detailed in Table 7.1. The surveys were undertaken between 2009 and 2013 and covered the following aspects of relevance to this chapter:

- Meteorological conditions;
- Electromagnetic fields and radiation;
- Seismicity;
- Geology;
- Geomorphology;
- Marine oceanography and setting; and
- Marine sediment and water quality.

The baseline data presented in this chapter is predominantly based on published literature and the information gathered during these surveys (Refs. 7.1, 7.4, 7.5, 7.6, 7.7, and 7.8).

Table 7.1 Onshore, Nearshore and Offshore Surveys, 2009 to 2013

Survey Date(s)	Survey Extent	Title of Survey / Information reviewed
April to July 2009	Russian Territorial and EEZ Waters (offshore section)	Geotechnical, hydrographical and geophysical surveys. Reconnaisance survey – multi-beam echosounder and sub-bottom profiler (slope and abyssal plain)
April 2009 to May 2012	Russian Territorial and EEZ Waters (landfall, nearshore and offshore sections)	Metocean survey. Measured waves, currents and water levels near the Russian coast
July 2009	Russian Territorial Waters (landfall and nearshore sections)	Geotechnical and geophysical surveys

Continued...

Survey Date(s)	Survey Extent	Title of Survey / Information reviewed
July 2009 to April 2011	Russian Territorial Waters (landfall and nearshore sections)	Metocean survey. Measured waves, currents and water levels near the Russian coast.
November to December 2010	Russian Territorial and EEZ Waters (offshore section)	2DHR seismic survey – streamer (slope)
December 2010	Terrestrial Survey Area	Geomorphology, geohazards, radiation survey
April 2011	Russian Territorial Waters (nearshore and offshore sections)	Metocean survey
April to May 2011	Russian Territorial Waters (nearshore and offshore sections)	High resolution geophysical survey – multi-beam echosounder, sub-bottom profiler and side-scan sonar (nearshore and shelf)
May 2011 to May 2012	Russian Territorial and EEZ Waters (nearshore and offshore sections)	Metocean Survey using a variety of instruments to measure parameters including waves, water levels, current velocities, temperature, and salinity
June to July 2011	Russian EEZ (offshore section)	Validation survey – multi-beam echosounder and sub-bottom profiler (abyssal plain)
June to July 2011	Russian Territorial and EEZ Waters (offshore section)	Geochemical sampling – gravity corer (slope and abyssal plain)
July to August 2011	Russian Territorial and EEZ Waters (nearshore and offshore sections)	Geotechnical survey – gravity cores and laboratory testing (abyssal plain, slope and shelf). Geomorphology surveys
September to November 2011	Russian Territorial and EEZ Waters (offshore section)	High resolution geophysical survey – AUV with multi-beam echosounder, sub-bottom profiler and side-scan sonar (slope and abyssal plain)

Continued...

Survey Date(s)	Survey Extent	Title of Survey / Information reviewed
October 2011 to June 2012	Terrestrial Survey Area (landfall section)	Geophysical and geotechnical surveys – geodetic, topographic, electric tomography, seismic refraction, geotechnical and hydrological (onshore microtunnel area)
October 2011	Russian Territorial Waters (nearshore and offshore sections)	High resolution geophysical survey – multi-beam echosounder, sub-bottom profiler and side-scan sonar (shelf)
November 2011 to January 2012	Russian Territorial and EEZ Waters (nearshore and offshore sections)	Geotechnical survey – CPT (abyssal plain, slope and shelf)
May to August 2012	Russian Territorial Waters (nearshore and offshore sections)	Geotechnical survey - boreholes and laboratory testing (nearshore) Geotechnical survey – jumbo piston cores and laboratory testing (slope and abyssal plain)
September to November 2012	Russian Territorial and EEZ Waters (offshore section)	ROV inspection and cable tracking survey Geotechnical survey – box cores and laboratory testing (slope and abyssal plain)
November 2012 to January 2013	Russian Territorial and EEZ Waters (nearshore and offshore sections)	Geotechnical and visual survey – CPT and ROV video (shelf and slope) Geotechnical survey – piston gravity cores and laboratory testing (shelf, slope and abyssal plain)
April to June 2013	Terrestrial Survey Area (landfall section)	Geotechnical survey – boreholes and laboratory testing (onshore route and facility area) Geophysical survey – geodetic, topographic, electric tomography, seismic refraction (onshore route and facility area)

Continued...

Survey Date(s)	Survey Extent	Title of Survey / Information reviewed
May 2013	Russian Territorial Waters (landfall and nearshore sections)	Geophysical survey – seismic refraction (nearshore)
June to July 2013	Terrestrial Survey Area (landfall section)	Radiation survey
July 2013	Russian Territorial and EEZ Waters (landfall, nearshore and offshore sections)	Marine sediment quality and sediment type
September 2013	Terrestrial Survey Area (landfall section)	Topographic survey – geodetic, topographic, (access roads)
September to November 2013	Terrestrial Survey Area (landfall section)	Geotechnical survey – boreholes and laboratory testing (access roads)

Complete.

7.3.3.1 Terrestrial Surveys

Field surveys were undertaken to assess electromagnetic fields and radiation levels (Ref. 7.1, 7.7). The majority of the field measurements and samples were located within or near the terrestrial Project Area.

The electromagnetic survey comprised measurements of the background electric and magnetic field intensity at five locations across the Terrestrial Survey Area (Figure 7.1). The measurements were recorded at an industrial frequency of 50 Hz. The locations sampled all represented potentially high emitting electromagnetic sources across the Terrestrial Survey Area, such as high voltage power lines, outdoor switchgears and transformer units.

Background radiation levels were measured across the Terrestrial Survey Area:

- Measurements of gamma radiation were recorded at a total of 134 control points across the Terrestrial Survey Area with 81 measurements taken during the 2010 survey, and a further 53 measurements taken during the 2011 survey (Figure 7.1);
- The equivalent dose rate[1] for external gamma radiation was then determined for a total of 1144 points in the Terrestrial Survey Area (Figure 7.1). Measurements were undertaken at

[1] The equivalent absorbed radiation dose (equivalent dose), measured in sievert per hour (Sv/h) is a measure for assessing the health risk of radiation exposure. It is a calculated average measure of the radiation absorbed by a fixed mass of biological tissue that attempts to account for the different biological damage potential of different types of ionizing radiation.

175 points during the 2010 survey, 555 points during the 2011 survey, and 414 points during the 2013 survey; and

- In addition, a total of 42 soil and stream bed sediment samples (Figure 7.1) were collected within the Terrestrial Survey Area. The samples were analysed in order to assess the levels of various radioactive isotopes. In total, 20 samples were collected during the 2010 survey, seven samples were collected during the 2011 survey, and 15 samples were collected during the 2013 survey.

The same Terrestrial Survey Area (Figure 7.1) was used for the geomorphological mapping. Additionally, soil and water samples were collected for analysis; this is discussed in **Chapter 8 Soils, Groundwater and Surface Water**.

Geotechnical and geophysical surveys were undertaken along the Pipeline route within the same Terrestrial Survey Area. The geotechnical surveys have included drilling boreholes up to 180 m deep to confirm the ground conditions. Soil and rock samples were collected from the boreholes for geotechnical testing. The geophysical surveys included seismic refraction and electrical tomography profiling to aid interpolation of the ground conditions between boreholes.

7.3.3.2 Marine Surveys

To complement the data obtained from desk studies, several marine surveys specific to the Project have been undertaken (Table 7.1).

A metocean survey of the pipeline route across the Black Sea was undertaken between 2010 and 2012 (Ref. 7.4). The survey locations are shown in Figure 7.2.

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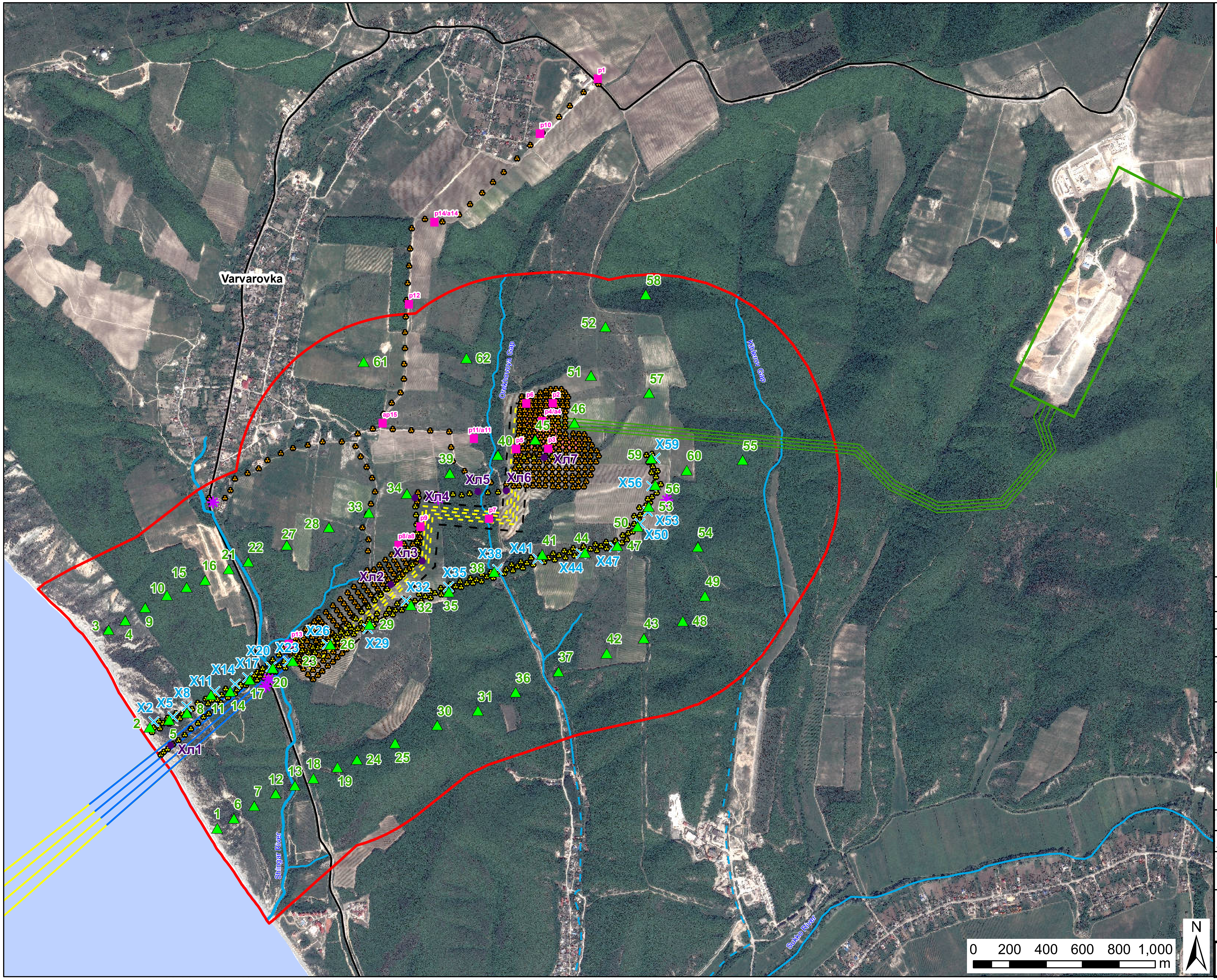

LEGEND

Geomorphology survey point

Gamma radiation survey

2010 Survey

2011 Survey

2013 Survey

Soil and Sediment Samples Tested for Radioactive Isotopes

2010 Survey

2011 Survey

2013 Survey

Study Area and PeterGaz Survey Area

Inferred watercourses

Rivers

Main roads

Russian Sector of South Stream Offshore Pipeline

Proposed landfall section pipelines

Landfall facilities

Proposed microtunnels

Proposed offshore pipelines

Construction corridor

United Gas Supply System

Russkaya compressor station

United Gas Supply System Pipelines

Projection: Lambert Conformal Conic

Revision Details	By Check	Check Date	Suffix

Purpose of Issue

For Information

Client

South Stream Offshore Pipeline — ENERGISING EUROPE

Project Title

SOUTH STREAM OFFSHORE PIPELINE

Drawing Title

LOCATION OF ELECTOMAGNETIC AND RADIATION SAMPLING POINTS

Drawn	Checked	Approved	Date
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Drawing Number: Figure 7.1

Rev

Plot Date: 04 Mar 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA\Chapter 7 Physical and Geophysical Environment\Figure 7.1 Location of electromagnetic and Radiation Sampling Points.mxd

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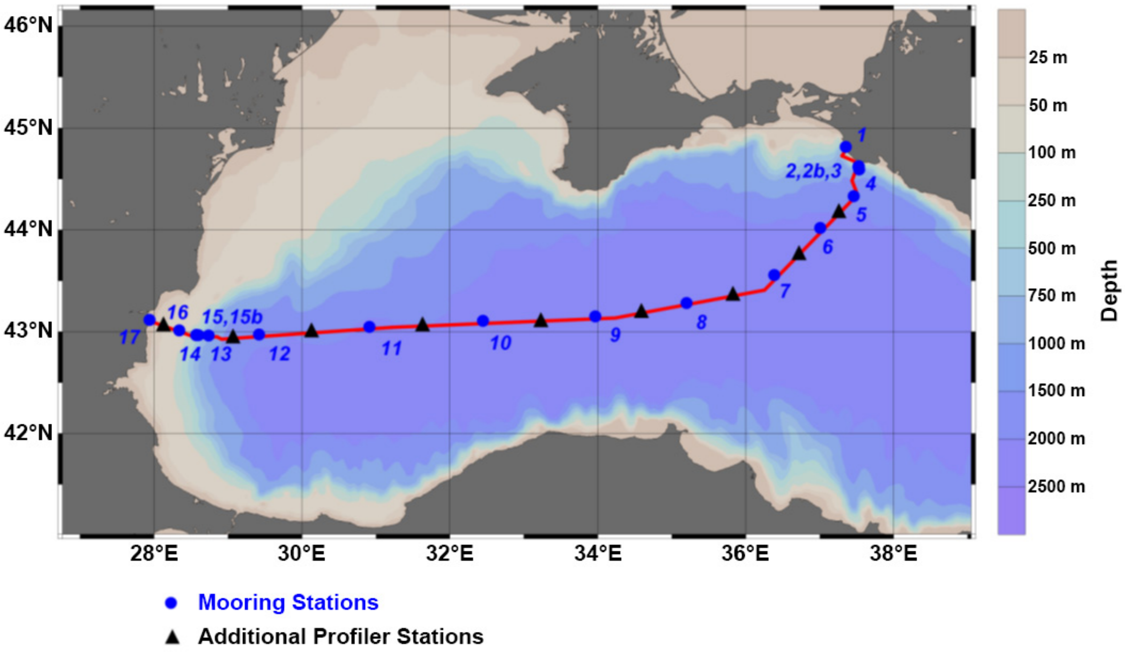
Figure 7.2 Metocean Survey Locations for 2011 to 2012 (Ref. 7.4)



Marine water quality surveys were undertaken (Ref. 7.1) in autumn 2010 and spring 2011. Water quality analysis for general hydrochemistry and potential pollutants was undertaken. Water sampling for laboratory analysis was undertaken in accordance with GOST 17.1.5.05-85 'General requirements for sampling of surface and sea waters'. (Ref. 7.9) Measurements of water temperature, salinity and density were undertaken in situ through the water column using a winched probe. Meteorological and oceanographic measurements were also obtained during these surveys.

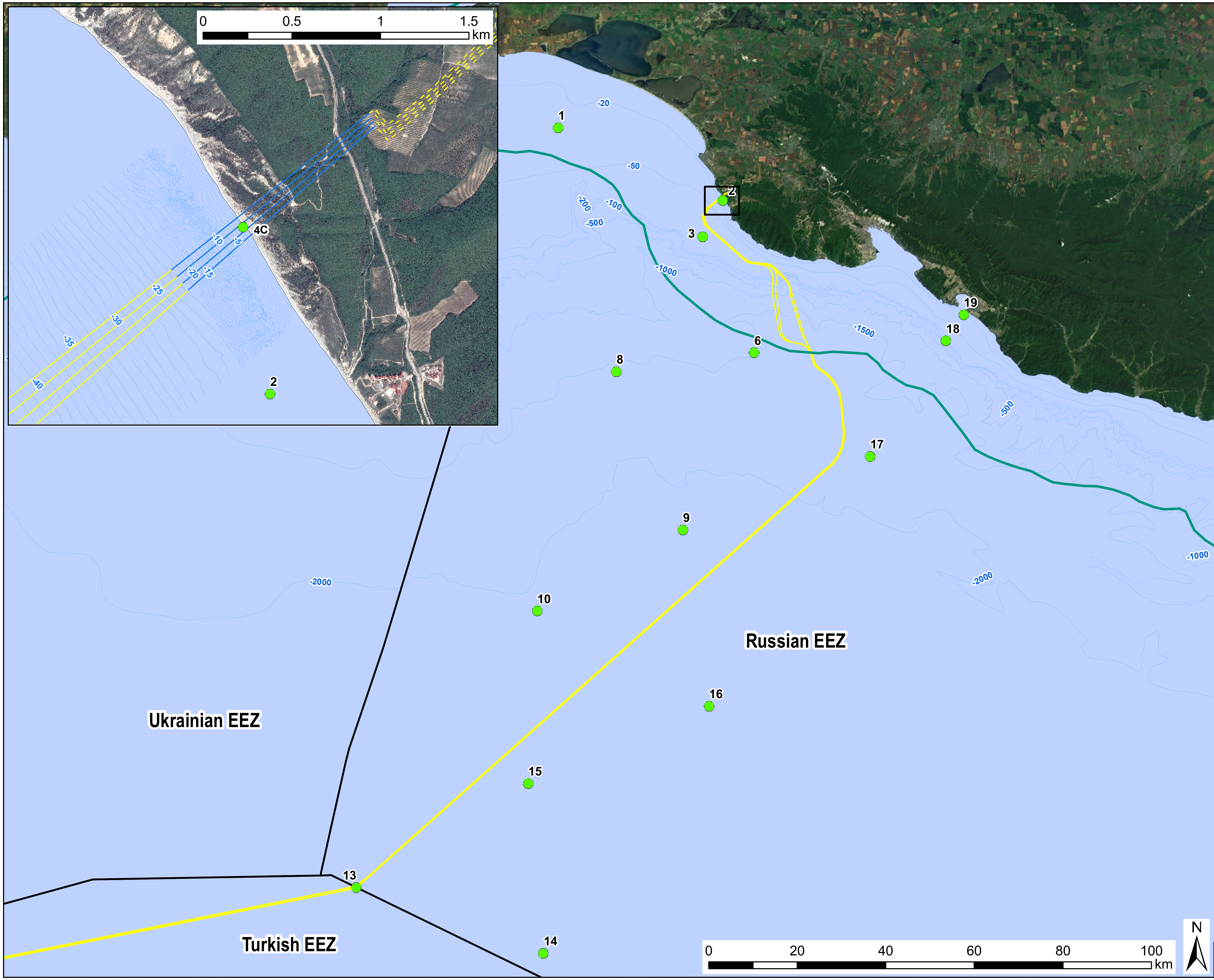
In November 2010, a total of 23 water samples were collected at eight survey locations (known as stations). In April 2011, a total of 45 water samples were collected at 14 stations. The spring 2011 survey extended further from the coast and thus covered a larger area than the autumn 2010 survey. In addition, in summer 2011 chemical and bacteriological testing was undertaken at two additional locations: Station 4C near the coast line and 5C in shallow waters (Ref. 7.1). The locations of the marine water survey location stations are presented in Figure 7.3. The depths at which the water samples were collected are presented in Table 7.2.

Marine sediment sampling from the seabed was undertaken between 2010 and 2011 and in July 2013 (Ref. 7.1, 7.8). The 2013 survey included coring within the area to be dredged and areas of seabed intervention to establish levels of potential contamination within the sediment in these areas in line with the requirements of the London Convention for disposal of dredged material. The sampling locations are shown on Figure 7.4.

Table 7.2 Marine Water Quality Samples (Ref 7.1)

Autumn 2010 Survey		Spring 2011 Survey	
Survey Location Station No.	**Sample Depths (m)**	**Survey Location Station No.**	**Sample Depths (m)**
1	0; 30	1	0; 30
2	0; 32	2	0; 15
3	0; 55; 86	3	0; 10; 80
6	0; 30; 120	6	0; 35; 160
8	0; 40; 100	8	0; 50; 136
17	0; 30; 110; 1,000; 1,900	9	0; 40; 105
18	0; 35; 89	10	0; 40; 105
19	0; 26	13	0; 45; 94
-	-	14	0; 40; 115; 1,000; 2,157
-	-	15	0; 45; 102
-	-	16	0; 45; 103; 1,000; 2,124
-	-	17	0; 35; 160; 1,000; 1,888
-	-	18	0; 10; 88
-	-	19	0; 21.5
Stations	*Total Number of Samples*	*Stations*	*Total Number of Samples*
8	23	14	45

In total, 28 samples were collected during the 2010 and 2011 surveys (Ref. 7.1): 6 in autumn 2010, 8 in spring 2011 and 14 in summer 2011. During the 2013 survey (Ref. 7.8), 57 sediment samples for analysis of contaminants were collected from 42 locations: 43 grab samples from 35 grab locations and 14 core samples at 7 core locations. The sediment samples were visually described before undergoing chemical analysis and grain size distribution analysis. Data on sediment type at sample locations were also collected by analysis of grain size in sediment samples or ROV footage where sediment samples could not be collected. Further interpretation of the bathymetric surveys and ROV footage was undertaken a report summarising the results is contained in Appendix 7.1 Abyssal Plain Report.



LEGEND

Marine water quality survey locations

Russian Sector of South Stream Offshore Pipeline

Proposed landfall section pipelines

Proposed microtunnels

Proposed offshore pipelines

Russia territorial waters boundary

Exclusive Economic Zone boundary

Isobaths

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

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For Information

Client
South Stream Offshore Pipeline ENERGISING EUROPE

Project Title
SOUTH STREAM OFFSHORE PIPELINE

Drawing Title
MARINE WATER QUALITY SURVEY LOCATIONS (2010 & 2011)

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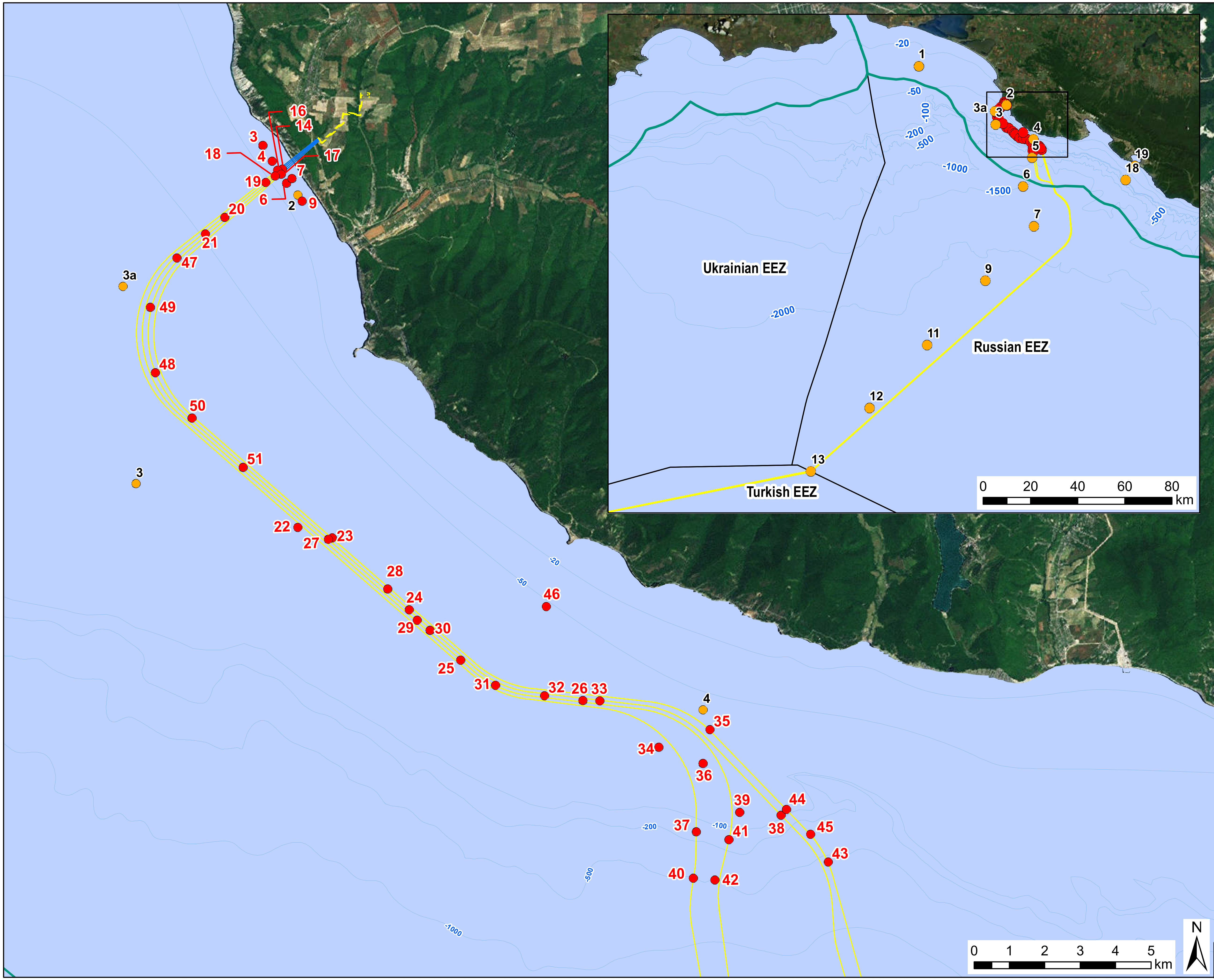
Plot Date: 04 Mar 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA\Chapter 7 Physical and Geophysical Environment\Figure 7.3 Marine Water Quality Survey Locations (2010 & 2011).mxd



LEGEND

- Marine Sediment Quality Survey Locations 2010/2011
- Marine Sediment Quality Survey Locations 2013

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Proposed microtunnels
- Proposed offshore pipelines
- Russia territorial waters boundary
- Exclusive Economic Zones Boundary
- Isobaths

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Project Title: SOUTH STREAM OFFSHORE PIPELINE

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Rev

Plot Date: 04 Mar 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA\Chapter 7 Physical and Geophysical Environment\Figure 7.4 Marine Sediment Quality Survey Locations.mxd

7.3.4 Applicable Standards

The policy, regulatory and administrative frameworks relevant to the Project and ESIA process are outlined in **Chapter 2 Policy, Regulatory and Administrative Framework**. In addition to these, there are a number of standards of specific relevance to this chapter. These comprise:

- International standards on electromagnetic fields:
  - International Finance Corporation (IFC) Environment, Health, and Safety Guidelines Electric Power Transmission and Distribution (Ref. 7.10); and
  - International Commission on Non-Ionizing Radiation Protection (ICNIRP) guidelines for Limiting Exposure to Time-varying Electric, Magnetic, and Electromagnetic Fields (Ref. 7.11).
- Russian national standards on electromagnetic fields:
  - Russian Standard SanPiN 2971-84 on Regulations for Public Protection Against the Impact of an Electrical Field Created by Overhead Power Lines with an Alternating Power of Industrial Frequency (Ref. 7.12); and
  - Russian standard GN 2.1.8/2.2.4.2262-07 on Maximum Permissible Levels of Magnetic Fields with a Frequency of 50 Hz in Residential Premises, Public Buildings and on Residential Territories (Ref. 7.13).
- Russian national standards on radiation:
  - Russian Standard MU 2.6.1.2398-08 on Radiation Monitoring and Sanitary Epidemiological Assessment of Land Plots for Construction of Houses, Buildings and Public Facilities and Industrial Projects with Regard to Radiation Safety (Ref. 7.14); and
  - Russian Standard SanPiN 2.6.1.2523-09 on Radiation Safety Standards (Ref. 7.15).
- Russian standards on marine water quality:
  - Order of the Federal Fisheries Agency No. 20 dated 18.01.2010, on Approving the Standards for Water Quality in Fishing Water Bodies, including Standards for Maximum Permissible Concentrations of Harmful Substances in the Water of Fishing Water Bodies (Ref. 7.16); and
  - Russian Standard SanPiN 2.1.5.2582-10 on Sanitary and Epidemiological Requirements for Protection of Sea Coastal Waters Against Pollution in Areas of Water Use of the Population (Ref. 7.17).
- Dutch standards on marine sediment quality (adopted in absence of equivalent Russian standards):
  - Circular on target values and intervention values for soil remediation, 2000. Ministry of Infrastructure and Environment of the Netherlands (Ref. 7.18). Recommended for use as a methodological guide by Russian Standard SP 11-102-97 'Environmental science surveys for construction'.

7.4 Physical Environment

7.4.1 Meteorological Conditions

The Krasnodar Regional Centre for Hydrometeorology and Environmental Monitoring has monitored long-term climatic characteristics for the period from 1977 to 2009 (Ref. 7.1) at the nearest weather station to the Project, which is located in Anapa, 5 km north of the proposed pipeline route (Anapa WMO, Station ID 37001, Ref. 7.19).

The Study Area is characterized by a Mediterranean-type climate, with a sunny, hot and dry summer and a relatively mild and humid winter.

The average air temperature data is summarised in Table 7.3. The annual average air temperature in Anapa is 12.1 ºC. On average, the warmest months are June to September with a maximum monthly average temperature of 21.0 °C. The coolest are November to March, with a minimum average temperature of 4.4 °C. The average maximum daily temperature is 29.0 °C and the average minimum daily temperature is -2.2 °C (Ref. 7.19). The absolute maximum and minimum air temperature during the period 1977 to 2009 is 38°C and -26°C, respectively.

Table 7.3 Average Monthly Air Temperature (°C)

Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Annual Average.
1.8	2.4	5.4	11.0	15.2	20.1	23.1	22.7	18.2	12.8	7.7	4.2	12.1

The annual average precipitation is 539 mm (an average of 45 mm per month), mainly in the form of rain (Figure 7.5). The maximum recorded daily precipitation is 85.9 mm. There is relatively limited seasonal variation in precipitation, with the greatest amount occurring during the months of November, December and January.

The deepest snowfall on record is 33 cm, though snowfall is generally sparse in comparison with the rest of the region and the Russian Federation. Snowfalls usually occur between November and March. Blizzard conditions can occur during winter storms. Frosts occur between October and April.

Figure 7.5 Average Monthly Rainfall at Anapa Meteorological Station (Ref. 7.19)

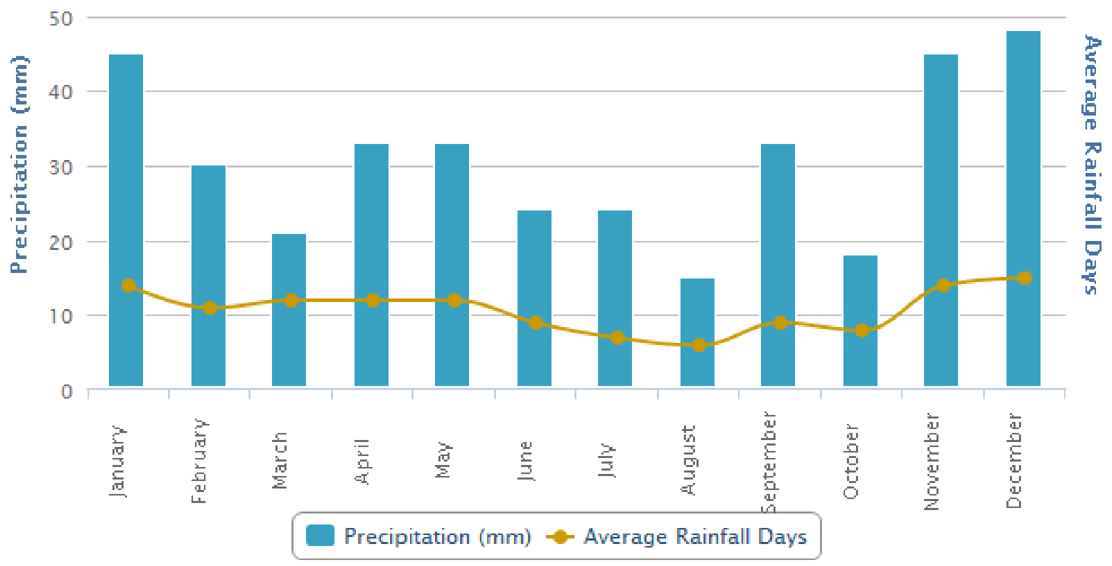


Table 7.4 presents the maximum number of recorded days with fog by month. It shows that May has the maximum number of fog days with nine fog events. August has the least number of fog days, with an average of one day with fog.

Table 7.4 Maximum Number of Days with Fog, by month

Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
3	5	6	5	9	4	2	1	4	4	3	4

Wind conditions vary seasonally. The summer is characterised by light breezes whereas squally winds are characteristic in winter. The average annual wind speed in Anapa is 4.8 m/s. The wind speed is over 13 m /s less than 5% of the time. Wind speeds of up to 40 m/s have been recorded at Anapa. Table 7.5 presents the wind statistics by geographic direction for Anapa.

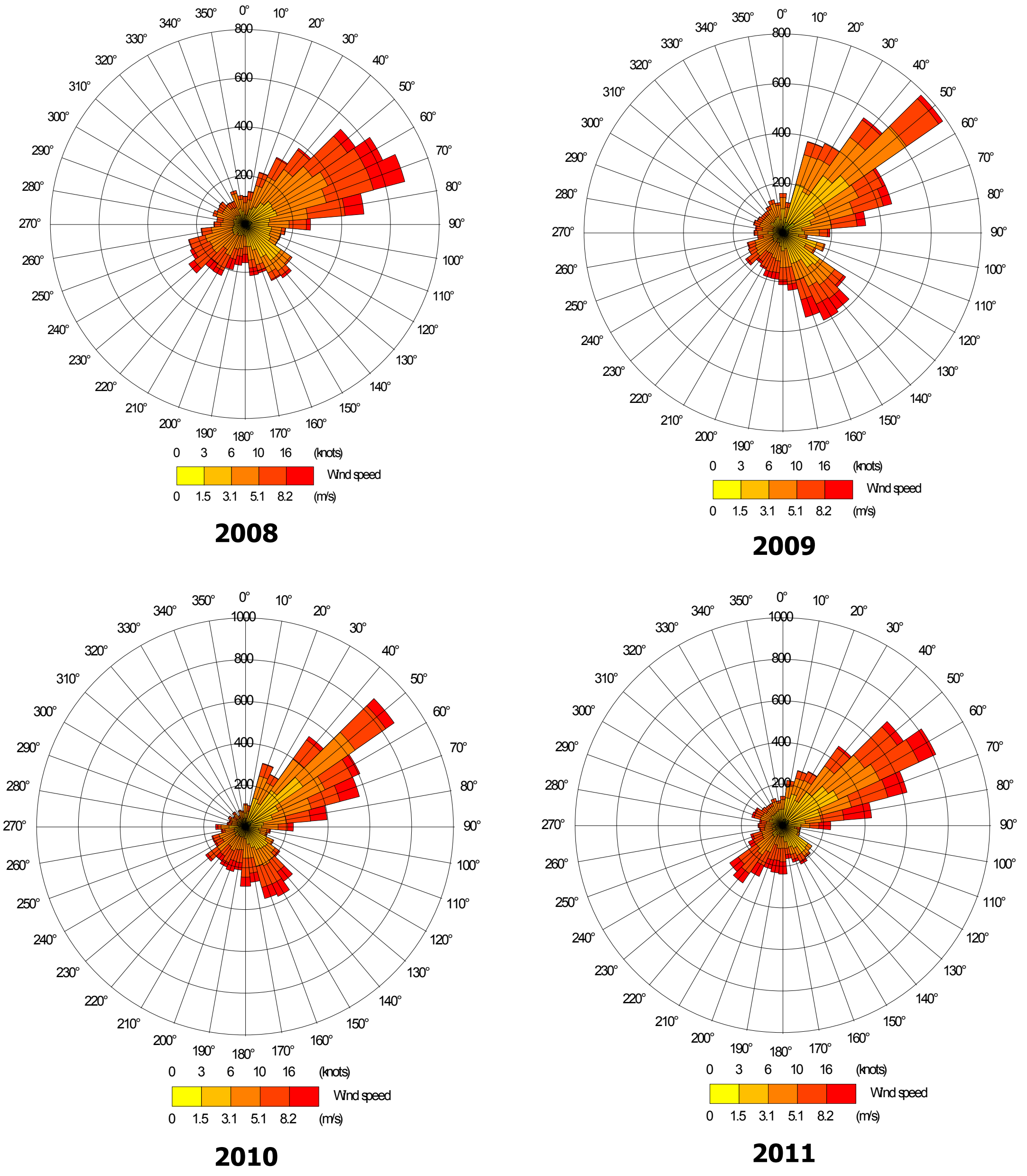
Table 7.5 Average Wind Statistics by Geographic Direction at Anapa (Ref. 7.19)

Parameter	N	NE	E	SE	S	SW	W	NW
Average wind speed (m/s)	3.6	4.4	3.7	4.8	6.7	5.7	4.7	4.3
Frequency of wind direction (%)	11	25	17	5	21	9	8	4

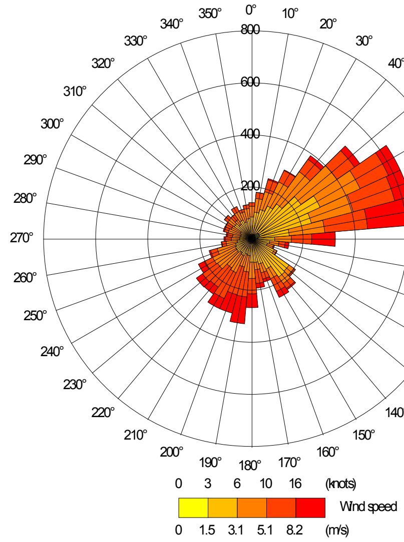
Hourly sequential meteorological data has been sourced from the nearest available meteorological station, Anapa WMO (Station ID 37001), for the period 2008 to 2012 inclusive.

Anapa is located on the coastline of the Black Sea and is, therefore, sufficiently similar to conditions at the Terrestrial Study Area (Figure 7.6).

Figure 7.6 Wind Rose, Anapa Meteorological Station (Ref. 7.1)[2]



[2] The vertical axis on each wind rose represents the frequency (number) of measurements that are in a given sector.



2012

The wind direction is predominantly from the northeast onshore with secondary winds from the south and southwest offshore (Figure 7.6). On average wind speed is slightly stronger from the south than from the northeast.

Wind monitoring has also been undertaken at sea in 2011 in the Marine Survey Area (Figure 7.2) as part of the metocean surveys (Ref. 7.6). The measured wind speeds were typically between 2 and 7 m/s with maximum wind speeds of up to 21 m/s during the survey period. The measured data were compared with hindcast and satellite data for the period 1992 to 2011 (Ref. 7.4, 7.6). The wind data was then modelled to predict wind statistics for the Marine Study Area (Ref. 7.6). The data shows that the wind speeds in the Marine Study Area during the survey period are approximately the same as the long-term wind speeds (Ref. 7.6).

The wind regime varies seasonally (Figure 7.7). Winds are stronger in winter with greater variability in wind direction. The seasonal variation in the wind regime is illustrated by Figure 7.7. The predicted normal and extreme wind conditions are presented in Tables 7.6 and 7.7.

Table 7.6 Predicted Normal Marine Wind Conditions (Ref. 7.6)

Parameter	Deep Water	Continental Slope	Coastal Waters
Monitoring Station (Figure 7.2)	6	3	1
% Time with Normal Wind Speed > 14 m/s (Beaufort Force 7 – High Wind)	0.480 (equivalent to 2 days per year)	0.892 (equivalent to 3 days per year)	0.892 (equivalent to 3 days per year)

Continued...

Parameter	Deep Water	Continental Slope	Coastal Waters
% Time with Normal Wind Speed > 17 m/s (Beaufort Force 8 – Gale)	0.049 (equivalent to <1 day per year)	0.110 (equivalent to <1 day per year)	0.110 (equivalent to <1 day per year)
Maximum Normal Wind Speed (m/s)	21	24	24

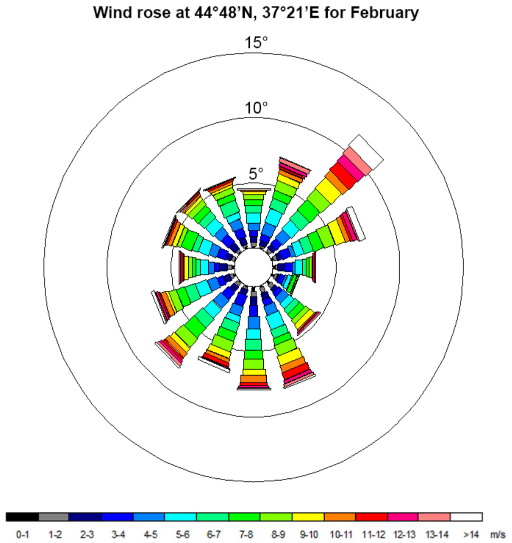
Complete.

Table 7.7 Predicted Extreme Marine Wind Conditions (in m/s) (Ref. 7.6)[3]

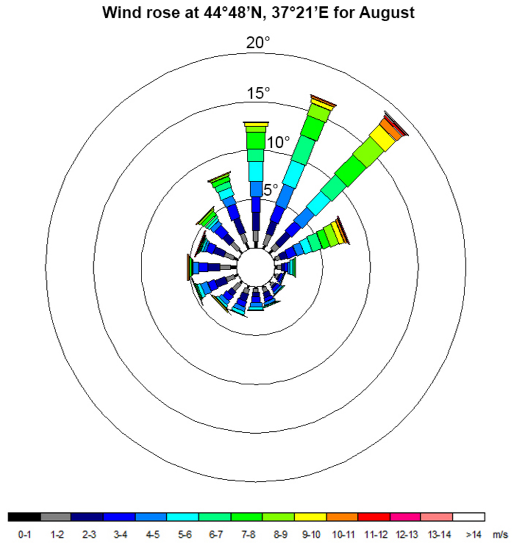
Extreme Wind Duration	Deep Water Monitoring Station 6 (Figure 7.2)					Continental Slope Monitoring Station 3 (Figure 7.2)				
Return Period (years)	*1*	*5*	*10*	*50*	*100*	*1*	*5*	*10*	*50*	*100*
1 hour	15.26	16.53	17.04	18.17	18.63	15.99	17.30	17.83	18.99	19.47
10 minutes	16.03	17.36	17.90	19.08	19.57	16.79	18.17	18.72	19.94	20.44
1 minute	18.99	20.57	21.20	22.61	23.18	19.90	21.52	22.18	23.62	24.22
10 seconds	21.87	23.69	24.42	26.04	26.70	22.92	24.79	25.55	27.21	27.90
3 seconds	23.03	24.95	25.72	27.42	28.12	24.13	26.11	26.90	28.66	29.38

[3] Extreme wind predictions were not made for coastal waters.

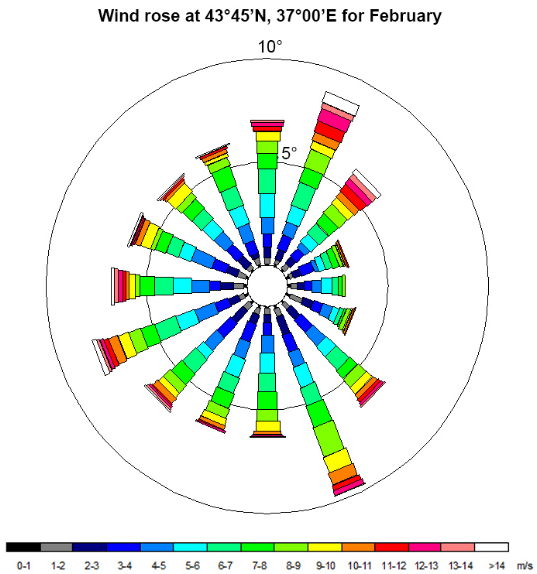
Figure 7.7 Seasonal Patterns in Offshore Winds, Ref. 7.6



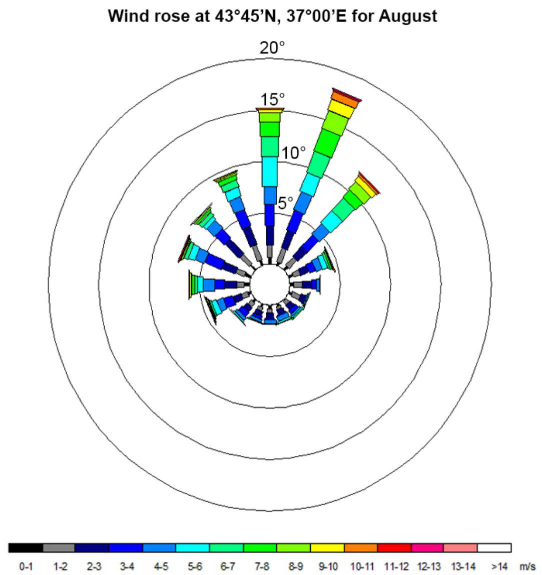
a) Coastal Mooring Station (1) - Winter



b) Coastal Mooring Station (1) - Summer



c) Deep Water Mooring Station (6) - Winter



d) Deep Water Mooring Station (6) – Summer

Note: Mooring stations are shown on Figure 7.2

7.4.2 Electromagnetic Fields

Electric and magnetic fields (EMF) are invisible lines of force produced by electrical devices, such as power lines and electrical equipment. Electric fields are produced by voltage and increase in strength as the voltage increases. Magnetic fields result from the flow of electric current and increase in strength as the current increases (Ref. 7.10).

Table 7.8 presents the results of the electric and magnetic field survey compared against both ICNIRP and Russian recommended exposure limits (Ref. 7.11 and 7.13, respectively). The results of the electromagnetic survey indicate that the background electric and magnetic field measurements recorded were within both the ICNIRP and Russian peak exposure limits for the prevention of adverse indirect effects for more than 90% of exposed individuals of the general public (Ref. 7.1).

Table 7.8 Electric and Magnetic Field Intensity Measurements, at 50 Hz

Limits		**Intensity of Electric Field, E (kV/m)**	**Magnetic Flux Density, B (μT)**
ICNIRP peak exposure limit (Ref. 7.11)		5	200
Russian Standard maximum permissible limits (for non-residential areas) (Ref. 7.13)		5	20
ID no.	*Location*	-	-
1	Close to the residential territory (Varvarovka)	0.01	0.00
2	Close to the Greater Utrish – Varvarovka road	0.02	0.01
3	Close to the Greater Utrish – Varvarovka road	0.03	0.00
4	Under 150 kV power line	0.21	0.05
5	Under 150 kV power line	0.15	0.02

7.4.3 Radiation

Background radiation levels associated with the Terrestrial Survey Area were assessed during surveys carried out in 2010, 2011 and 2013 (Ref. 7.1, 7.7).

7.4.3.1 Gamma Radiation Levels

Results of the surveys across the Terrestrial Survey Area recorded the following background gamma radiation levels:

- 2010 survey: background gamma radiation levels ranged from 0.10 to 0.15 microSieverts per hour (μSv/h), with an average of 0.11 μSv/h;
- 2011 survey: background gamma radiation levels ranged from 0.04 to 0.15 μSv/h, with an average of 0.09 μSv/h; and
- 2013 survey: background gamma radiation levels ranged from 0.08 to 0.15 μSv/h, with an average of 0.1 μSv/h.

All measurements taken were assessed to be normal for gamma background levels, and did not exceed the Russian limits for anomalous levels (defined as readings of greater than twice the average background gamma radiation levels or 0.3 µSv/h) (Ref. 7.14).

7.4.3.2 Equivalent Dose of Gamma Radiation

The average equivalent dose[4] of gamma radiation levels in the area were calculated to range from 0.09 to 0.13 µSv/h across the Terrestrial Survey Area, as follows:

- 2010 survey: calculated equivalent dose of gamma radiation ranged from 0.08 to 0.15 µSv/h;
- 2011 survey: calculated equivalent dose of gamma radiation ranged from 0.06 to 0.14 µSv/h; and
- 2013 survey: calculated equivalent dose of gamma radiation ranged from 0.07 to 0.13 µSv/h, with an average of 0.1 µSv/h.

These levels were within acceptable background levels, and met the requirements of the Russian guidelines for assessing radiation safety (Ref. 7.14).

7.4.3.3 Radioactive Isotopes

Samples of soils and stream bed sediments were analysed using gamma spectroscopy methods to assess the levels of radioactive isotopes including: Radium-226 (^{226}Ra), Thorium-232 (^{232}Th), Potassium-40 (^{40}K), Caesium-137 (^{137}Cs) and Strontium-90 (^{90}Sr).

Elevated levels of ^{137}Cs in the environment are associated with nuclear testing in the atmosphere (during the last century) and emissions from nuclear accidents at nuclear power facilities. The behaviour of the ^{137}Cs isotope in the soil is controlled largely by the processes of particle absorption, migration of isotope carrying particles and erosion processes.

In general, ^{137}Cs levels measured in the soils within the Terrestrial Survey Area were predominantly within the range expected for background soil levels (Ref. 7.1):

- Of the 42 samples taken, the measured specific activity of isotope ^{137}Cs recorded in 26 samples was below detection limits of five Becquerels per kilogram (Bq/kg). In a further 14 samples the measured specific activity of isotope ^{137}Cs recorded was within anticipated background levels associated with radiation falling to the ground, i.e. within 5 to 15 Bq/kg (Ref. 7.1);
- Two samples recorded isotope ^{137}Cs activity above background levels (15 Bq/kg). The maximum recorded ^{137}Cs activity value of 22 Bq/kg was recorded during the 2010 survey. However, these values were still within acceptable limits (Ref. 7.14) and

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[4] The equivalent dose (or equivalent absorbed radiation dose) is a computed average measure of the radiation absorbed by a fixed mass of biological tissue that attempts to account for the different biological damage potential of different types of ionizing radiation.

- Isotope activity levels for ^{90}Sr were measured in 20 soil samples taken from the 2010 survey only (Ref. 7.1). The activity levels measured for isotope ^{90}Sr ranged from 0 to 47 Bq/kg (with an average measured value of 24 Bq/kg recorded) within the Terrestrial Survey Area and were within normal background levels.

Isotope activity levels recorded for natural radionuclides ^{226}Ra and ^{232}Th and ^{40}K in soils within the Terrestrial Survey Area were found to be within normal background levels (Ref. 7.15):

- Isotope activity levels for ^{226}Ra were typically well below normal natural background levels of 20 to 50 Bq/kg. Measurements of isotope activity levels for all 42 samples were at or below natural background levels, with measurements ranging from 8 to 27 Bq/kg for ^{226}Ra;
- Isotope activity levels for ^{232}Th measured in the soils ranged from 9 to 32 Bq/kg and were within normal natural background levels for ^{232}Th (20 to 50 Bq/kg);
- Isotope activity levels for ^{40}K measured in the soils ranged from 88 to 513 Bq/kg and were within or below normal natural background levels for ^{40}K (200 to 800 Bq/kg); and
- Effective specific NRN activity in the soils ranged from 32 to 114 Bq/kg. These values are well below the Russian threshold intervention level of 370 Bq/kg permitted for building materials at public buildings and facilities (Ref. 7.15).

7.4.3.4 Summary

Results of the radiation survey indicate background radiation levels within the Terrestrial Survey Area meet the requirements of the Russian Standards on radiation protection. Radiation levels measured in the soils do not pose a risk to human health in terms of radiation exposure.

7.4.4 Oceanography

7.4.4.1 Bathymetry

The bathymetry of the Russian Sector of the Black Sea is shown in Figure 7.9.

The Black Sea is a semi-enclosed sea connected to the shallow (10 to 20 m deep) Azov Sea through the Kerch Straits and to the Mediterranean Sea through the Bosporus Straits, the Marmara Sea and the Dardanelles Straits. The flat abyssal plain (at a depth of 2,000 m) rises to the continental shelves. The north western shelf, with a mean depth 50 m, has a shelf break at about 100 m depth between the Crimean peninsula and Varna in the south.

The Russian continental shelf is gently inclined towards the west and extends to a water depth of 100 m (Ref. 7.1). Beyond 100 m depth, the continental slope starts dipping steeply to the west; it is characterised by patterns of ridges and canyons. The slope angle decreases towards the base (at 1,900 m depth) and typically varies from 27° at the top to 5° at the bottom.

The oceanography of the Black Sea has been assessed based on published datasets (Refs. 7.3, 7.35, 7.36, 7.37) and using Project survey data (Refs. 7.1, 7.4, 7.6).

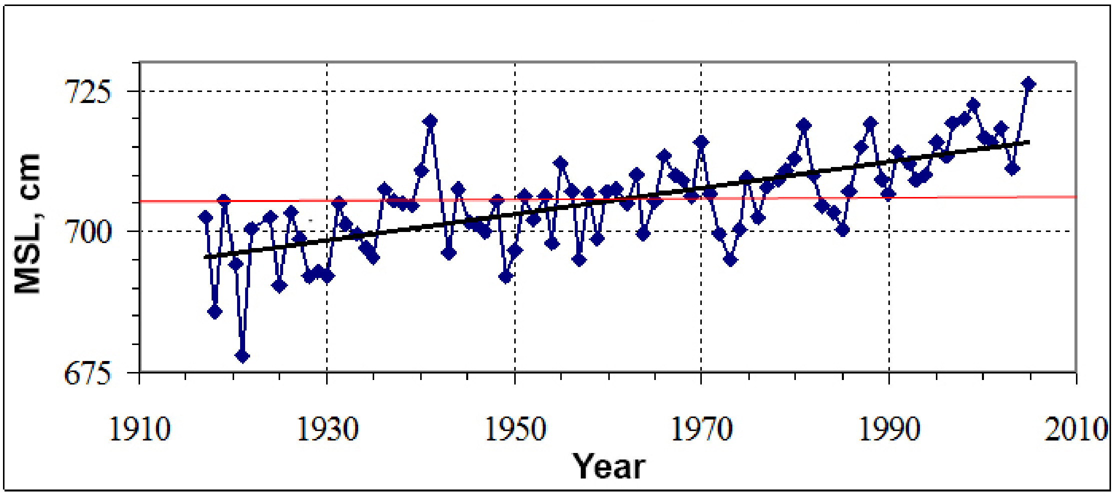
7.4.4.2 Sea Level Variation

The Black Sea is practically non-tidal with a maximum range of no more than 0.1 m. Changes in water levels in the Black Sea are thus primarily caused by one or more of the following factors:

- Inter-annual fluctuations in the sea level;
- Seasonal fluctuation as a result of seasonal atmospheric dynamics (e.g. temperature, wind, rainfall and storms);
- River flows;
- Spatial changes in the atmospheric pressure; and
- Natural temporal and spatial variability in dynamics of the water column.

Long-term data collected (for approximately the last 90 years) along the Caucasian coast shows a slight yearly increase in mean sea level of about 0.23 cm per year (Figure 7.8), while the water level of the Black Sea is subject to seasonal fluctuations of about 20 cm (Figure 7.10). Long-term average seal level data is presented in Table 7.9.

Figure 7.8 Changes in Sea Level in the Black Sea from 1917 to 2005 (Ref. 7.1)



LEGEND

Russian Sector of South Stream Offshore Pipeline

- Proposed offshore pipelines
- Exclusive Economic Zone boundary
- Isobaths
- Regional Boundaries
- Country Boundaries

Projection: Lambert Conformal Conic

Purpose of Issue: For Information

Client: South Stream Offshore Pipeline — ENERGISING EUROPE

Project Title: SOUTH STREAM OFFSHORE PIPELINE

Drawing Title: BATHYMETRY OF RUSSIAN SECTOR OF BLACK SEA

Drawn	Checked	Approved	Date
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Plot Date: 21 Mar 2014
File Name: I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 7 Geology\Figure 7-8 Bathymetry of Russian Sector of Black Sea.mxd

Figure 7.10 Deviation in Average Sea Level from 1917 to 2005 (Ref. 7.1)

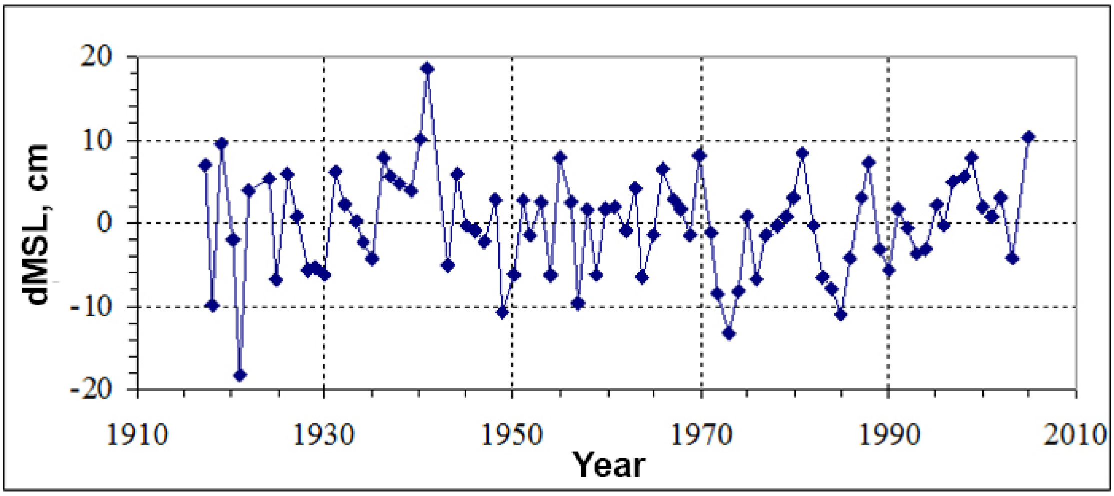


Table 7.9 Long-Term Average Sea Levels in the Black Sea at Sochi (Ref. 7.1)

Sea level	Average annual sea level	Maximum annual sea level		Minimum annual sea level	
	m+BS	m+BS	year	m+BS	year
Annual maximum	-0.01	+0.17	1953	-0.23	1949
Average annual	-0.34	-0.22	1981	-0.48	1949
Annual minimum	-0.62	-0.46	1955	-0.88	1928

In addition to the long-term dataset, sea levels were measured in the Marine Survey Area during the 2011 to 2012 metocean surveys (Ref. 7.4); the results are presented in Table 7.10.

Table 7.10 Measured Range of Sea Level Values in Marine Survey Area (Ref. 7.4)

Monitoring Station	Water Depth (m)	Observed Maximum (m+BS)	Observed Minimum (m+BS)
1	25	0.13	-0.14
1b	73	0.83	-0.26
2	381	0.22	-0.19
5	1790	0.20	-0.18

Much more significant sea level variations have, however, occurred during the Quaternary Period, which are associated with global climatic variations, ice sheet collapse and the regional tectonic events that led to the opening of the Bosphorus Strait. There has been considerable scientific debate about the timing and process of the transition from the Black Sea lake at the end of the last ice age to its present mode. Over the past 30,000 years sea levels have varied due to periods of low river input during cold periods and major river inflow during periods of ice melt (Ref. 7.36). The timing of the most recent reconnection of the Black Sea with the Mediterranean is estimated to be 9,000 years BP[5] (Ref. 7.36). This caused a transition from freshwater to marine conditions and resulted in the inundation of coastal landscapes. These transgressions caused wide spread shoreline regression in some locations and led to significant wave based shoreline erosion. The refilling of the Black Sea once the reconnection with the Mediterranean was established is estimated to have occurred over about 100 years but the transition from freshwater to marine conditions is estimated to have taken about 900 years beginning with the deepest water (Ref. 7.36). The transition was completed by about 7,700 years BP at mid water depths and by about 7,200 years BP on the shelves (Ref. 7.36).

Inundation of prehistoric habitations and reworking of cultural materials within the sediments is discussed further in **Chapter 16 Cultural Heritage**.

7.4.4.3 Wave Climate

The wind regime in the Russian part of the Black Sea is defined by the air mass transfer with a south-southwest to north-northeast direction, which is typical for the moderate zone of the Northern hemisphere. The winter is characterized by squally northerly, north-eastern and easterly winds, as a result of the increased Mediterranean cyclone activity and the existing anticyclone activity above Eastern Europe.

The prevailing winds in the Russian part of Black Sea are from the southwest. The highest wind speeds usually are registered during November to March when the hurricane north-eastern wind (bora) winds may bring gusty winds and cold temperatures to the coastline. The Russian coastline experiences approximately 15 to 20 storm days each winter, with wind speeds reaching up to 20 m/s approximately once a year.

The wave climate adjacent to the Russian coastline of the Black Sea is heavily influenced by the shallow continental shelf. The limited fetch lengths result in smaller primarily wind driven waves. The relatively shallow continental slope affects entering waves by transforming their 2-dimensional (2D) spectrum due to bottom friction and wave breaking.

Estimation of wave characteristics based on archival data held by the Institute of Ocean Sciences has been undertaken (Ref. 7.1, 7.2). A typical yearly maximum wave height in the Marine Study Area has been estimated as 2.9 m, with a 1 in 100 year return period wave reaching 4.8 m. A summary of the wave characteristics based on archival data (Ref. 7.1, 7.2) is presented in Table 7.11 and Table 7.12.

[5] Before Present

Table 7.11 Typical Maximum Wave Geometry (Ref. 7.1, 7.2)

Return Period (years)	1	5	10	25	50	100
Wave Height, Hs (m)	2.9	3.6	3.9	4.3	4.6	4.8
Wave Length (m)	105	129	139	153	164	174
Wave Period (s)	8.2	9.1	9.5	9.9	10.2	10.6

Table 7.12 Correlation of Wave Heights and Directions (Ref. 7.1)

Wave Height (m)	N	NE	E	SE	S	SW	W	NW	Frequency (%)
0-1	4.7	9.0	4.2	2.7	2.8	7.5	11.1	3.7	45.6
1-2	3.4	7.2	2.9	1.5	2.1	6.5	8.1	3.1	34.9
2-3	1.1	3.1	0.9	0.3	0.7	3.1	3.0	1.3	13.5
3-4	0.2	1.1	0.2	0.02	0.2	1.1	0.9	0.4	4.1
4-5	0.03	0.4	0.07	-	0.03	0.4	0.3	0.08	1.3
5-6	+	0.13	0.02	-	+	0.13	0.11	0.02	0.4
6-7	-	0.04	+	-	+	0.04	0.03	+	0.12
>7	-	0.01	-	-	+	0.01	+	-	0.03
Frequency of Wave Direction	9.5	21.0	8.3	4.5	5.8	18.8	23.5	8.6	100
Regression	1.2	1.4	1.2	1.0	1.2	1.5	1.3	1.3	

Wave measurements were undertaken during the 2011 to 2013 metocean survey (Ref. 7.4); the station locations are shown on Figure 7.2. The results were correlated with a long-term satellite data (26 year dataset) (Ref. 7.6). The significant wave height[6] predictions are presented in Table 7.13. The average significant wave height increases with distance from the shore to about 1 m offshore. Near the coast, waves are predominantly from the west and southwest. Offshore, there is additionally a north-northeast wave component due to the increased fetch.

[6] Significant wave height is the average wave height of the 1/3 highest waves.

Table 7.13 Summary of Estimated Wave Heights (Ref. 7.6)

Location	Deep Water	Continental Shelf	Nearshore Waters
Water Depth	>150 m	50 m	23 m
Significant Wave Height (50% Probability)	1 m	0.5 m	0.5 m
Significant Wave Height (90% Probability)	2 m	1.5 m	1.5 m
Maximum Significant Wave Height	8 m	6.75 m	6.25 m

7.4.4.4 Storm Surges

Short-term sea level variations are also associated with varying meteorological conditions and can result in localised sea level surges of up to 1 m. However, storm surge levels along the Caucasus coast are typically less than 40 cm.

Surge predictions based on published data (Ref. 7.1) are presented in Table 7.14.

Table 7.14 Surge Level Fluctuations (m) Compared with Average Black Sea Level (Ref. 7.1)

Surge Level	Maximum (positive surge)				Minimum (negative surge)			
Return Period (years)	10	25	50	100	10	25	50	100
Anapa	0.52	0.58	0.62	0.67	-0.46	-0.51	-0.54	-0.58

The frequency of storm surges in the Black Sea is lower than that in other regions of the world's oceans (Ref. 7.38). The gently sloping continental slope open to winds and waves is subject to storm surges. It is estimated that typical storm durations vary between 56 and 151 hours with an average duration of 95 hours (Ref. 7.39). Extreme storms have quite a short growth phase with an average duration of 61 hours. Hence, the typical storm pattern is characterised with fast growth, a rather durable energetic development phase and relatively prolonged decay.

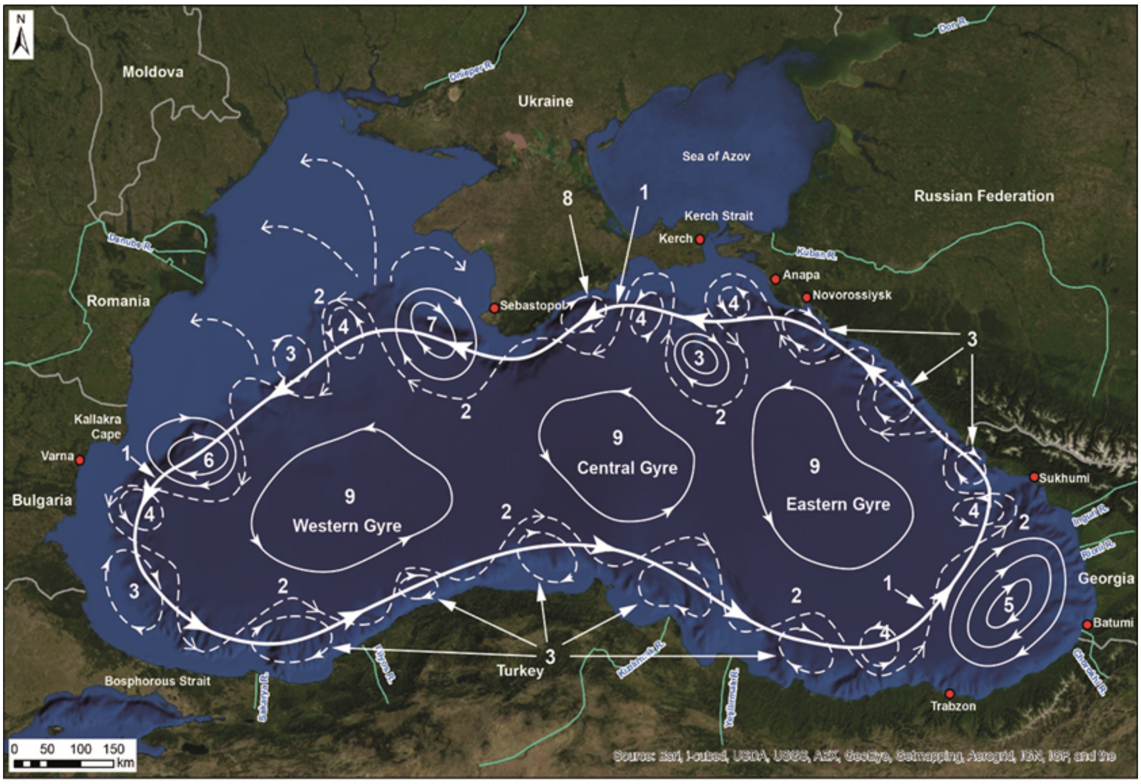
7.4.4.5 Currents

The Main Black Sea Current (MBSC) affects the whole basin in one cyclonic (counter clockwise in the northern hemisphere) circular motion. A prominent feature in the upper layer circulation in the Black Sea is the so-called "Rim Current", a cyclonic current that follows the abrupt continental slope and encompasses a cyclonic cell that occupies the basin. A diagram of the MBSC is shown in Figure 7.11.

The MBSC is directed counter-clockwise forming the two rings over the basin apron in the western and eastern parts of the Sea (referred to as the 'Knipovich spectacles' after the name of one of the Russian oceanographers who described the phenomenon). The MBSC is associated with a series of cyclonic and anti-cyclonic eddies in the cyclonic meanders. Outside the Rim Current, numerous quasi-permanent coastal eddies are formed as a result of 'wind curl' mechanisms and upwelling around the coastal apron (Ref. 7.36).

The MBSC is a 50 to 80 km wide flow within the upper 300 m of the water column and remains present during the entire year. The current is more distinct during summer and winter. On average, the current passes some 15 to 50 km from the Russian coast.

Figure 7.11 Main Black Sea Current (Ref. 7.1)



Key:
1: mean position of the cyclonic Rim Current jet current
2: Rim Current meanders
3: anticyclonic coastal eddies
4: cyclonic eddies
5: Batumi anticyclonic eddy
6: Kaliakra anticyclonic eddy
7: Sebastopol anticyclonic eddy
8: Crimea anticyclonic eddy
9: quasi-stationary cyclonic gyres

As shown in Figure 7.11, coastal currents in the Caucasus region are characterised by two diametrically opposite directions of water movement: north-western and south-eastern. The north-western flow direction is dominant over the south-eastern flow (approximate ratio is 85% and 15% respectively). The maximum velocity of the north-western current is between 0.3 to

0.5 m/s and between 0.5 to 0.8 m/s in the summer and winter respectively; in comparison, the maximum velocity of the south-eastern current is 30 to 50% less (Ref. 7.1).

Current speeds in the core of the MBSC typically flow at 0.3 to 0.6 m/s depending on synoptic, seasonal and inter-annual variability.

Based on the results of current data measurements in 1998-1999, the values of extreme current speeds on the shelf, continental slope and abyssal plain were estimated (Ref. 7.1). Current speeds are inversely proportionate to depth. The 1-year return period nearshore current velocity is approximately 0.7 m/s. The maximum velocity (1:100 years return period) is approximately 1 m/s. On the continental slope (depth 100 to 1700 m), the current velocity varies from 0.1 m/s (1:1 year return period) to 0.2 m/s (1:100 years). A similar pattern is observed in the current speeds on the abyssal plain.

Further surveys of marine currents have been undertaken from 2011 to 2012 (Ref. 7.6) with currents measured close to the pipeline route; the station locations are shown in Figure 7.2. This included monitoring of differences in currents with depth. The current measurements have been combined with hindcasting from long-term datasets to estimate potential current speeds (Ref. 7.6). Surface and nearbed current data for the Marine Survey Area are summarised in Table 7.15 and Table 7.16. Yearly variation in nearbed currents is estimated to be about 30% in the nearshore section and 20% in the offshore section of the Marine Study Area (Ref. 7.6). Only minor variations in surface currents, predominantly due to the wind conditions, are anticipated.

Table 7.15 Summary of Surface Currents (Ref. 7.6)

Station	Water Depth (m)	Observed Maximum (m/s)	Return Period (years)				
			1	5	10	50	100
1	25	0.64	0.69	0.76	0.81	0.91	0.95
1b	73	1.38	1.54	1.70	1.77	1.92	1.98
2	381	1.35	1.72	1.91	1.99	2.18	2.26
3	509	1.38	1.55	1.71	1.78	1.94	2.00

Table 7.16 Summary of Nearbed Currents (Ref. 7.6)

Station	Water Depth (m)	Observed Maximum (m/s)	Return Period (years)				
			1	5	10	50	100
1	25	0.40	0.49	0.55	0.58	0.63	0.66
2	381	0.51	0.18	0.20	0.22	0.24	0.26

Continued...

Station	Water Depth (m)	Observed Maximum (m/s)	Return Period (years)				
			1	5	10	50	100
3	509	0.13	0.13	0.15	0.16	0.18	0.19
4	1750	0.06	0.06	0.07	0.07	0.07	0.07
5	1790	0.09	0.10	0.11	0.12	0.13	0.13
6	2088	0.11	0.12	0.13	0.13	0.14	0.15
7	2129	0.06	0.07	0.07	0.07	0.07	0.08

Complete.

7.4.4.6 Ice Period

The northern part of the Black Sea and the Kerch Strait are normally covered by ice during winter (Table 7.17). Shore ice occurs regularly along the eastern and western shores of the strait. The ice normally occurs between December and April.

The ice period of the Anapa-Novorossiysk region is unique. Ice in the form of "shuga" (slush ice) is short-term, forming nearly every year, but it is rare for the sea to freeze over completely. Novorossiysk Bay froze completely twice in the past century: during the winters of 1924-25 and 1933-34. The width of the shore ice exceeded 200 m and the ice was up to 15 m thick.

Table 7.17 Summary of the Ice Period in Kerch Strait from 1991–2005 (Ref. 7.1)

	Winter type	Early	Late
First appearance of early types of ice	mild	12 Dec	24 Jan
	moderate	10 Dec	11 Feb
Maximum distribution to the South	mild	18 Jan	2 Feb
	moderate	19 Dec	28 Mar
Last full clearance	mild	26 Jan	6 Mar
	moderate	1 Mar	5 Apr
Number of clearances a year	mild	1	3
	moderate	3	2

Icing of vessels, hydro-engineering structures, and the near shore area occurs every year. And in this context, the most favourable period for engineering work is from May to October. The key shelter ports are Novorossiysk, Anapa and Gelendzhik. Novorossiysk Port and the adjacent Tsemes Bay are normally ice-free in winter (Ref. 7.40).

Ice scour is caused by erosion of the sea bed where floating sea ice comes into contact with the sea bed. This is not considered to be a significant risk for the Project as the pipelines exit the microtunnels at a water depth 23 m depth and because sea ice is an infrequent occurrence in the Study Area.

7.4.4.7 Water Temperature

The Black Sea exhibits a characteristically layered pattern in the vertical distribution of water temperature (Ref. 7.1, 7.2, 7.3). There are three principal layers: the surface water layer, the low temperature layer and the deep layer (Figure 7.12). This thermal layering is influenced by the salinity stratification described below.

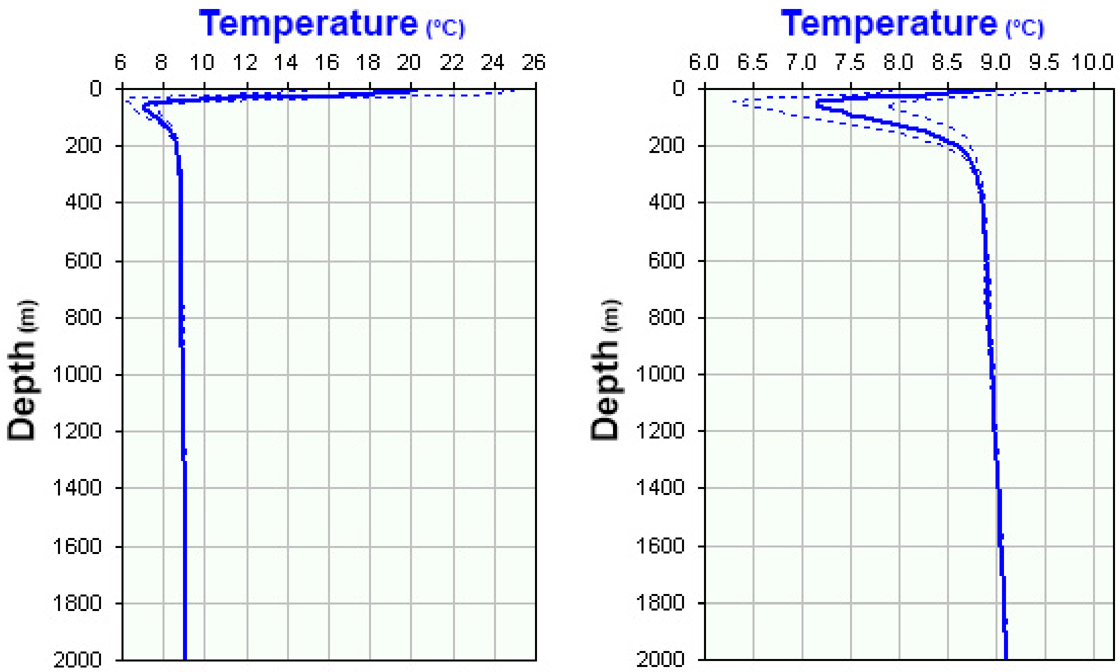
The surface water layer is typically 20 to 40 m deep. The temperature of the surface waters varies seasonally by around 16°C, ranging from about 9°C in February to about 25°C in August. Considerable short term fluctuations (from several hours to several days) are observed against the background of seasonal changes in temperature. In autumn, winter and spring, these fluctuations are only 1 to 2 °C. In summer, short-term changes of water temperature can reach 9 °C. These fluctuations are mainly due to interactions of diurnal (daily) solar radiation and local wind field effects.

Below the surface waters there is a low temperature layer. In this layer, water temperatures reach their minimum values of about 6 to 7°C. The low temperature layer typically extends from the base of the surface water layer at on average 35 m to about 110 to 120 m deep. The thickness of the low temperature layer varies annually in response to the antecedent weather conditions over the preceding winter.

The temperature of the low temperature layer varies seasonally but there is an observable lag of several months compared with the surface layer. Temperatures at the top and the core of the low temperature layer reach their minimums in March and May, respectively, compared with the minimum of the surface layer in February. Similarly, temperatures at the top and the core of the low temperature layer reach their maximums in October and February, respectively, compared with the August maximum in the surface layer.

Below the low temperature zone (>100 to 120 m), water temperatures gradually rise with depth to a nearly constant 8.9°C at 400 m depth. Minimal seasonal variation in water temperatures is observed at depth. The stratification of the Black Sea limits active vertical mixing of surface and deep waters, thus confining seasonal variations to the upper layers.

Figure 7.12 Long-term Average Annual Profiles of Temperature with Depth (Ref. 7.1)



a) Summer Profile

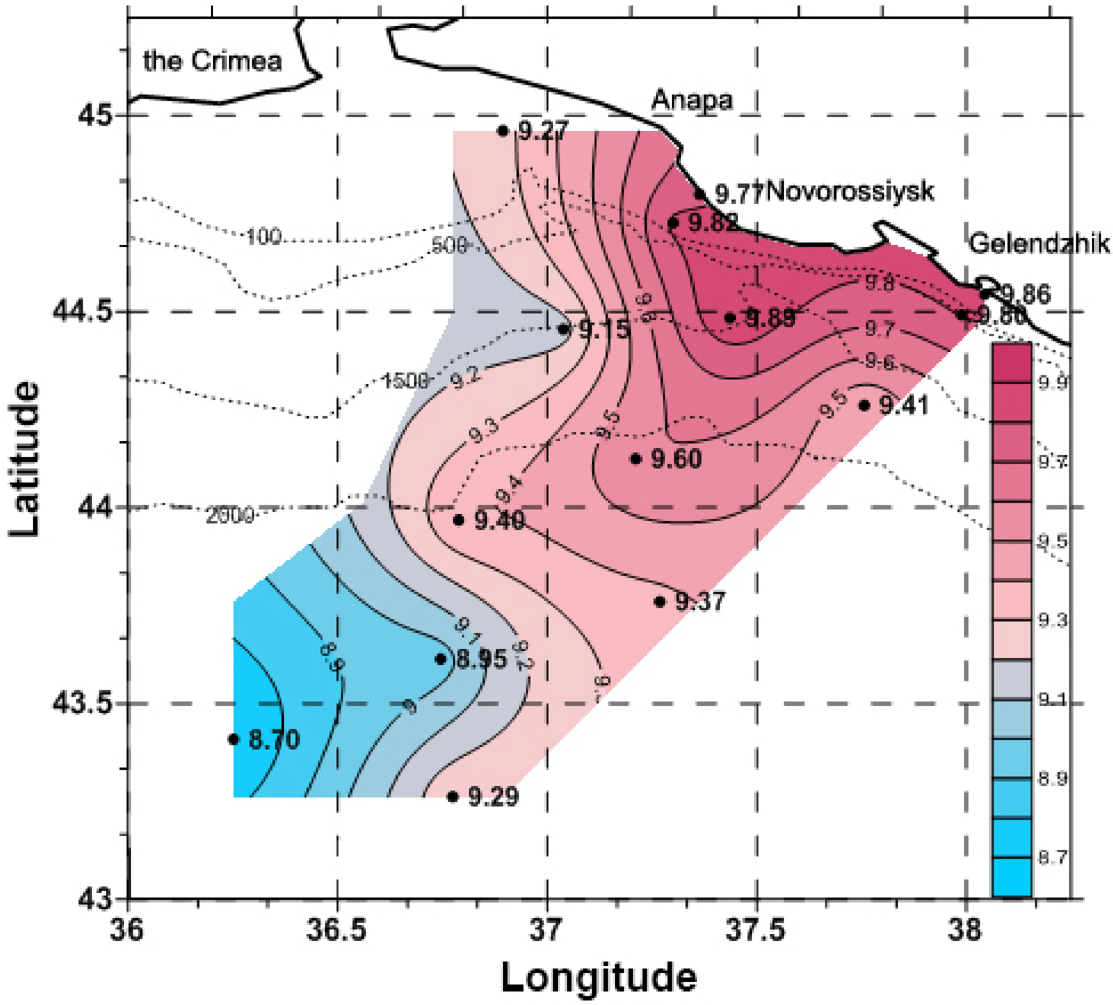
b) Winter Profile

Note: Average square deviations are marked by dotted lines.

The 2011 survey data showed a similar pattern to the literature dataset (Ref. 7.1). Water temperatures varied with depth. In the surface layer, water temperature also decreased with distance from the shore (Figure 7.13). Water temperature in the surface waters ranged from 8.70 to 9.89°C. A thermocline was identified at around 40 to 45 m depth. Water at 100 m and 500 m depth was on average 8.43°C and 8.88°C respectively.

Measured seabed water temperatures ranged from 6.35 to 26.34°C in shallow waters (<20 m) (Ref. 7.6). The seasonal range in seabed water temperature decreases as water depth increases. By water depths of 100 m, the seasonal variation is less than 2°C. There is negligible seasonal variation in seabed water temperatures in water depths over 200 m. Seabed water temperatures in deep water areas are around 9°C (Ref. 7.6).

Figure 7.13 Sea Water Temperatures (°C) in the Surface Waters in April 2011 (Ref. 7.1)



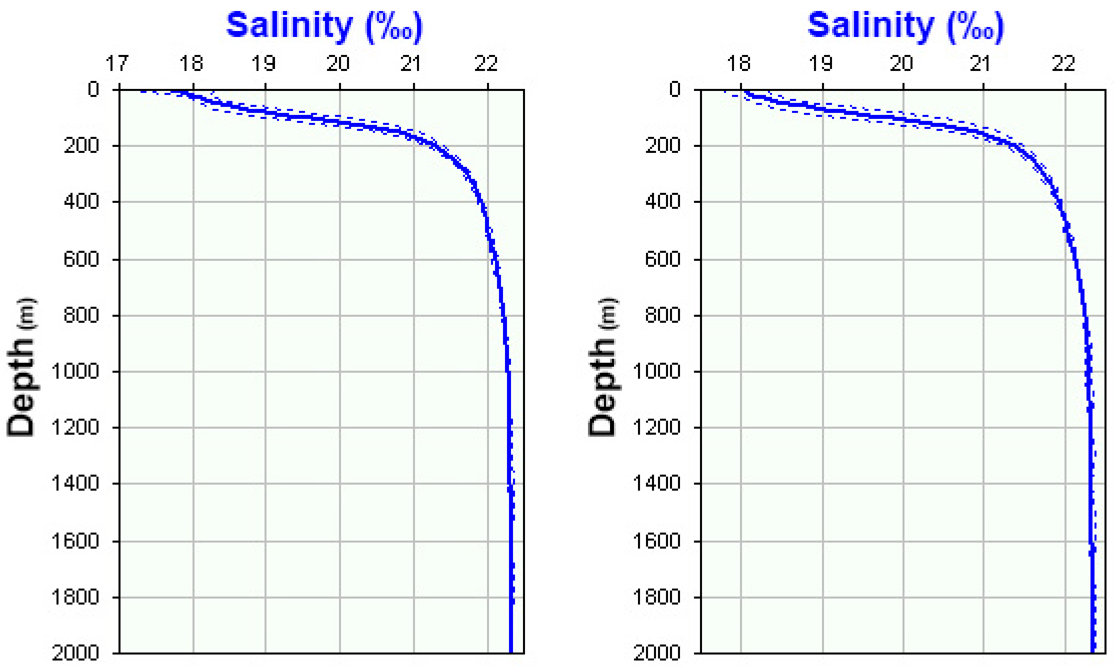
7.4.4.8 Water Salinity

Globally, typical marine salinity is about 35‰. In some inland seas where evaporation exceeds the input of the fresh water, salinity can reach up to 37 to 38‰ (for example, in the eastern part of the Mediterranean Sea) and even 40‰ (in the Red Sea). In comparison, in the Black Sea, salinity is considerably lower at about 22‰ than that of the Mediterranean Sea. This is due to the dominance of fresh water inputs and the limited water exchange with the Mediterranean.

The total volume of river flows and atmospheric precipitation entering the Black Sea exceeds evaporation by more than one third. This forms a surface layer of lower salinity. The deep water is more saline than the surface layer due to the inflow of saline waters into the Black Sea from the Mediterranean through the Bosphorus Strait.

The combination of these factors causes the Black Sea to exhibit strong vertical stratification in salinity. A typical depth profile for salinity based on long-term metocean datasets for the Russian EEZ (Ref. 7.1, 7.2) is shown in Figure 7.14. There is an upper layer of lower salinity water overlying a deep layer of more saline water. The permanent halocline in the Black Sea is located between 120 and 200 m water depth (Ref. 7.1, 7.2, 7.3). Salinity varies in the upper layer varies seasonally.

Figure 7.14 Long-term Average Annual Profiles of Salinity with Depth (Ref. 7.1)



a) Summer Profile

b) Winter Profile

Note: Average square deviations are marked by dotted lines.

Salinity at the sea surface is at a maximum in winter (18.2‰ in December) then reduces to a summer minimum (17.6‰ in August). In the upper layer, water salinity also increases with distance from the shore (Figure 7.15 and Figure 7.16). Salinity varies with depth (Table 7.18). Salinity levels rise rapidly to approximately 21‰ by around 200 m depth. The seasonal pattern in salinity reverses with depth within this zone; from about 25 m downwards salinity is higher in summer than in winter due to the lag time in vertical mixing. By 150 m depth, the salinity minimum is 19.9‰ from December to March and the maximum is 20.6‰ from August to September; the annual range of seasonal salinity change (0.7‰) at this depth is slightly higher that at the sea surface.

Beyond about 200 m depth, salinity levels continue to rise with depth but at a slower rate. Below 500 m, salinity is approximately 22‰ with no significant seasonal variation (Ref. 7.1). Seabed water salinity in the deep water areas is around 22.3 ‰ (Ref. 7.5).

Table 7.18 Measured Salinity with Depth for 2010-2011 (Ref. 7.1)

Depth (m)	Salinity (‰)		
	Minimum	Maximum	Average
Near-Surface	17.16	18.25	17.93
10	17.202	18.250	17.957
25	17.799	18.254	18.059
40-45 (Thermocline)	17.810	18.441	18.139
100	19.355	20.860	20.355
200	21.230	21.578	21.446
500	22.014	22.071	22.044

Figure 7.15 Sea Water Salinity (‰) in the Surface Waters in April 2011 (Ref. 7.1)

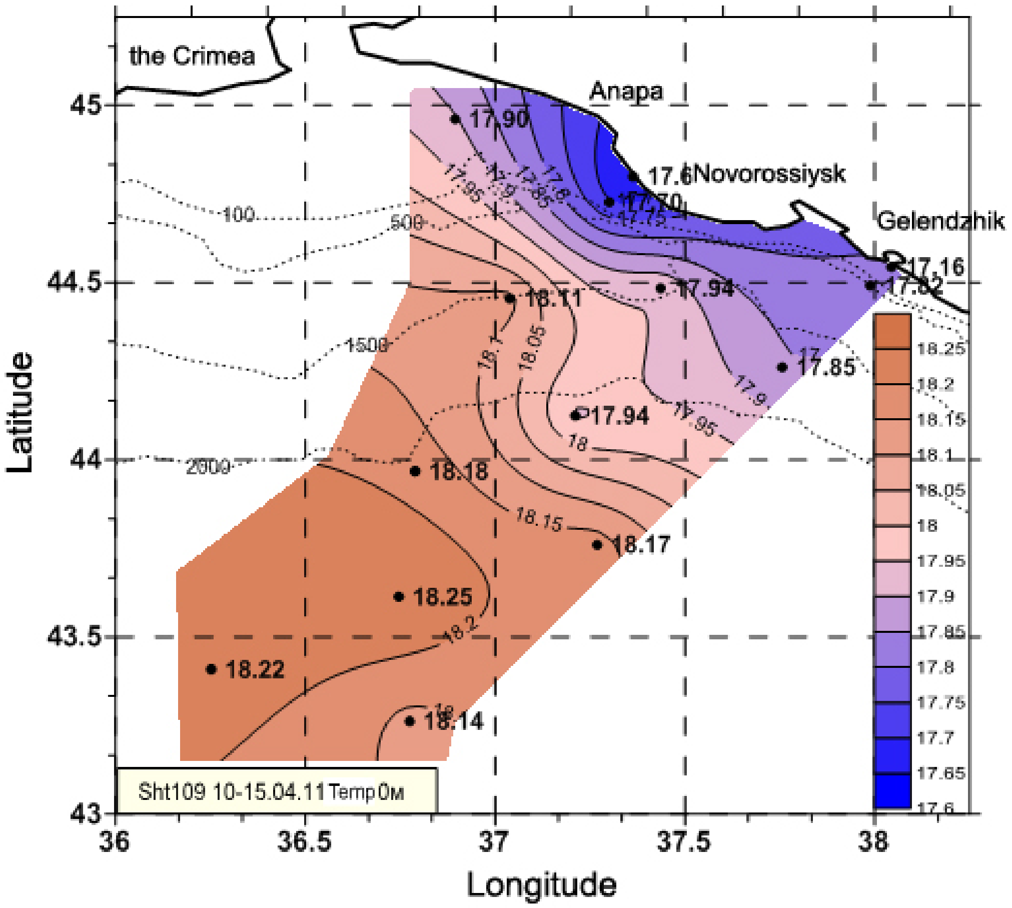
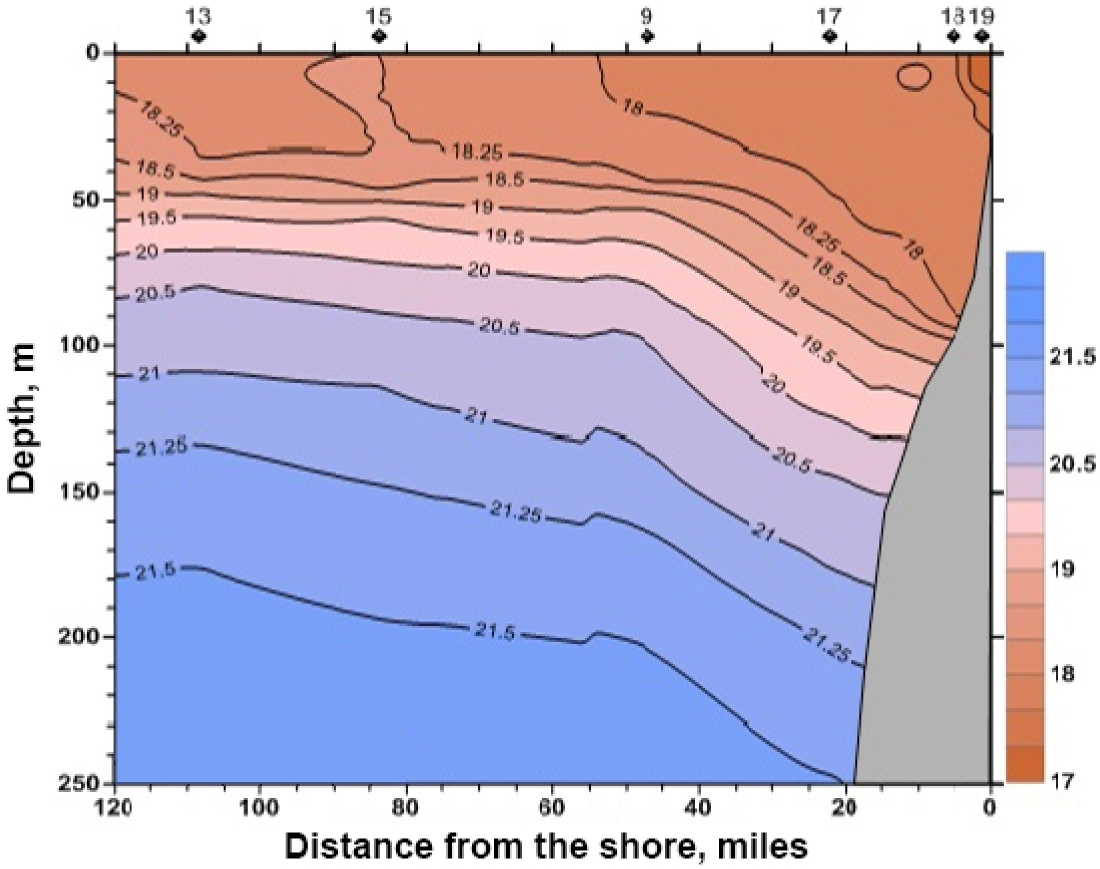


Figure 7.16 Distribution of Sea Water Salinity (‰) with Depth and Distance from Shore in April 2011 (Ref 7.1)



7.4.4.9 Water Density

During the year, water density changes as a function of salinity and temperature.

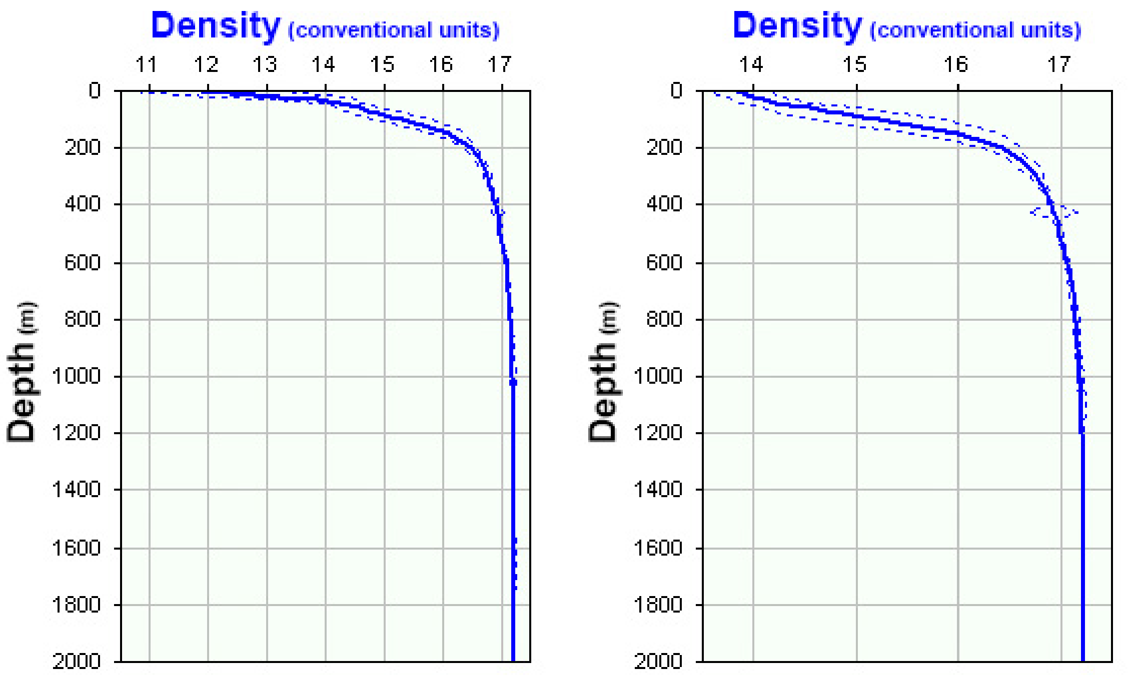
In the near-surface waters (0 to 10 m), the water density is at a minimum in July and August (10.44 conventional units), when temperatures are highest and salinity is lowest. In comparison, water density is at a maximum in March (14.02 conventional units) (Ref. 7.1, 7.2, 7.3).

Below the surface, density increases rapidly with depth (Figure 7.17) reflecting the increase in salinity and decrease in temperature. The vertical pattern in water density distribution is similar to the salt distribution pattern except that there is an increase in density at around 20 to 60 m relating to the low temperature zone at this depth. The pycnocline is typically higher and more distinct in the central seas as compared with the continental slope.

From 300 to 500 m, density increases slowly with depth. No significant seasonal trends are observed. Below 500 m, density is around 17 conventional units and is relatively constant with depth, mirroring the patterns observed in salinity and temperature.

The 2011 survey data (Ref. 7.1) showed a similar pattern to the literature dataset (Table 7.19). Water density varied with depth. In the upper layer, water density also increased with distance from the shore. As would be expected, the vertical and lateral distribution patterns for density were broadly similar to those for salinity. Density in the surface layer ranged from 13.08 to 14.05 conventional units with an average value of 13.73 conventional units. At 100 m and 500 m, the average density values were 15.75 and 17.02 conventional units respectively.

Figure 7.17 Long-term Average Annual Profiles of Conventional Density with Depth (Ref. 7.1, 7.2)



a) Summer Profile

b) Winter Profile

Note: Average square deviations are marked by dotted lines.

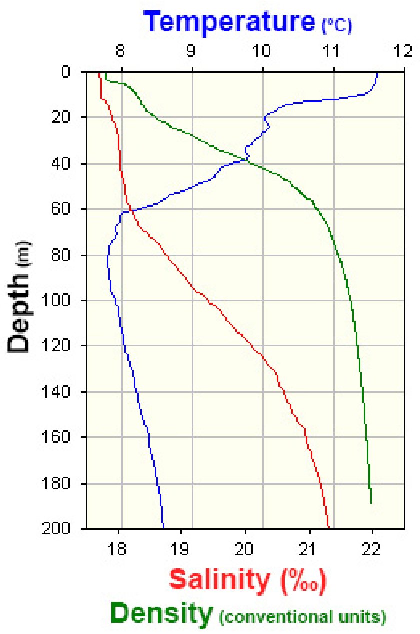
The relationship between salinity, temperature and density is key to appreciating the stratification of the Black Sea. This stratification has implications for water quality and for biological activity. Figure 7.18 shows the typical interrelationship.

Table 7.19 Measured Water Density with Depth in 2010-2011 (Ref. 7.1)

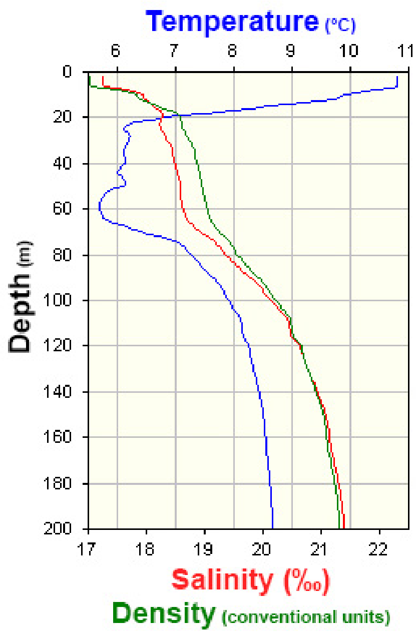
Depth (m)	Density (conventional unit)		
	Minimum	Maximum	Average
Near-Surface	13.080	14.050	13.730
10	13.133	14.053	13.766
25	13.599	14.077	13.869
40-45 (Thermocline)	13.609	14.282	13.972
100	14.967	16.136	15.749
200	16.411	16.667	16.570
500	16.992	17.036	17.015

Figure 7.18 Comparison of Distribution Profiles of Temperature, Salinity and Density with Depth (Ref 7.1)

a) Winter Profiles

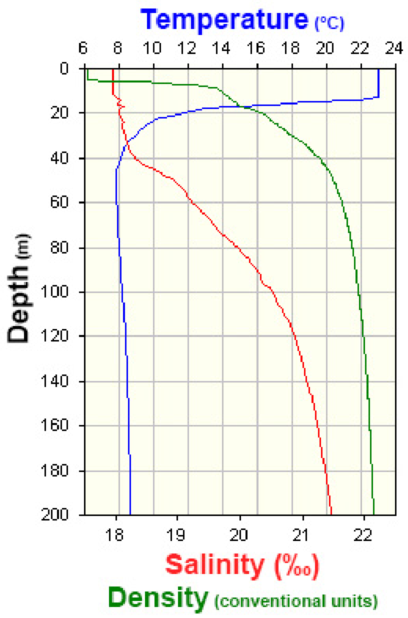


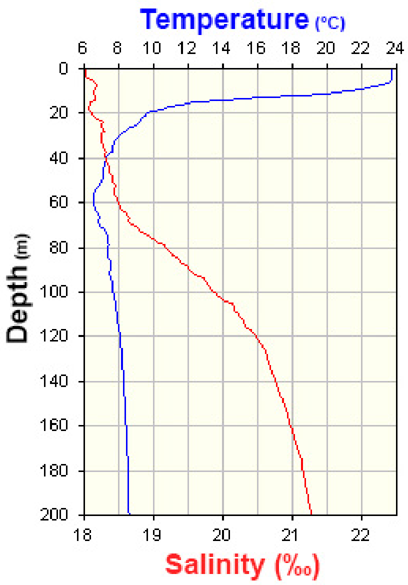
i) Central Black Sea



ii) Russian Continental Slope

b) Summer Profiles





i) Central Black Sea

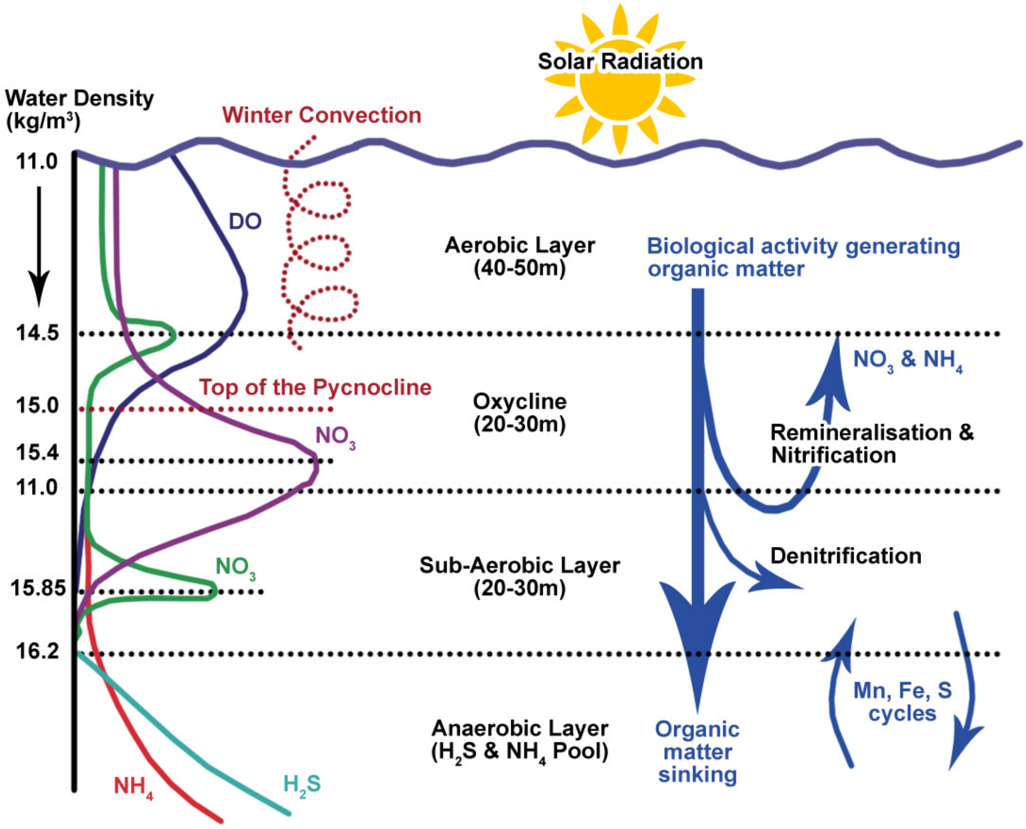
ii) Russian Continental Slope

7.4.5 Marine Water Quality

Understanding of marine water quality in the Black Sea requires an appreciation of the importance of stratification with depth. The upper sea layer experiences seasonal and year to year variation in hydrophysical and hydrochemical characteristics under the influence of external climatic factors. Its lower boundary is a deep pycnocline, below which influence of the external factors does not normally extend and hydrochemical conditions are relatively stable (Ref. 7.1). The upper layer is aerobic whereas anaerobic conditions exist at depth. The vertical zonation in hydrogeochemistry is illustrated in Figure 7.19.

All characteristic features of the depth distribution of hydrochemical parameters (horizons of wedging out of oxygen, hydrogen sulphide, and extreme values of biogenic elements) are usually located lower in the Black Sea coastal zone than in the central areas. This domal structure to the stratification is connected with the cyclonic character of water circulation. However, the hydrochemical horizons are almost always at the same density levels, consistent with the importance of density stratification to hydrochemical processes. Note that the upper boundary of the anaerobic zone exactly corresponds to a specific isopycnic surface (water density).

Figure 7.19 Vertical Stratification in Hydrogeochemistry (Ref. 7.36)

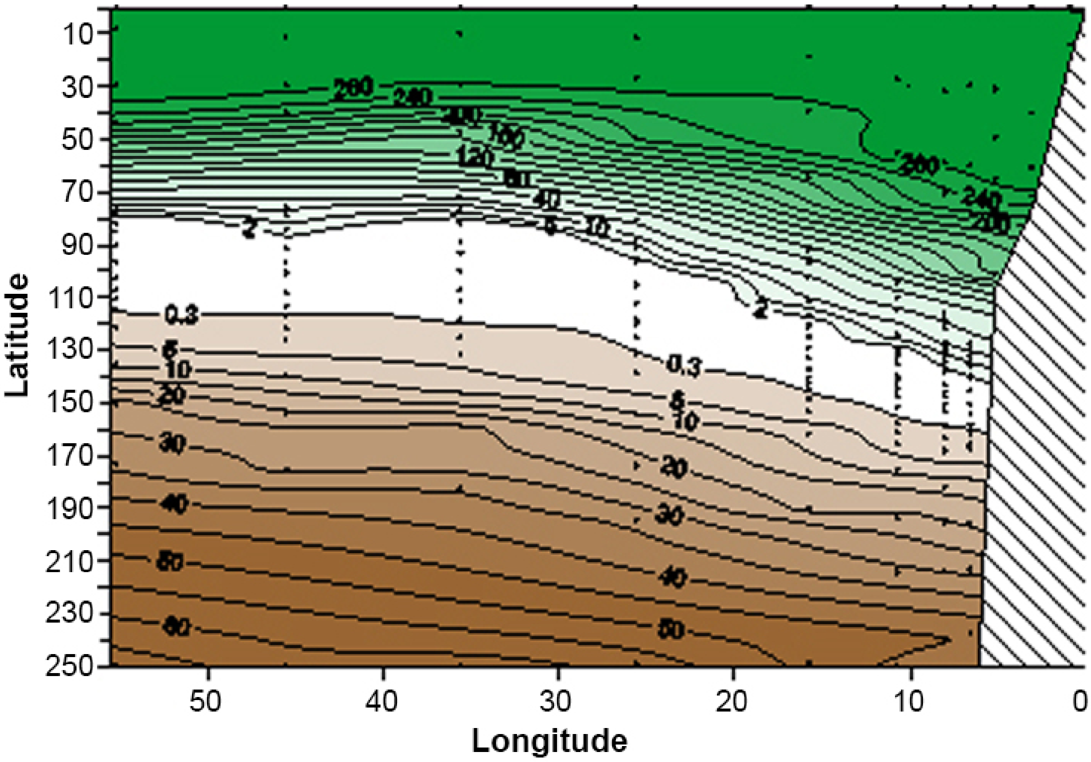


7.4.5.1 Oxygen

Oxygen is present in the surface waters, being at highest in concentration around 10 to 40 m depth. Oxygen concentrations in the surface waters vary seasonally, reflecting biological activity and the inverse relationship between oxygen solubility and water temperature. Oxygen concentrations in the surface waters are highest in March to May, which relates to the spring phytoplankton bloom and when surface water temperatures are relatively low. The minimum oxygen concentrations are in August to September when surface water temperatures are at their maximum.

Oxygen concentrations decrease from around 40 m depth, with oxygen depletion occurring in layers below 80 to 150 m (Figure 7.20). Oxygen disappears at a water density of about 15.9 conventional units. This is due to the salinity stratification limiting the potential for vertical mixing. Oxygen is typically absent from the deeper waters below the pycnocline, creating anoxic conditions; the Black Sea is the world's largest anoxic basin. Waters with hypoxic or entirely anoxic conditions are typically incapable of sustaining permanent populations of species dependant on aerobic respiration.

Figure 7.20 Distribution of Oxygen (Green) and Hydrogen Sulphide (Brown) Concentrations (µM) from Archival Data (Ref. 7.1)



The average oxygen content of the surface waters was 8.91 mg/L in autumn 2010 (Ref. 7.1). Oxygen concentrations decreased below about 25 to 35 m; oxygen was not detected below about 100 to 140 m depth. In spring 2011, the oxygen content of the surface waters ranged from 10.10 to 10.35 mg/L. Oxygen concentrations decreased below about 30 m depth; oxygen was not detected below about 80 m depth.

Both autumn 2010 and spring 2011 surveys had similar spatial patterns in oxygen content (Ref. 7.1). Oxygen concentrations generally increased with distance from the coast. Coastal concentrations were highest near Gelendzhik and lowest near Anapa. The lower oxygen concentrations near the coast are interpreted to be due to warmer water temperatures near the coast, continental run-off and oxygen consumption by the oxidation of terrestrially-sourced organic matter.

In the summer 2011 survey (Ref. 7.1), the dissolved oxygen content in the surface layer of water in the coastal waters (as measured at coastal station "4C"; location on Figure 7.3) was 7.48 mg/L, which satisfies the Maximum Permissible Concentration (MPC) for human health in bathing waters set in SanPiN 2.1.5.2582-10 (Ref. 7.17).

7.4.5.2 Hydrogen Sulphide

The lack of oxygen at depth due to vertical stratification of the water column means that the potential for significant marine life occurring at depths of greater than 200 m within the Black Sea is likely to be limited to those organisms capable of anaerobic respiration (e.g. chemosynthetic life). Chemosynthesis typically produces hydrogen sulphide (H_2S) and methane as by-products, although these molecules are also formed by other biological and non-biological processes.

The widespread presence of hydrogen sulphide at depth is a notable characteristic of the Black Sea. The deep part of the water column throughout the Black Sea is characterised by high concentrations of H_2S. H_2S first appears at a water density of about 16.1 conventional units. From surveys in spring 2011 (Ref. 7.1), the H_2S upper boundary occurred at a depth of between 100 to 160 m in Russian waters (Figure 7.19). H_2S concentrations increased with depth up to a relatively high value of 13.2 mg/L in depths exceeding 2,000 m.

The depth at which H_2S appears varies seasonally, being deeper in winter. This is more pronounced in the shore areas compared with the deeper sea. This reflects seasonal changes in density as there is a close correlation between the conditional density and the appearance of H_2S. There is typically minimal seasonal variation in H_2S concentrations at depth.

7.4.5.3 pH

The surface waters of the Marine Survey Area are alkaline with a pH of around 8.2 to 8.3. Slightly lower pH levels have been recorded in the surface waters in and near river estuaries. Below 25 m, the pH decreases reaching 7.6 to 7.9 at the depth of H_2S appearance (c.80 to 160 m). Thereafter, pH slowly decreases with depth to about 7.5 at 2,000 m.

Slight seasonal variation in pH occurs (<0.5 pH units) in the surface waters, with summer values typically being slightly higher than winter values in coastal areas but the inverse in open seas.

In autumn 2010, the pH of the surface waters ranged from 8.2 to 8.4. In spring 2011, the pH of the surface waters were slightly lower, typically about 8.2. The pH values decreased with depth, dropping sharply below 80 m to 7.6. In the deep waters (>2,000 m) the pH is about 7.4, which corresponds to the long-term average pH for the deep waters of the Black Sea (Ref. 7.1).

7.4.5.4 Alkalinity

The total alkalinity of the surface waters is on average 3.196 mg/L. Alkalinity increases with depth, being 4.100 to 4.787 mg/L at 2,000 m.

Alkalinity in the surface waters varies spatially and seasonally, reflecting variations in river flows and quality and in precipitation inputs.

Alkalinity values measured in the autumn 2010 and spring 2011 surveys were within typical ranges for the Black Sea (Ref. 7.1). Coastal concentrations in the surface waters increased northwards along the coast. Concentrations were lower in the vicinity of the MBSC and then increased in the central part of the Eastern Black Sea. Alkalinity concentrations increased with depth.

7.4.5.5 Silica

Silica concentrations in surface waters are low at 0.1 mg/L. Low silica concentrations in surface waters reflect its intensive use in biochemical processes in the photosynthesis zone. Below 50 m, silica concentrations rise gradually to 8.5 to 11.2 mg/L at 2,000 m.

Silica concentrations vary seasonally and spatially. Concentrations are typically higher in coastal waters than in the open seas and are higher in winter than in summer.

In autumn 2010, silica concentrations in the surface waters ranged from 0.03 to 0.06 mg/L with an average value of 0.03 mg/L (Ref. 7.1). Concentrations were higher in the southern part of the Marine Survey Area. The silica concentrations increased with depth. Silica concentrations below 60 to 80 m exceeded 1 mg/L, with the maximum concentration of 6.51 mg/L being recorded at a depth of 1900 m.

In spring 2011, the silica concentrations in the surface waters were up to 0.2 mg/L (Ref. 7.1). Again, higher concentrations were observed in the south around Gelendzhik, reflecting river inputs in this area. Silica increases with depth, being on average about 6 mg/L at 1,000 m depth.

7.4.5.6 Organic Matter

Measurements of the biochemical consumption of oxygen (BOD5) have been undertaken to provide indirect measurement of organic matter in the water.

BOD5 is highest in the surface waters. Maximum concentrations in the surface waters in coastal areas are higher than in the open sea. Concentrations in coastal areas are relatively variable but have been measured up to 2.92 mg/L. BOD5 concentrations in the open seas are 0.1 to 0.6 mg/L. Organic matter decreases with depth. Beneath the pycnocline, BOD5 levels are typically 0.3 mg/L.

In autumn 2010, the BOD5 concentrations in the surface waters ranged from 0.09 to 0.47 mg/L with an average value of 0.31 mg/L (Ref. 7.1). In spring 2011, the BOD5 concentrations in the surface waters ranged were up to 1.03 mg/L. The measured BOD5 values are relatively low (compared with Maximum Allowable Concentrations (MAC) of 3 mg/L) and are consistent with background values in the Black Sea and a relative lack of significant water pollution by organic compounds.

Chemical Oxygen Demand (COD) measurements were also obtained in autumn 2010 and spring 2011 (Ref. 7.1). COD values reflect the total organic matter content of the sea water. Measured COD values ranged from 1.2 to 1.5 mg/L with an average of 1.37 mg/L in autumn 2010. Measured COD values in spring 2011 ranged from 0.7 to 4.5 mg/L with an average of 1.3 mg/L in the whole water column but from 0.9 to 1.5 mg/L with an average of 1.2 mg/L in the surface waters. COD concentrations were highest near the coast and lowest in the MBSC. The measured COD values typically fell within the range (1 to 2 mg/L) considered representative of “clean” water (Ref. 7.1).

No BOD5 or COD was detected in measureable concentrations in coastal waters during the summer 2011 survey.

7.4.5.7 Turbidity and Suspended Sediments

The optical properties (transparency and colour) of the Black Sea waters vary seasonally. In interpreting the seasonal patterns it should be noted that there is limited data available on typical optical properties in the sea water over winter. Spatial variations are also observed, with transparency typically being lower near the coast especially near river mouths.

Transparency in the eastern and central parts of the Black Sea is typically highest during summer when the volume of water discharged by rivers is lowest. Correspondingly, colour values are at their lowest at this time. Transparency is lowest and colour values are highest in spring due to phytoplankton blooms and snow melt flows. From autumn to spring, storm activity in shallow waters mobilises seabed sediments causing an increase in turbidity in coastal areas.

In April 2011 (Ref. 7.1), turbidity values at 10 m depth ranged from 0.11 to 15.47 relative units with an average value of 1.90 relative units. Turbidity declined with depth, with average values of 0.50, 0.25 and 0.08 relative units at 25, 50 and 100 m respectively. The depth profiles show a clear distinction between the more turbid, upper active layer and the less turbid deep layer.

The main source of suspended solids is from river waters, wave induced disturbance of seabed sediments, and airborne particles. At the Caucasus shores where there is little in the way of shallow waters, the river flows entering the sea are rapidly mixed into the deep water column. Up to the depth of 100 m, the vertical distribution of suspended solids is characterised by gradual decrease in their concentration.

In the autumn 2010 survey (Ref. 7.1) the measured suspended sediment concentration varied from 2.0 to 6.7 mg/L with the greatest concentrations within the water column occurring in the southern part of the Marine Survey Area.

In the spring 2011 survey (Ref. 7.1) the suspended sediment concentration varied across the Marine Survey Area from 2.0 to 41.3 mg/L. However the peak concentration of 41.3 mg/L was only recorded at one station, with all other concentrations being below 10 mg/L.

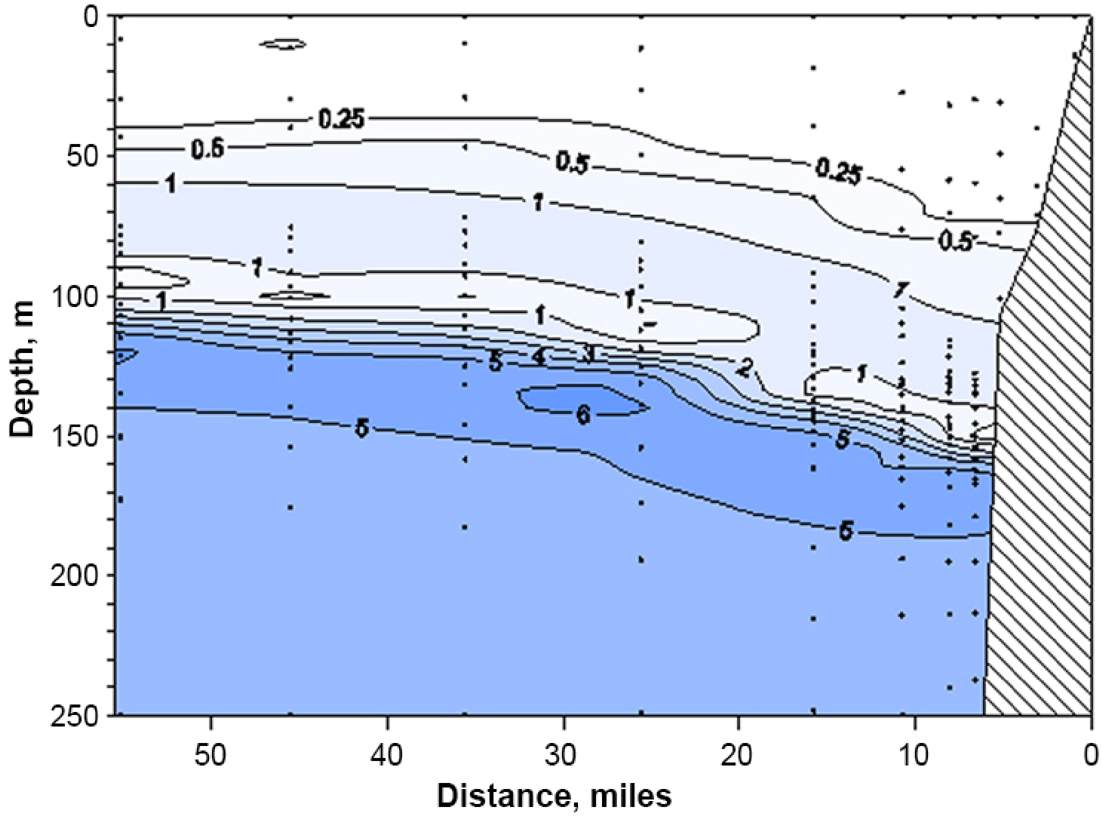
7.4.5.8 Phosphorus Compounds

Phosphorus compounds play a key environmental role, influencing biological productivity.

Phosphates

The vertical distribution of phosphates is controlled by density and redox conditions, reflecting the stratification of the sea (Figure 7.21).

Figure 7.21 Distribution of Phosphate Concentrations (µM) with Depth and Distance from Shore based on Archival Data (Ref. 7.1)



Concentrations are lowest in the surface waters, particularly during active photosynthesis. Phosphate concentrations are typically higher in coastal areas than in the open seas, reflecting the influence of continental runoff. Surface concentrations in nearshore areas are typically 0.013 mg/L in winter and 0.028 mg/L in summer, compared with 0.009 mg/L in winter and 0.017 mg/L in summer in the open sea.

Phosphate concentrations increase below around 40 m, with a secondary maximum around 100 to 150 m depth, then decreasing slightly before rising again to around 0.45 to 0.48 mg/L when the density is around 16.2 conventional units. Concentrations at 2,000 m depth are of the order of 0.5 to 0.7 mg/L.

Phosphate concentrations vary seasonally. Concentrations are higher in summer than in winter. An increase in phosphate concentrations in both summer and winter has been observed in recent years.

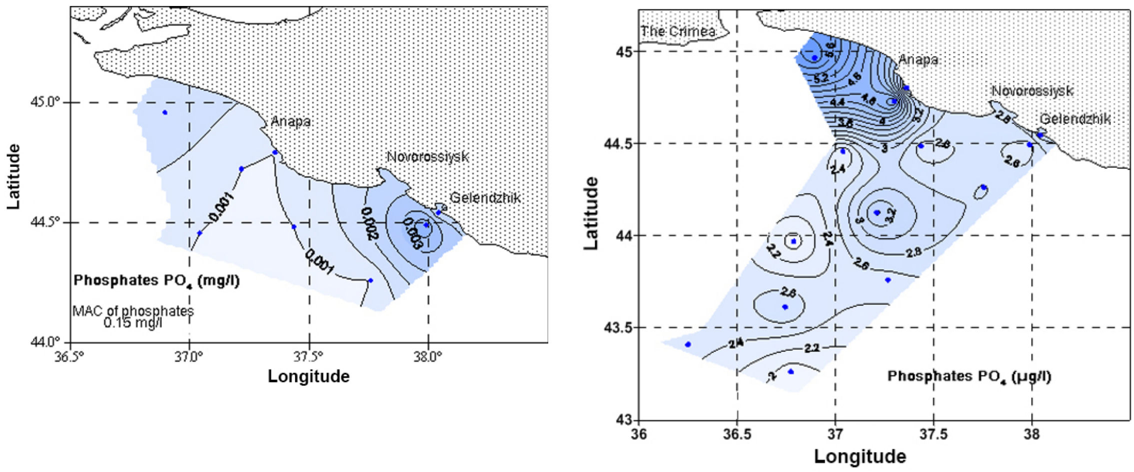
In autumn 2010, phosphate in the surface waters ranged up to 0.004 mg/L with an average value of 0.001 mg/L (Ref. 7.1). Concentrations were highest near Gelendzhik (Figure 7.22). Maximum phosphate concentrations of about 0.2 mg/L were observed at the depth where hydrogen sulphide begins to appear.

In spring 2011, phosphate concentrations in the surface waters ranged from 0.002 to 0.005 mg/L, being highest in the northwest of the Marine Survey Area (Figure 7.22). Phosphate concentrations increase with depth, reaching 0.25 to 0.27 mg/L at 2,000 m.

In summer 2011, the measured phosphate concentration in the coastal waters was 8 mg/L (Ref. 7.1).

Phosphate content in the surface waters of the nearshore and offshore sections of the Marine Survey Area do not typically exceed the MAC for fisheries (0.15 mg/L) (Ref. 7.16).

Figure 7.22 Spatial Distribution of Phosphate Concentrations in Surface Waters (Ref. 7.1)



a) Autumn 2010

b) Spring 2011

Total and Organic Phosphorus

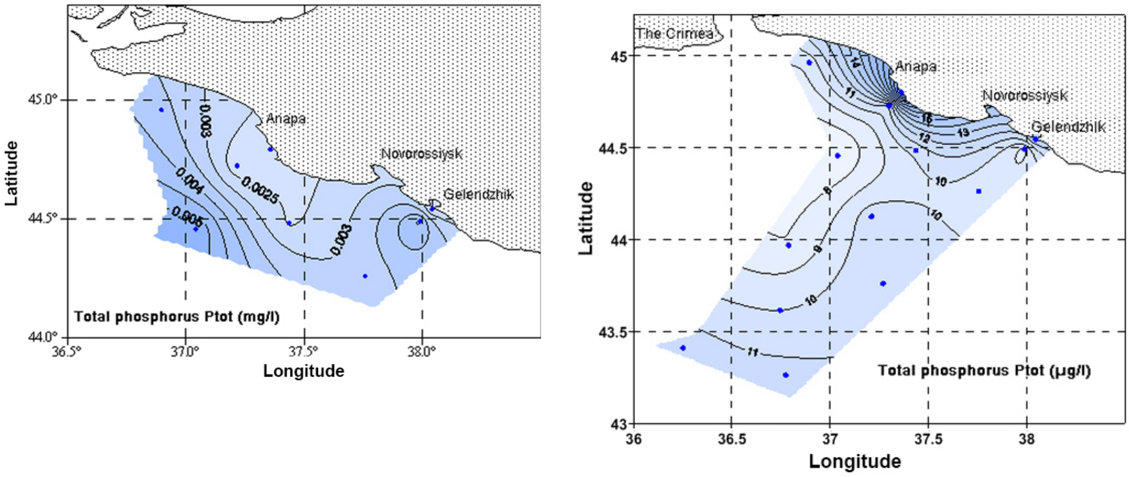
There is limited information available regarding total and organic phosphorus concentrations in the Black Sea.

Concentrations of total phosphorus in the surface waters of the Black Sea are typically 8 to 10 µg/L. Concentrations are usually highest near the coast as the main source of total phosphorus in the surface waters are coastal flows. Concentrations rise at the pycnocline to around 200 µg/L. Organic phosphorus concentrations are also relatively low in the surface waters. The spatial patterns in organic phosphorus concentrations are typically generally similar to those observed for total phosphorus.

In autumn 2010, total phosphorus concentrations in the surface waters ranged from 2 to 6 µg/L being 3 µg/L on average. Concentrations were higher near Gelendzhik and in the seaward part of the surface area (Figure 7.23).

In Spring 2011, total phosphorus concentrations in the surface waters varied from 8 to 10 µg/L in the MBSC to around 20 µg/L near the coast (Figure 7.23).

Figure 7.23 Spatial Distribution of Total Phosphorus Concentrations in Surface Waters (Ref. 7.1)



a) Autumn 2010 b) Spring 2011

7.4.5.9 Nitrogen Compounds

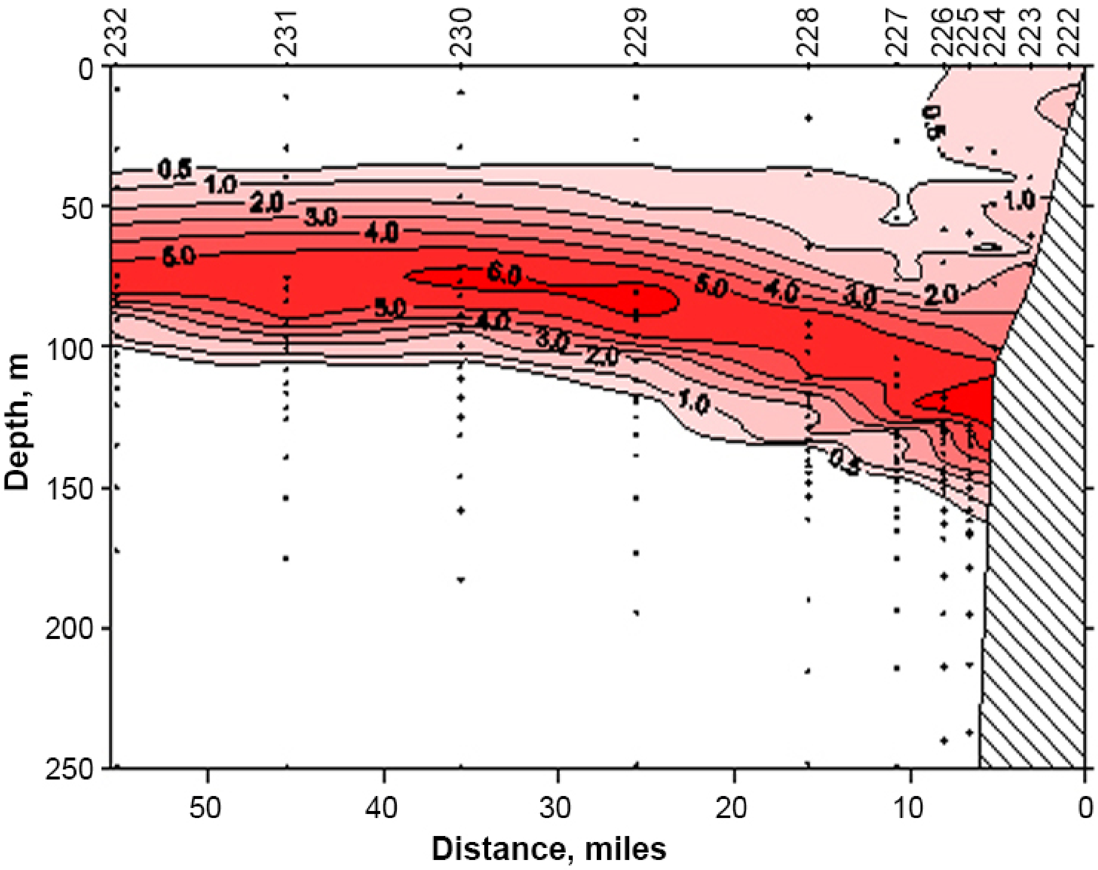
In sea water, nitrogen is represented by inorganic (nitrate, nitrite, ammonium salts) and organic (humic and fulvic acids, proteins, amino acids, amines etc.) compounds. Nitrogen distribution is an important controlling factor in biological productivity.

Nitrate

Nitrates are predominantly present at around 50 to 150 m depth within the transition zone between aerobic and anaerobic conditions (Figure 7.24). Typical concentrations in this zone are around 0.1 to 0.2 mg/L. Nitrate concentrations are very low in the surface waters above 50 m, being typically 0.028 to 0.12 mg/L. Nitrate is absent at depth in the deeper anaerobic (H_2S) zone.

Nitrate concentrations vary seasonally, reflecting variations in biological activity. Nitrate concentrations are highest in winter, dropping markedly with the spring phytoplankton bloom before rising slightly in summer. There is a secondary drop in autumn reflecting increased phytoplankton activity. The seasonal variation is more marked at shallow depths.

Figure 7.24 Distribution of Nitrate Concentrations (µM) with Depth and Distance from Shore based on Archival Data (Ref. 7.1)



In autumn 2010, nitrate concentrations in the surface waters ranged from 0.003 to 0.014 mg/L. Concentrations were highest in the north-west part of the Marine Survey Area (Figure 7.25). Concentrations rose to between 0.035 and 0.045 mg/L at 60 to 70 m depth.

In spring 2011, nitrate concentrations in the surface waters were highest near the coast, typically around 0.01 to 0.02 mg/L, but were very low (below 0.002 mg/L) further out to sea (Figure 7.25). Concentrations rose to between 0.05 and 0.06 mg/L at 50 to 60 m.

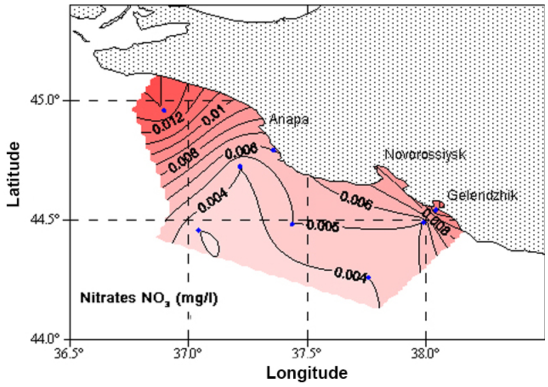
Nitrate content in the surface waters of the nearshore and offshore sections of the Marine Survey Area did not usually exceed the MAC for fisheries (Ref. 7.16).

Nitrite

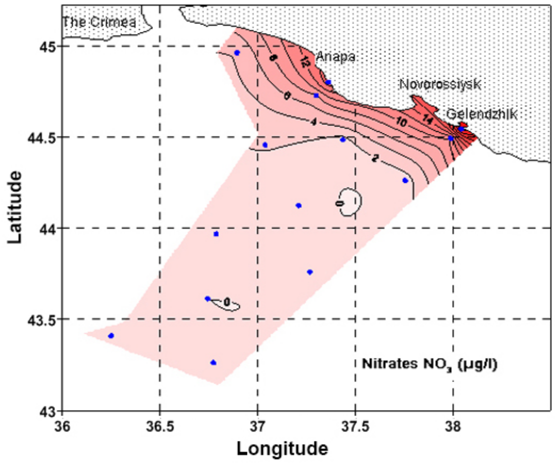
Nitrite is present in the marine surface waters, being relatively evenly distributed to the thermocline in summer and winter but depleted at the surface during the spring and autumn phytoplankton blooms. Nitrite concentrations in the surface waters typically range from 1.5 to 4.5 µg/L but are 6 to 8 µg/L at around 50 to 75 m depth. Nitrites are absent in the deeper anaerobic (H_2S) zone.

In autumn 2010, nitrite concentrations in the surface waters were up to 6 µg/L. In spring 2011, nitrate concentrations in the surface waters were up to 5 µg/L, being higher near the coast. The maximum concentration was observed in the Anapa area. Nitrite content in the nearshore and offshore sections of the Marine Survey Area did not exceed the MAC of 80 µg/L for fisheries (Ref. 7.16).

Figure 7.25 Spatial Distribution of Nitrate Concentrations in Surface Waters (Ref. 7.1)



a) Autumn 2010



b) Spring 2011

Ammonium Nitrogen

Ammonium nitrogen concentrations are low in the aerobic surface waters, with concentrations of 0.002 to 0.036 mg/L. In the anaerobic zone, concentrations rise with depth up to 1.8 mg/L at 2,000 m. The seasonal patterns in ammonium nitrogen mirror those of nitrate, reflecting the influence of phytoplankton activity.

In autumn 2010, ammonium nitrogen concentrations in the surface waters ranged from 0.009 to 0.025 mg/L with an average value of 0.011 mg/L. The maximum concentration was recorded near Gelendzhik.

In spring 2011, ammonium nitrogen concentrations in the surface waters showed a similar pattern to nitrate, being highest (typically around 0.015 to 0.025 mg/L) near the coast in the vicinity of Gelendzhik and Anapa. In the seaward part of the Marine Survey Area, concentrations were lower, ranging from 0.005 to 0.010 mg/L. Ammonium nitrogen concentrations were highest at depth, being 0.20 to 0.35 mg/L in deep waters.

Ammonium nitrogen content in the nearshore and offshore sections of the Marine Survey Area did not exceed the MAC of 2.9 mg/L for fisheries (Ref. 7.16).

Total and Organic Nitrogen

There is limited information available regarding total and organic nitrogen concentrations in the Black Sea. Literature values indicate that total nitrogen concentrations in the Russian sector of the Black Sea range from 89.6 to 681 µg/L with an average value of 263 µg/L in the open seas. Organic nitrogen concentrations range from 76 to 669 µg/L with an average value of 243 µg/L. The total nitrogen predominantly comprises organic nitrogen.

In autumn 2010, total nitrogen concentrations ranged from 0.05 to 1.32 mg/L with an average value of 0.14 mg/L. The majority of the total nitrogen was organic nitrogen. Organic nitrogen concentrations were 0.015 to 1.066 mg/L with an average value of 0.114 mg/L. Concentrations were highest in the northwest of the Marine Survey Area.

In spring 2011, total nitrogen concentrations in surface waters were typically 0.2 to 0.25 mg/L but were up to 0.4 mg/L in the northwest of the Marine Survey Area. Concentrations increased with depth, being 1.4 to 1.5 mg/L at 2,000 m depth. Organic nitrogen concentrations were typically 0.2 mg/L but were over 0.3 mg/L in the northwest and east of the Marine Survey Area. Concentrations increased with depth up to 1.33 mg/L at 2,000 m depth.

7.4.5.10 Sea Water Contamination

Previous surveys in the Russian Sector of the Black Sea have identified the presence of contaminants in the sea water, including several organochlorine pesticides, petroleum hydrocarbons, phenols, and anionic surfactants. Additionally, elevated concentrations of heavy metals were locally detected, including copper, cadmium, lead, mercury and zinc. Contaminant concentrations varied spatially, but were typically higher near the coast (Ref. 7.1, 7.3).

Additional marine surveys (Ref. 7.1) were undertaken within the Marine Survey Area in 2010 and 2011 to further assess recent water quality in the nearshore and offshore areas. The results are summarised in Table 7.20 and 7.21. The sampling locations are shown in Figure 7.3.

Table 7.20 Summary of Contaminants in Sea Water for Autumn (Ref. 7.1)

Parameter	Unit	MPC	Range	No. Detects
Oil Products	mg/L	0.05	0.006 – 0.18	6
Anionic Surfactants	mg/L	0.1	<0.025 – 0.043	7
Phenols	µg/L	1	<0.1 – 6.1	11
Organochlorine Pesticides	µg/L	0.01	<DL1	0
Arsenic	µg/L	10	0.43 – 3.26	23
Cadmium	µg/L	10	0.8 – 3.4	23
Chromium	mg/L	0.07	0.007 – 0.027	23
Copper	µg/L	5	1.7 – 10	23
Iron	mg/L	0.05	<0.02 – 0.072	8
Lead	µg/L	10	<2 – 15.6	19
Manganese	mg/L	0.05	<0.01 – 0.224	14
Mercury	µg/L	0.1	<0.016 – 0.03	2
Molybdenum	µg/L	1	<1 - 4	21
Nickel	µg/L	10	<5 – 5.1	1
Selenium	µg/L	2	<0.1	0
Zinc	µg/L	50	<0.2 – 39	18

Note –
1. The detection limit for the organochlorine pesticides varied between compounds:
α-hexachlorocyclohexane <0.0004 µg/L,
β-hexachlorocyclohexane <0.002 µg/L,
γ-hexachlorocyclohexane <0.0005 µg/L,
heptachlor <0.002 µg/L,
aldrin <0.01 µg/L,
4,4-dichlorodiphenyltrichloroethane (DDT) <0.003 µg/L,
4,4-dichlorodiphenyldichloroethylene (DDE) <0.002 µg/L,
4,4-dichlorodiphenyldichloroethane (DDD) <0.003 µg/L.
2. Background concentrations of some heavy metals (e.g. iron, manganese) in sea water in the deeper anaerobic waters would be anticipated to be higher than in the aerobic surface waters due to redox processes. For some heavy metals it is considered that exceedance of MACs set for fisheries is more significant in the surface waters than exceedance at depth in the anaerobic hydrosulphuric zone. Therefore, only MAC exceedances in the surface waters are presented in the above table; there may be additional exceedances in the deeper waters.

Table 7.21 Summary of Contaminants in Sea Water for Spring 2011 (Ref. 7.1)

Parameter	Unit	MPC	Range	No. Detects
Oil Products	mg/L	0.05	<0.004 – 0.03	9
Anionic Surfactants	mg/L	0.1	<0.025 – 0.113	8
Phenols	µg/L	1	<0.5 – 0.8	3
Organochlorine Pesticides	µg/L	0.01	<DL	0
Arsenic	µg/L	10	<0.5 - 1	13
Cadmium	µg/L	10	<5– 6.6	1
Chromium	mg/L	0.07	<0.02 – 0.042	27
Copper	µg/L	5	2.1 – 10	45
Iron	mg/L	0.05	<0.02 – 0.093	6
Lead	µg/L	10	18.3 – 37.9	45
Manganese	mg/L	0.05	<0.01 – 0.204	19
Mercury	µg/L	0.1	<0.016 – 0.06	19
Molybdenum	µg/L	1	<1 – 5	26
Nickel	µg/L	10	<5 – 5.2	2
Selenium	µg/L	2	<0.5 – 1.87	4
Zinc	µg/L	50	0.06 – 8	45

Note –
1. The detection limit for the organochlorine pesticides varied between compounds:
α-hexachlorocyclohexane <0.0004 µg/L,
β-hexachlorocyclohexane <0.002 µg/L,
γ-hexachlorocyclohexane <0.0005 µg/L,
heptachlor <0.002 µg/L,
aldrin <0.01 µg/L,
4,4-dichlorodiphenyltrichloroethane (DDT) <0.003 µg/L,
4,4-dichlorodiphenyldichloroethylene (DDE) <0.002 µg/L,
4,4-dichlorodiphenyldichloroethane (DDD) <0.003 µg/L.
2. Background concentrations of some heavy metals (e.g. iron, manganese) in sea water in the deeper anaerobic waters would be anticipated to be higher than in the aerobic surface waters due to redox processes. For some heavy metals it is considered that exceedance of MACs set for fisheries is more significant in the surface waters than exceedance at depth in the anaerobic hydrosulphuric zone. Therefore, only MAC exceedances in the surface waters are presented in the above table; there may be additional exceedances in the deeper waters.

Oil products were present in the majority of samples but have been detected at concentrations above MAC in only three samples in autumn 2010. Concentrations were highest near Gelendzhik (Figure 7.26). Oil products were detected but did not exceed the MAC in the coastal sample collected in summer 2011.

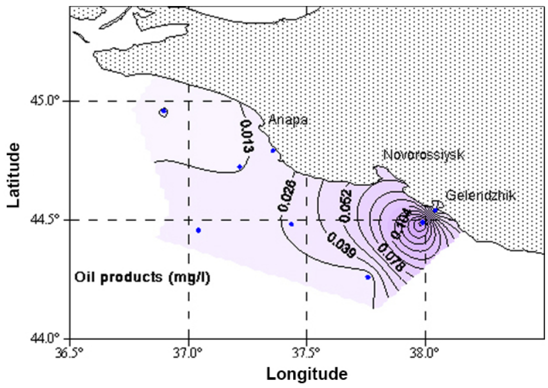
Anionic surfactants have been detected in the majority of the water samples. The only sample that exceeded the MAC for anionic surfactants was Station 14 at 1,000 m depth. Concentrations in the surface waters were generally low.

Phenols were detected in about half the water samples in 2010 but in a smaller proportion of samples in 2011. Concentrations were highest near Gelendzhik.

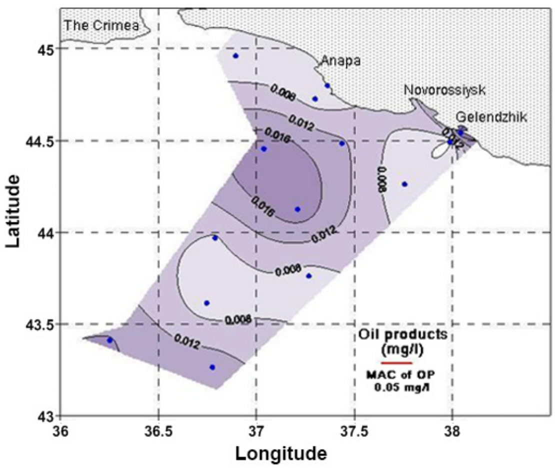
The single exceedance of the MAC for manganese in the surface waters was in a coastal station near Anapa. Manganese concentrations in the surface waters generally decreased with distance from the coast. Concentrations were higher, locally exceeding the MAC, at depth in the deep water area but this is likely to be due to natural processes. Iron exhibited a similar pattern.

Chromium concentrations were below MAC. Concentrations were highest near the coast and the in the seaward cyclonic rise; concentrations were lowest in the MBSC.

Figure 7.26 Spatial Distribution of Oil Product Concentrations in Surface Waters (Ref. 7.1)



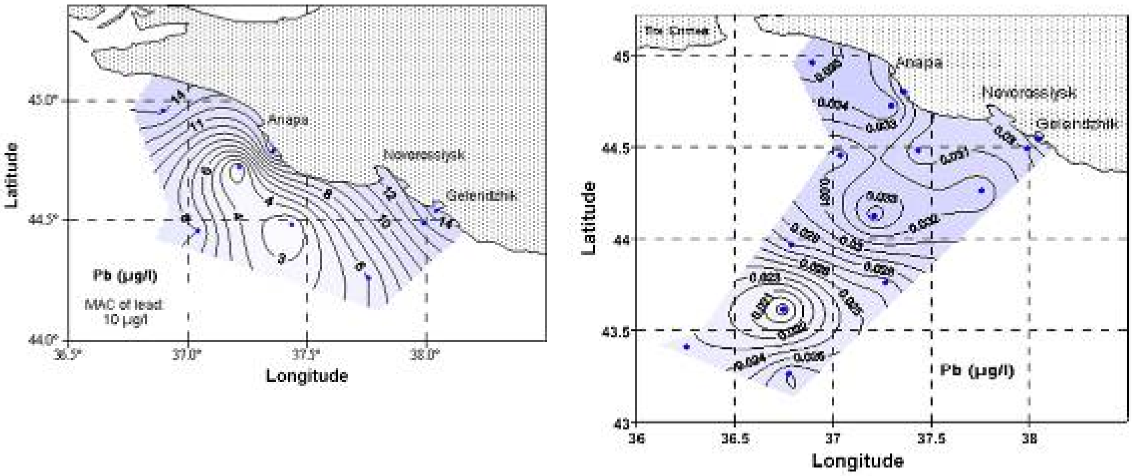
a) Autumn 2010



b) Spring 2011

Lead concentrations exceeded the MAC value in a significant proportion of the samples, including surface waters. Lead concentrations were typically highest near the coast (Figure 7.27). Lead concentrations on average are at or slightly above the MAC value.

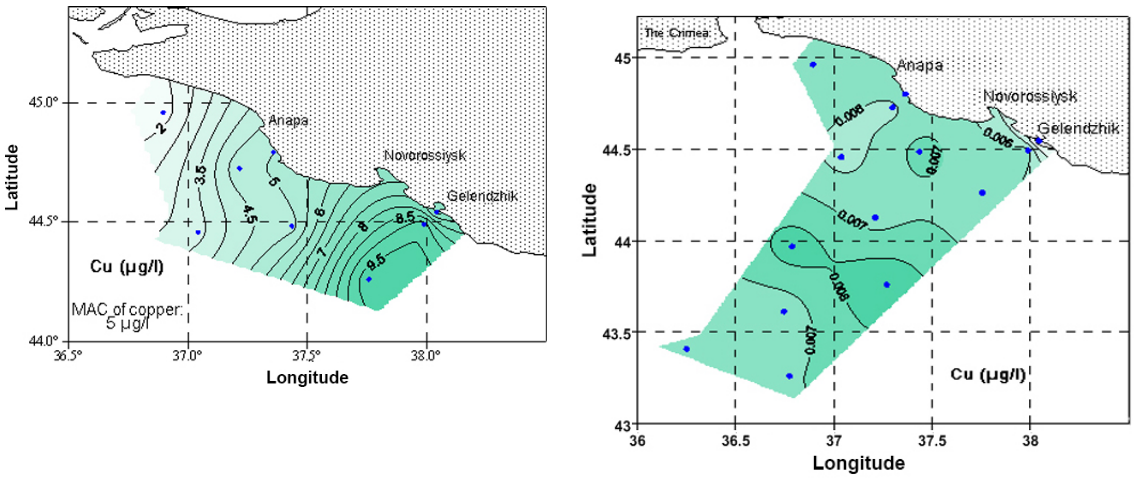
Figure 7.27 Spatial Distribution of Lead Concentrations in Surface Waters (Ref. 7.1)



a) Autumn 2010 b) Spring 2011

Copper concentrations exceeded the MAC value in a large proportion of the samples, including surface waters. Copper concentrations on average are at or slightly above the MAC value. Concentrations are highest in the southeast of the Marine Survey Area (Figure 7.28). Generally the measured copper concentrations are similar to reported background concentrations in the Black Sea. Zinc concentrations were all below the MAC value but showed a similar distribution pattern to copper in the surface waters.

Figure 7.28 Spatial Distribution of Copper Concentrations in Surface Waters (Ref. 7.1)



a) Autumn 2010 b) Spring 2011

Cadmium concentrations did not exceed the fisheries MAC and were in line with background concentrations in the Black Sea. Mercury concentrations did not exceed the fisheries MAC; concentrations were highest near the coast and in the area of cyclonic rise in the seaward area.

Nickel did not exceed the fishery MAC values in the autumn 2010 or spring 2011 surveys with concentrations typically being below detection limits except near the coast. However, in summer 2011, the concentration was 13.7 µg/L in the coastal sample, exceeding the MPC.

Concentrations of molybdenum were typically at or just above the MAC value. Concentrations were highest in the south and near Anapa. Generally the measured molybdenum concentrations were reported to be similar to background concentrations in the Black Sea.

Bacteriological testing was undertaken on two coastal samples collected in summer 2011. The results are consistent with relatively low levels of faecal contamination. Based on the limited testing, the waters meet the microbiological requirements of SanPiN 2.1.5.2582-10 (Ref. 7.17).

The eastern part of the Black Sea is less affected by eutrophication (increase in nutrients into the aquatic system) than the west due to the absence of major riverine inputs (Ref. 7.3).

The offshore Russian waters do not show evidence of significant pollution. Although some exceedances of fishery MACs by metals were measured, the majority of these can be attributed to natural background concentrations taking into account the natural chemical processes of the Black Sea. The coastal waters, particularly near Gelendzhik and Anapa, have elevated concentrations of contaminants present, including oil products, anionic surfactants, phenols and metals such as lead. Sources of contamination are likely to include port activities, runoff and discharges.

7.5 Geophysical Environment

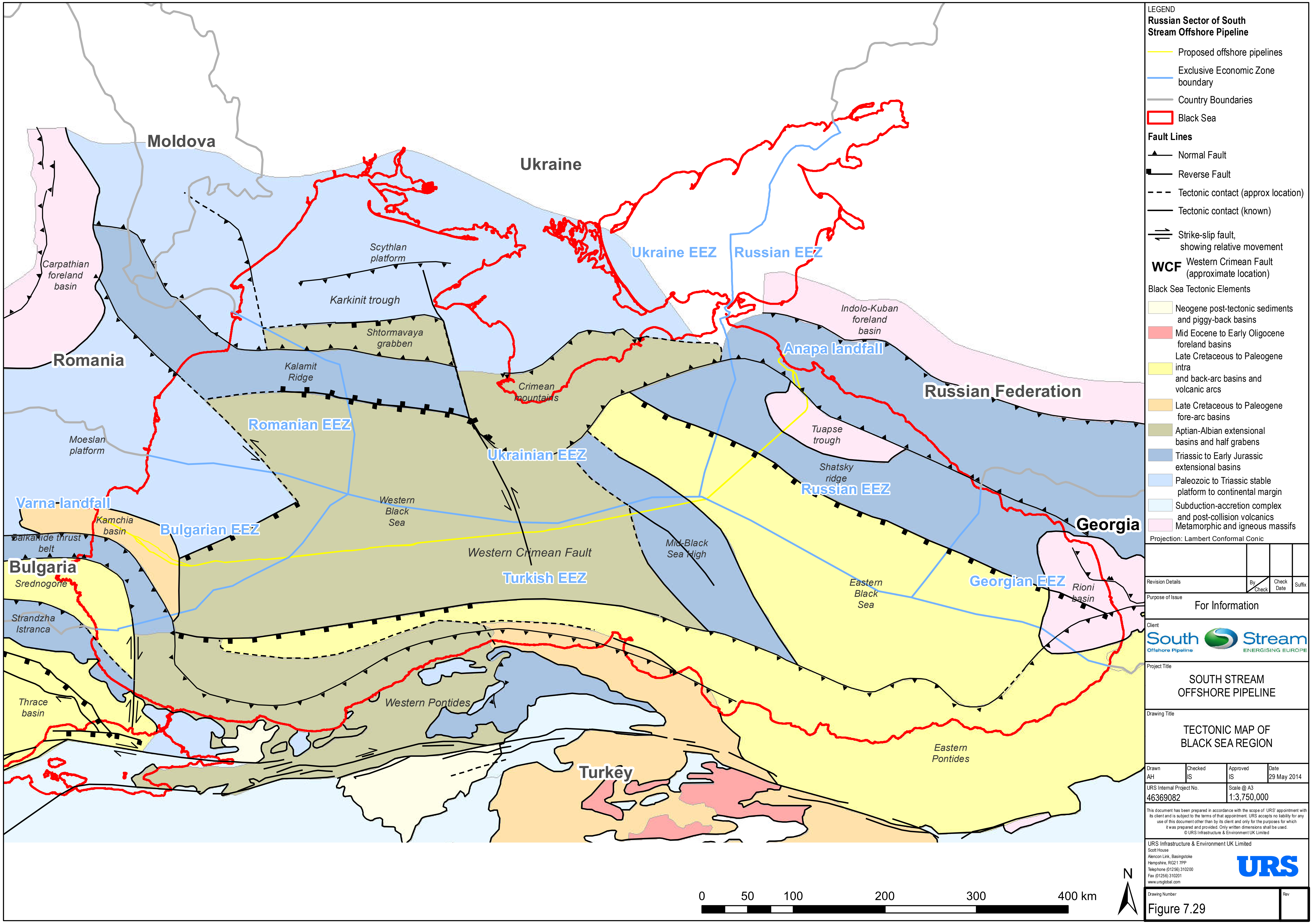
7.5.1 Tectonic Setting and Geology

7.5.1.1 Tectonic Setting

The tectonic setting of the eastern Black Sea region is presented in Figure 7.29.

The Black Sea is a back-arc marginal extensional basin, which originated from the northward subduction of the Tethys Ocean beneath the southern margin of the Eurasian plate (Ref. 7.1).

The present day Black Sea basin was formed by the joining of two extensional basins, the Western Black Sea basin and the Eastern Black Sea basin, which have different tectonic histories and are different ages. The two basins are separated by the Mid-Black Sea high (Andrusov ridge and Archangelsky ridge). Further compressional tectonic processes led to the subsequent subsidence of the region (including western basin, eastern basin and separating ridge) to form the present day Black Sea basin (Ref. 7.1).



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File Name: I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 7 Geology\Figure 7-29 Tectonic Map of Black Sea Region.mxd

The Greater Caucasus is part of the Alpine-Himalayan orogenic system and is located between the Eurasian plate to the north and the African-Arabian plates to the south.

Global plate models and space geodetic measurements indicate that in the surrounding region, northward moving African and the Arabian plates collided with the Eurasian plate. From this collision, the Anatolian micro-plate moves westward with a rotation pole located approximately in the north of the Sinai Peninsula.

The Terrestrial Study Area is located in foothills, between the Greater Caucasus Main Range mountains and the Azov-Kuban lowland. Tectonically, the Terrestrial Study Area is part of the Greater Caucasus thrust belt, which extends east from the edge of the Tuapse trough (located in the Black Sea) inland to Indolo-Kuban foreland basin (Ref. 7.20). The north-western part of the Greater Caucasus' fold belt is a ridge composed of Mesozoic and Palaeogenic rocks. The landscape has been developed through the erosion of the mountain range following tectonic faulting and folding during the Neogene, approximately 23 to 2.6 million years ago (Ref. 7.1).

The Marine Study Area is located in the Eastern Black Sea Basin.

The south-western flank of the Greater Caucasus thrust belt extends along the narrow shelf and upper part of the Black Sea's continental shelf. Towards the north-west from Anapa, the Mesozoic and Palaeogenic rocks plunge sharply beneath the Oligocene to Quaternary sediments of the Kerch Strait.

The Tuapse depression (also known as the Tuapse Basin) was formed in the Oligocene by subduction beneath the Greater Caucasus. The depression is about 60 to 70 km wide, and is oriented northwest to southeast roughly parallel to the shore. The depression has a sharply asymmetric geometry, with a steep north-east slope and a gentle south-west slope.

The Shatsky Ridge is a massive raised crustal block that forms the north-eastern edge of the deep-water Eastern Black Sea depression. The Shatsky Ridge is oriented northwest to southeast and has very steep south-western and north-eastern slopes. The upper part of the elevation is covered by post-Maikopean deposits.

The Eastern Black Sea depression is the deepest part of the Marine Study Area. It is characterised by thick sedimentary sequences of Palaeogene and Holocene age. These sediments are underlain by Eocene chalk deposits over basement strata.

7.5.1.2 Terrestrial Geology

The underlying bedrock geology within the Terrestrial Study Area is characterised by terrigenous and carbonate Miocene and Pliocene rocks, including argillites and clays, conglomerates, limestones, dolomites, marls and sandstones (Ref. 7.1). Based on the geotechnical investigations, the majority of the near-surface strata in the Terrestrial Survey Area comprise marls interbedded with sandstone, limestones and clays (Ref. 7.21). These strata are more than 25 m thick in the Terrestrial Survey Area. The Miocene and Pliocene strata are underlain by folded Palaeozoic structures and Jurassic and Cretaceous monoclines. A map of the regional geology at the Study Area is presented in Figure 7.30.

The bedrock is exposed at the coast and locally in the valleys. The bedrock deposits are well to medium bedded (Ref. 7.22). The marl beds are up to 2 m thick. In the upper 5 m near the surface, the bedrock is weathered and has a low rock mass rating. At depth, the bedrock has a low to medium rock mass rating, with considerable lateral and vertical variation. At the shore, the bedrock bedding dips steeply towards the sea. The coastal ridge comprises an anticlinal structure; the folding is disrupted locally by faulting.

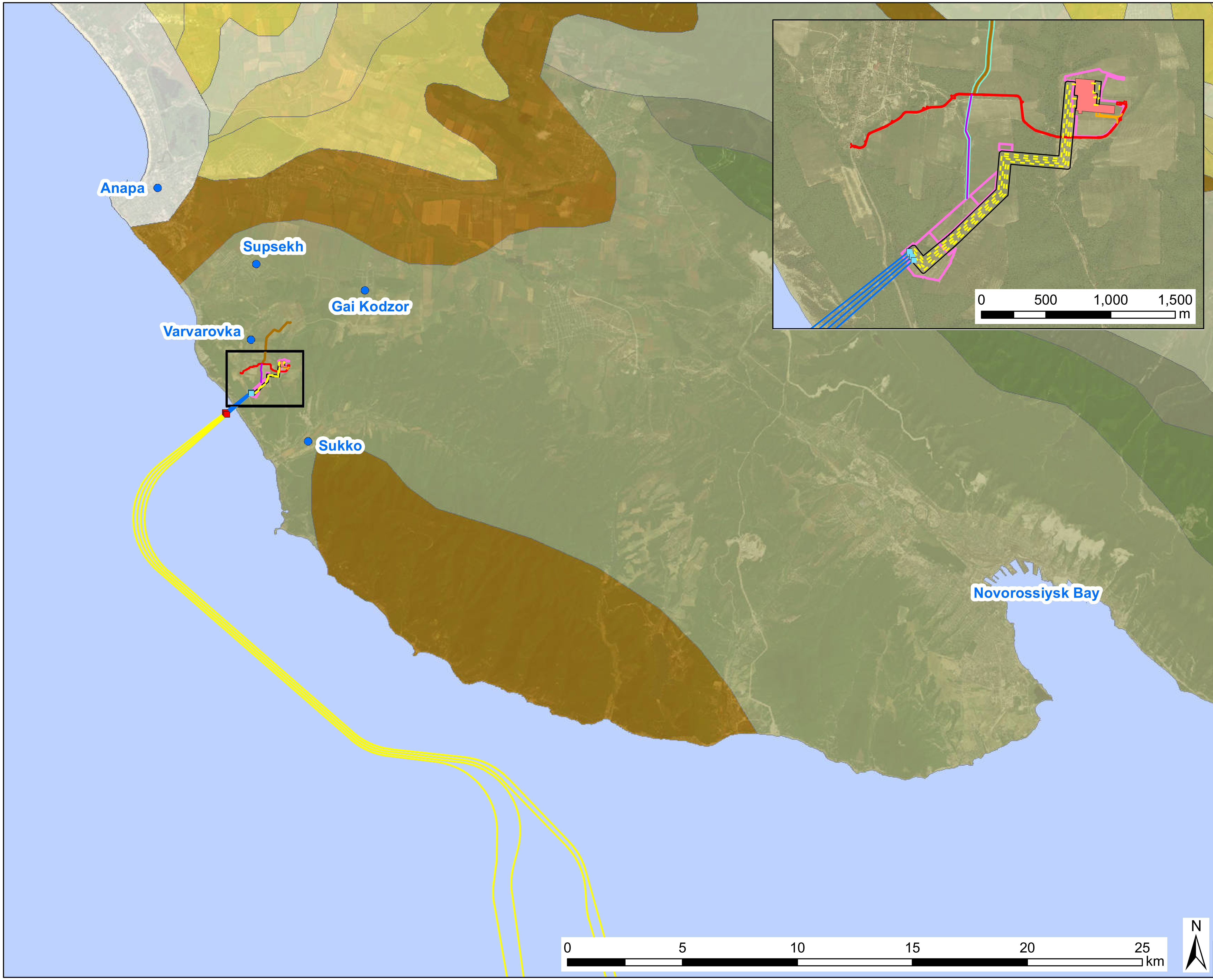
The bedrock deposits are overlain by a mantle of unconsolidated Quaternary deposits of variable thickness.

Overlying Quaternary deposits include a mantle of unconsolidated alluvial, colluvial, eluvial, fluvial, diluvial and coastal marine sediments of variable thickness ranging from a few metres to tens of metres. The general characteristics of Quaternary deposits encountered in the Terrestrial Survey Area are described below (Ref. 7.1):

- Alluvial deposits – Loose, unconsolidated (un-cemented) sediments, which have been eroded and/or reshaped by water and redeposited on land down gradient of their origin. Alluvial deposits are typically 1 to 5 m thick. Deposits are distributed along valley floors and are variable in composition (comprising sandy clay, limestones, marls and/or fragments of other types of weathered bedrock);
- Colluvial deposits – Loose unconsolidated variable sized sediments, ranging from silt to rock sized fragments. Deposits are typically located at the base of hill slopes, as a result of erosion and deposition by rain wash, sheetwash and/or slow downslope creep of sediments;
- Eluvial deposits – Soils derived from either the in-situ weathering of underlying bedrock or the weathering of bedrock combined with limited movement or accumulation of the soils due to gravitational creep on gently inclined slopes;
- Fluvial deposits – Fluvial soils are typically located on alluvial floodplains, river fans and valleys. They form on alluvial sediments and can be mixed in with flood surge deposits. Deposits include loam, silts and sandy clays to clayey sands;
- Diluvial (flood) deposits – Encountered mainly on the slopes of hills and at the base of coastal cliffs. Deposits comprise loose accumulation of angular rock fragments in a matrix of clay and sand, and typically range between 1 to 5 m thick; and
- Coastal Marine Sediments – Includes sandy beaches, and sand, gravel and boulders.

Soils are typically formed through the erosion and re-deposition of underlying bedrock deposits. The predominant soil forming bedrock material is weathered marl. Soils covering higher slopes and ridges are typically formed by the weathering or re-deposition of calcareous argillites and interbedded sandstones and siltstones. Soils encountered within river valley systems typically form from weathered calcareous marls, interbedded limestones, siltstones and shales. Deposits in the valley bottoms comprise variable gravel and sand deposits with occasional layers of clays and loam material interbedded in the coarser-grained material (Ref. 7.23).

The characteristics and distribution of soils across the Terrestrial Survey Area are described in further detail in **Chapter 8 Soils, Groundwater and Surface Water**.



LEGEND

Russian Settlements

Geology

- Middle-quaternary deposits
- Pliocene deposits
- Akchagly stage deposits
- Cimmerian stage deposits
- Upper Miocene and Lower Pliocene deposits
- Oligocene and Miocene deposits
- Lower section (Polenian section of Volga) deposits
- Cenomanian, Turonian stage and Senonian stage deposits
- Senonian (Konyanian, Santonian, Campanianand Maastrichtian) stage deposits
- Turonian stage deposits
- Aptian and Albian stage deposits

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Landfall facilities
- Proposed microtunnels
- Proposed offshore pipelines
- Right-of-Way
- Microtunnel exit pit
- Microtunnel entry shaft
- Temporary construction area for road construction
- Construction sites

Roads

- Permanent access road to be constructed by SSTTBV
- Temporary access road constructed by SSTTBV
- Varvarovka bypass road (used by Project during construction only)
- Permanent access road to be constructed by Gazprom Invest

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue

For Information

Client

South Stream Offshore Pipeline — Stream ENERGISING EUROPE

Project Title

SOUTH STREAM
OFFSHORE PIPELINE

Drawing Title

GEOLOGICAL MAP OF THE LANDFALL SECTION OF THE PROJECT AREA

Drawn	Checked	Approved	Date
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URS Internal Project No.	Scale @ A3
46369082	1:150,000

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Drawing Number	Rev
Figure 7.30	

Plot Date: 19 Mar 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 7 Geology\Figure 7-30 Geological Map of the Landfall Section of the Project Area.mxd

7.5.1.3 Marine Geology

The geology in the nearshore and offshore sections of the Marine Study Area comprise both Upper Cretaceous and Palaeogene Flysch deposits. Upper Cretaceous flysch deposits comprise coarsely stratified bituminous marls inter-bedded with the bands of quartz-glauconite sandstones. The uppermost sequence of Cretaceous flysch deposits are typically dark clays, separated by sandstones and dense dark marls. Palaeogene flysch deposits comprise dense clays, dark coloured hard metamorphosed marls with some inter-bedded sandstone bands.

During the Neogene stage of Alpine orogeny the flysch deposits of both the Upper Cretaceous and Palaeogene were subject to intensive deformation and folding associated with this period of thrusting and faulting.

The marine sediments that overlie the bedrock vary in thickness from absent to several metres thick. The marine sediments are discussed further in Section 7.5.5.

7.5.2 Seismicity and Geohazards

The tectonic structure of the Black Sea basin is complex and the collision zone between the African and Eurasian plates, as well as movement around the various microplates, has created a zone which is prone to earthquakes. Significant earthquakes have affected several countries, including Russia, on the eastern side of the Black Sea tectonic basin.

The Greater Caucasus is a zone with active compression where thrust and strike-slip faulting associated with on-going earthquake activity has continued to the present time (Ref. 7.25). A seismically active zone is known in the Anapa region where the Crimean and Caucasus structures meet. This is manifested as a seismic belt from the southern foot of the Crimea to the Anapa region. In 1966, the Anapa earthquake (magnitude 5.8) occurred in this belt.

Seismic activity in the region typically has a potential to cause earthquakes of magnitude 5 to 6 on the Richter Scale (Ref. 7.1). Recent earthquakes in the area include a 4.9 magnitude earthquake centred in Varenikovskaya (located approximately 32 km northeast of Anapa) in 2012 and a 4.4 magnitude earthquake centred at Anapa in 2011.

Seismic studies (Ref. 7.5, 7.29, 7.30, 7.31, 7.32, 7.33, and 7.34) have been undertaken along the Pipeline route.

The Pipeline route crosses the southern branch of the Marfovsky Fault (Figure 7.31). This fault is active (Ref. 7.22). The fault is not a single lineament but instead comprises a fracture zone with northern and southern branches. The fault zone is approximately 200 m wide. The fault is well defined due to a distinct tectonic scarp. Current displacement values are estimated to be 0.2 m vertically and 1 m horizontally (Ref. 7.22). Slow (creep) fault displacement is estimated to be at a rate of 0.2 to 0.35 mm per year (Ref. 7.22).

As described in **Chapter 5 Project Description**, the fault will be crossed using traditional open-cut techniques. However, to minimise the effect of potential displacement from seismic activity, each pipeline will be laid in an enlarged trench backfilled with loose sand rather than the previously excavated soils. The combination of the wider trench and backfilling with loose sand allows the pipelines to move in a lateral direction. This reduces the risk of movement on the Marfovsky Fault affecting pipeline integrity.

The pipeline route also crosses the Shingarsky Fault (Figure 7.32). This fault was mapped using geophysical survey methods (Ref. 7.21). The Shingarsky Fault comprises a fracture zone up to 50 m wide of weak and weathered rock. Based on local geomorphology and the overlying superficial deposits, this fault is considered to be inactive (Ref. 7.5). The Shingar River is aligned with the Shingarsky Fault; the weathered fracture zone of the fault is likely to have allowed preferential erosion along the line of the fault during flood events. The microtunnel route crosses the Shingarsky Fault.

The West Utrish Fault is a large regional tectonic fault associated with the structural zoning of the North West Caucasus (Ref. 7.22). It is inferred to have an east-west strike. The West Utrish Fault has not been identified within the Project Area (Ref. 7.22); it is interpreted to be parallel to the coast (probably on seaward side) and to be inactive in the Project Area.

Additional fracture zones (interpreted to be potential faults) have also been interpreted (Ref. 7.22, 7.27) from the seismic survey data and geohazard mapping. These may reflect conjugate faulting or jointing associated with past activity of the Shingarsky Fault.

Four fissure zones have been mapped along the coastal ridge (Ref. 7.22); these are shown on Figure 7.31. The fissure zones are up to 80 m wide. The fissure zones have been preferentially weathered and have a topographical expression. The fissure zones may have formed through local tectonic or gravity-induced ground movements. These may relate to the deep-seated rotational failure planes mapped along the coast or to conjugate jointing associated with past activity of the Shingarsky Fault.

Although the abyssal plain is predominantly flat / to gently inclined, hill and ravine features are locally present. Hills are typically formed by mud volcano activity and may be 1 to 30 m high, with basal diameters of 600 to 1,000 m wide. Mud volcanoes are formed by the expulsion of mud, rock fragments and fluids (especially methane) from depth. Recent turbidite flows occur in the vicinity of the mud volcanoes. No large mud volcanoes have been identified along the Pipeline route (Ref. 7.36). Ravines are typically associated with tectonic faults, none of which are considered to be active (Ref. 7.28). The ravines are generally asymmetric in shape, with one relatively steep slope (typically 10 to 20 m deep) and one comparatively flatter slope; although some symmetrically shaped gently inclined ravines are also encountered. Ravines are typically between 500 to 1,000 m in length (minimum of 200 and maximum of 4,500 m).

Natural gas seepage associated with the degradation of organic rich material may be encountered on the abyssal plain. In addition, features associated with natural gas seepages include blow outs of shallow gas reservoirs and gas plumes (Ref. 7.1).

The Russian continental slope is currently tectonically active, with fault movement impacting slope stability, sediment distribution and earthquakes. Tectonic activity reduces away from the coast from the Caucasus Mountains to the Tuapse depression (Ref. 7.5).

The north eastern Black Sea seismic source zone is characterized by low to moderate seismicity with the majority of events having a magnitude lower than 5 (Ref. 7.26, 7.30). The largest event recorded occurred in 1905 with a magnitude of MW 6.6 and focal depth of 38 km. The epicentre was in the offshore Southern Black Sea at more than 300 km from the Anapa landfall. The event was associated with a tsunami.

No significant seismic events have been recorded within the Shatsky Ridge. Very rare earthquakes may be associated with small movements over rejuvenated faults penetrating the Quaternary layer. Faults occur in the Maikopean (Upper Palaeogene – Lower Neogene) clays on the shelf of the Kerch-Taman deflection and in the Tuapse deflection. These faults are associated with clay diapers and mud volcanoes. The faulting is predominantly oriented northwest-southeast.

Several of the earthquakes in the Black Sea region appear to have been associated with tsunami waves along the coast (Ref. 7.26).

Within the Marine Study Area, seismic studies (Ref. 7.5, 7.30, 7.31, 7.32, 7.33, 7.34, and 7.35) indicate that:

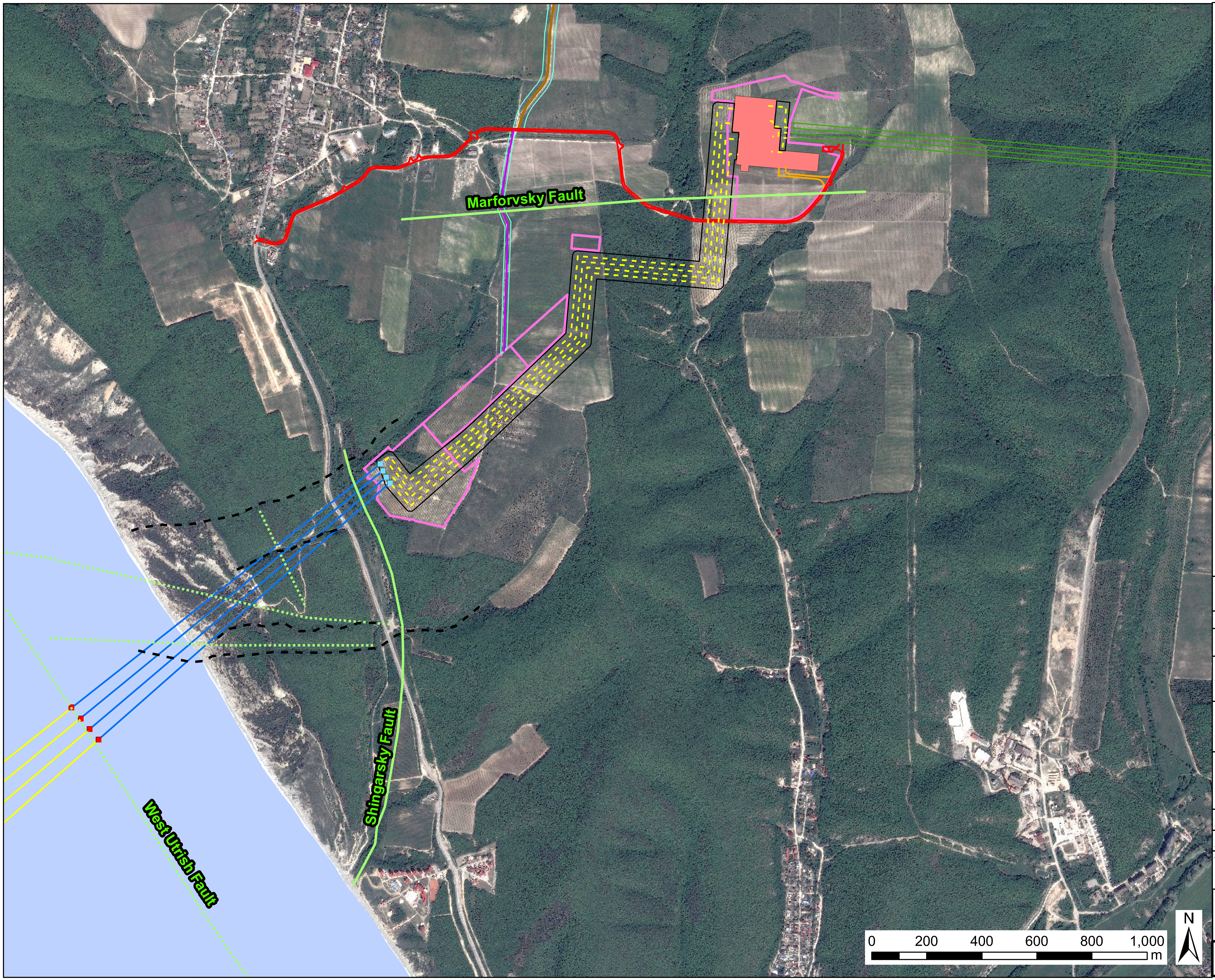
- Major active tectonic faulting does not cross the offshore pipeline route (Ref. 7.26, 7.30);
- Active faults were not observed on any of the sub-bottom profiles conducted along the pipeline routes (Ref. 7.29);
- No faults considered dangerous to pipeline integrity have been identified (Ref. 7.26) along the pipeline route in the marine Project Area;
- Sediment deformation associated with tectonic movement is most likely to impact very soft superficial clay deposits on the shelf and continental slopes; and
- Limited slope failure involving 2 to 3 m thick layers of sediment and movement of superficial sediments on the continental slope are anticipated as a result of an earthquake of with a return period of 1 in 475 years. Shallow failures of <2 to 3 m thick have been predicted for an earthquake of this recurrence period.

7.5.3 Terrestrial Geomorphology

The landscape and geomorphology of the Terrestrial Survey Area often dictates the vegetation cover. There are two distinct landscape terrains and associated vegetation cover:

- Plain (gently sloping plateau) and hilly terrain covered by a complex of arid woodlands; and
- Hilly submontane terrain, covered by mixed oak, pine, juniper forests and arid woodlands.

A map of the local geomorphology of the Terrestrial Survey Area is presented in Figure 7.32.



LEGEND

Indicative Fault and Fissure Lines

- Fault
- Possible Fault
- Fissure Zone

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Landfall facilities
- Proposed microtunnels
- Proposed offshore pipelines
- Right-of-Way
- Temporary construction area for road construction
- Construction sites
- Microtunnel entry shaft
- Microtunnel exit pit
- Permanent access road to be constructed by SSTTBV
- Temporary access road constructed by SSTTBV
- Varvarovka bypass road (used by Project during construction only)

United Gas Supply System

- United Gas Supply System pipelines
- Permanent access road to be constructed by Gazprom Invest

Projection: Lambert Conformal Conic

Revision Details	By Check	Check Date	Suffix

Purpose of Issue

For Information

Client

South Offshore Pipeline — South Stream ENERGISING EUROPE

Project Title

SOUTH STREAM OFFSHORE PIPELINE

Drawing Title

MAPPED FAULTS IN TERRESTRIAL LANDFALL SECTION

Drawn	Checked	Approved	Date
AH	IS	IS	04 Mar 2014

URS Internal Project No.	Scale @ A3
46369082	1:12,500

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Drawing Number: Figure 7.31

Rev

Plot Date: 04 Mar 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 7 Geology\Figure 7-31 Mapped Faults in Terrestrial Landfall Section.mxd

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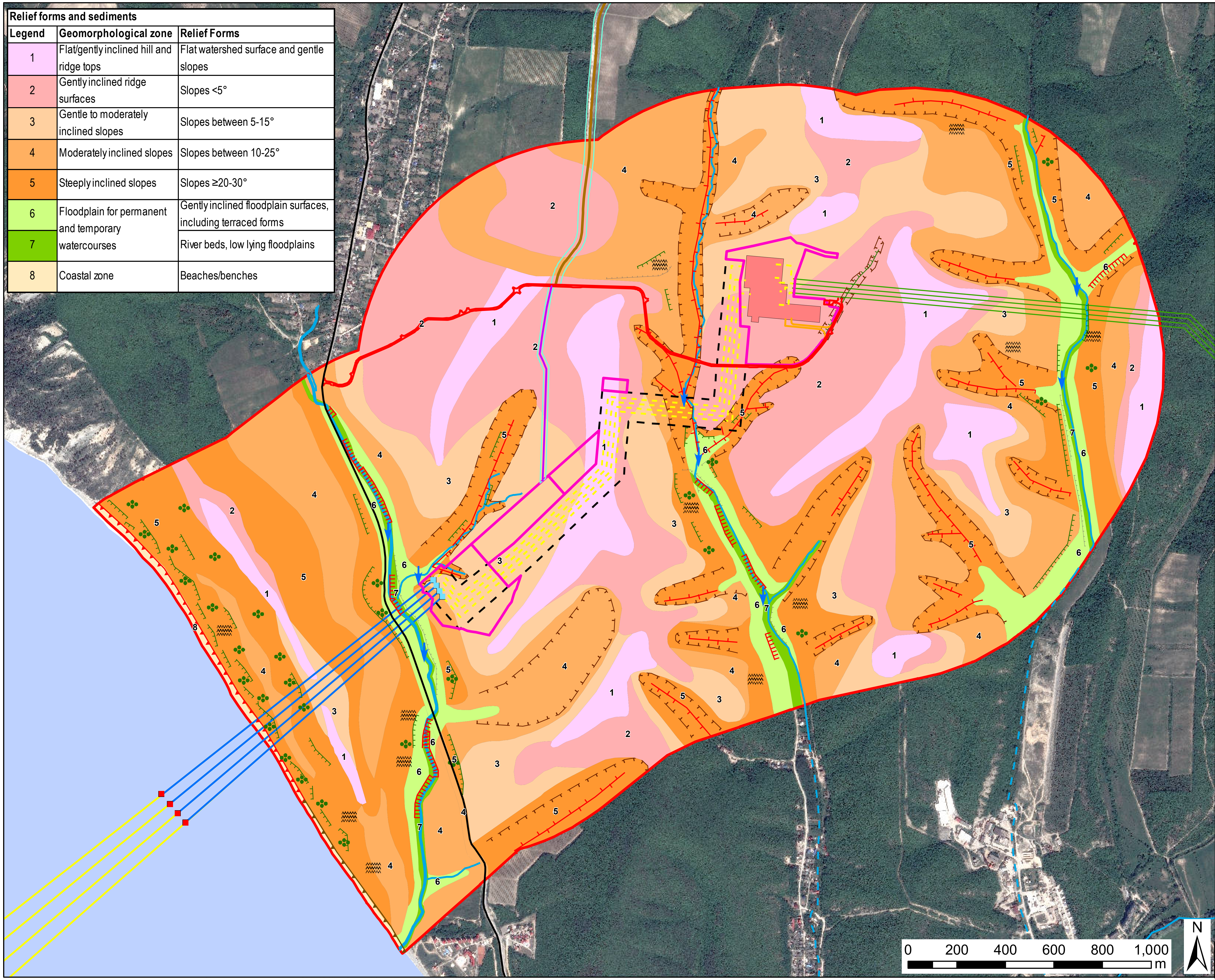

Relief forms and sediments		
Legend	**Geomorphological zone**	**Relief Forms**
1	Flat/gently inclined hill and ridge tops	Flat watershed surface and gentle slopes
2	Gently inclined ridge surfaces	Slopes <5°
3	Gentle to moderately inclined slopes	Slopes between 5-15°
4	Moderately inclined slopes	Slopes between 10-25°
5	Steeply inclined slopes	Slopes ≥20-30°
6	Floodplain for permanent and temporary watercourses	Gently inclined floodplain surfaces, including terraced forms
7		River beds, low lying floodplains
8	Coastal zone	Beaches/benches

LEGEND

Geomorphological features and associated geohazards

- Lateral Erosion of rivers and streams
- Gully (linear) erosion
- Abrasion of cemented sedimentary rocks
- Abrasion of unconsolidated sediments
- Landslides
- Mobile talus and rockfalls
- Mudflows

Other symbols

- Scarp
- Man-made mudflow mitigation measures (ditches, dams, water - diversion canals etc.)
- Edge of small erosion forms (gullies and hollows)
- Study Area
- Main roads
- Rivers
- Inferred watercourses

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Landfall facilities
- Proposed microtunnels
- Proposed offshore pipelines
- Construction corridor
- Temporary construction area for road construction
- Construction sites
- Microtunnel entry shaft
- Microtunnel exit pit
- Permanent access road to be constructed by SSTTBV
- Temporary access road constructed by SSTTBV
- Varvarovka bypass road (used by Project during construction only)

United Gas Supply System

- United Gas Supply System pipelines
- Permanent access road to be constructed by Gazprom Invest

Projection: Lambert Conformal Conic

Purpose of Issue
For Information

Client
South Stream Offshore Pipeline
Stream ENERGISING EUROPE

Project Title
SOUTH STREAM OFFSHORE PIPELINE

Drawing Title
GEOMORPHOLOGICAL MAP OF THE TERRESTRIAL SURVEY AREA

Drawn	Checked	Approved	Date
AH	IS	IS	04 Mar 2014

URS Internal Project No.	Scale @ A3
46369082	1:15,000

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Drawing Number
Figure 7.32

Rev

Plot Date: 04 Mar 2014
File Name: I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 7 Geology\Figure 7-32 Geomorphological Map of the terrestrial survey area.mxd

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An example of the gently rolling hills encountered in the Terrestrial Survey Area showing a combination of agricultural fields (vineyards) and woodlands is presented below in Figure 7.33. The ecological habitats are described in **Chapter 11 Terrestrial Ecology**.

Figure 7.33 Typical Undulating Landscape of Terrestrial Landfall Section (Ref. 7.1)

The landfall facilities will be located approximately 1.4 km inland north-east of a steep coastal cliff (approximately 150 m high where crossed by the Pipeline route), on a high level gently sloping 'plateau'. The surface of the plateau is typically gently undulating; however, in places the plateau has been eroded by fluvial processes to form steeply sloped river valleys, up to 150 m deep. Erosion features include hollows, incisions and gullies, which are often steeply sided and are up to 5 to 10 m deep (Ref. 7.1).

7.5.3.1 Fluvial Geomorphology

The fluvial erosion features are typically formed by a process of surface washout and flooding by the ephemeral[7] watercourses. This causes soil sediments and underlying rock to be removed and transported down gradient to form landslide and talus (debris) slope deposits (Figure 7.34).

[7] An ephemeral waterbody is a wetland, spring, stream, river, pond or lake that only exists for a short period following rainfall or snowmelt.

The spring-summer period is characterised by large storms, which often lead to further soil erosion and subsequent aggradation and accumulation of sediments on lower slopes.

Figure 7.34 Erosion Features Associated with the Watercourse in the Graphova Gap (Ref 7.1)

Valley and water channel features associated with ephemeral watercourses and their tributary gullies are also present across the Terrestrial Survey Area. Further details on the watercourses and groundwater within the Terrestrial Survey Area are provided in **Chapter 8 Soil, Groundwater and Surface Water.**

Watercourses in the Terrestrial Survey Area include the Shingar River and an unnamed tributary of the Sukko River (Graphova Gap). Both rivers flow approximately north to south crossing the Project Area, with the route of the proposed pipeline crossing them at approximately right angles. The Pipeline will cross the Graphova Gap by open-cut methods and will be microtunnelled beneath the Shingar River.

In the vicinity of where the proposed pipeline route crosses the Shingar River, the river valley is asymmetrical in shape, and the base of the valley is approximately 55 to 65 m wide. The slope on the eastern side of the valley is approximately 15 to 25°, 30 to 50 m in length and forested. The western side of the valley has been altered due to the construction of the coastal access road. The slope is stepped, with the road constructed on a cut and fill bench approximately 13 to 15 m wide. The western slope is very steep in places (up to 25 to 35°), largely treeless and is subject to slope erosional processes. The Shingar River is typically 1.5 to 2.5 m wide in the vicinity of the pipeline crossing and is located approximately 1.0 to 2.0 m below the adjacent floodplain terrace at the base of the river valley (Ref. 7.1).

Approximately 1.5 km east of the Shingar River, the pipeline route crosses the unnamed tributary of the Sukko River at the Graphova Gap. At this location, the Graphova Gap is asymmetrical in shape, and the base of the valley is approximately 80 to 100 m wide. Valley slopes are 30 to 40 m high and steeply sloped at 20 to 30°. In general, the slopes of the valley are forested; however, there are localised areas of slope that are devoid of vegetation (due to removal associated with economic activity within the valley) that have exposed bedrock and associated erosion processes in the valley sides. On the lower slopes of the valley and associated floodplain are several man-made embankment and ditch features (typically <3.0 m wide and 0.5 to 1.3 m deep) constructed as protection measures to help control storm water flow into valley of the unnamed tributary (Ref. 7.1).

The steep scarp slopes along the Graphova Gap and the Shingar River are subject to fluvial erosion. Erosional scour of 3 m can be expected as well as undercutting and collapse of the banks (Ref. 7.22).

Russia's Black Sea coastal region is known to experience periodic mudflows. The sudden formation of mudflow and mudrock flows is possible in the valleys of the Shingar River and the Graphova Gap and their tributary gullies. Retrospective analysis and reports from locals indicate that mudflows occur once every several (5 to 7) years, each time causing large damage (Ref. 7.5). Mudflows are typically triggered by intense rainfall events or prolonged rain.

7.5.3.2 Coastal Morphology

The coastal cliff is approximately 150 m high in the landfall area of the pipeline crossing and generally convex to a stepped-in profile. The average steepness of the slope is 15° to 25°; however, in places the slope can increase to 40° to 70° (Ref. 7.22). The lower 30 to 50 m of the cliff is typically covered by a talus apron of eroded and abraded loose cliff sediments, with active cliff erosion and rockfall processes having been observed to a height of 120 to 140 m above sea level (Ref. 7.1). Vegetation within the coastal zone is limited to sparse plant cover on the cliffs, rock outcrops and scree slopes associated with the coastal cliffs. At the shore, the beach deposits comprise varied and often poorly sorted sediments ranging from boulders and pebbles to sands and silts. The width of the beach at the foot of the cliff is generally 5 to 15 m wide.

Erosional processes associated with the coastal cliff zone include landsliding and slumping of the coastal cliff and erosion of interbeds of softer sediments exposed in the cliff face (Figure 7.35). Erosion processes along the coastal cliff typically occur as a result of abrasion and weakening of the cliff face from wave action, gravity slumping or tectonic processes (earthquakes or movement along fault planes).

The relatively narrow beach provides limited protection to the base of the cliffs against direct wave action. Wave attack also assists in the removal of material at the toe of the cliffs resulting in periodic landsliding and slumping events (Figure 7.35). In the Terrestrial Survey Area, cliff recession rates are typically 3 to 10 cm per year and the average shoreline recession is calculated to be 41.6 m per century. The microtunnelling approach to the shore crossing (**Chapter 5 Project Description**) mitigates the risks associated with coastal erosion.

Figure 7.35 Examples of Typical Coastal Abrasion Features Associated with Coastal Cliff Landsliding and Erosion of Softer Sediments on the Cliff Face (Ref. 7.1)

There are large-scale rotational slump features along the coast (Ref. 7.22), where material is moving downhill under gravity. These are up to 160 m long and 700 m wide, with hanging walls of up to 15 m. These are regarded as active features. Their rotational failure planes are potentially deep-seated.

A relatively recent landslip has occurred approximately 2 km northwest of the Project Area (Ref. 7.22). This feature has collapsed into the sea causing a local inflection of the coastline. The landslip is about 500 m wide. The toe of the slope extends 60 m into the sea. This landslip is assumed to have failed in a rotational manner. The failure plane may extend below sea level.

Within the coastal area of the Abrau Peninsula located to the south of the Terrestrial Study Area are four landslides, inferred to be earthquake induced, with areas of approximately 3 to 4 km^2 (Ref. 7.1). The heads of the earthquake induced landslides are located on land but the features extend a further 2.0 to 2.5 km out to sea across the coastal shelf.

7.5.4 Marine Geomorphology

The geometry of the sea floor in the Russian Sector of the Black Sea has been mapped using a multi-beam echosounder (SSC FSUGE Yuzhmorgeologiya, 1996-1997). The bathymetry data has been used to assess the marine geomorphology (Ref. 7.5).

From east to west the route of the pipeline crosses three main geomorphological zones through the Russian Sector of the Black Sea: the continental shelf, the eastern continental slope and the abyssal plain. The geomorphological zones are shown in Figure 7.36.

The geomorphology of each zone is discussed in the following sections:

Figure 7.36 Geomorphological Zones of Russian Sector of the Black Sea (Ref. 7.5)

7.5.4.1 Continental Shelf

The Russian continental shelf is gently inclined towards the west at 0.4° and is subdivided into two zones:

- Coastal slope - extending from coastline to 50 m below sea level (mbsl); and
- Coastal platform - extending from 50 mbsl to 100 mbsl.

Sediment cover on the Russian Shelf is typically between 5 to 12 m thick and overlays folded bedrock of carbonate flysch.

The western extent of the Russian continental shelf is bound by a major fault scarp which crosses the Black Sea between Anapa and Gelendzhik, which marks the start of the Continental slope.

Evidence of landslides on the continental shelf has been identified near the Utrish Cape. Elsewhere on the shelf, limited evidence of landsliding has been found. Mudslides in response to earthquakes are anticipated in the base of the continental shelf. Sensitive deposits include the weak silts found close to the brow of the shelf.

7.5.4.2 Continental Slope

Beyond 100 m water depth, the continental slope starts dipping steeply to the west towards the abyssal plain. The transition from the continental shelf to the continental slope is marked by a distinct escarpment.

The shape of the continental slope off Anapa is controlled by bedrock, comprised primarily of the Mesozoic and Neogene Flysch which is also observed along the present coast. Bedrock is at or close to the surface in parallel ridges aligned along the slope. The presence of bedrock at or near the sea floor is the main reason why the continental slope is steep (Ref. 7.5).

In general, the gradient of the continental slope decreases towards the base of the slope (at 1,900 m depth). Gradients can exceed 30° at the shelf break and the continental slope typically varies from 27° at the top to 5° at the bottom.

The geomorphology of the continental slope is characterised by highly dissected dendritic drainage patterns of ridges and canyons. This morphology is the result of cycles of erosion, which caused retreat of the slope and the development of a random network of valleys (Ref. 7.5). The channels are partially filled with mud flow deposits.

The Anapa Canyon is the predominant geomorphic feature on the continental slope in the Study Area (Ref. 7.26). The Anapa Canyon cuts through sediments from the Pleistocene Kuban River delta. The main canyon corresponds with the sediment transport path from the Sea of Azov to the Black Sea and is a relic feature of the estuaries of the Don and Kuban rivers. As the Kuban fan slopes southeast towards the abyssal plain, the toe of the continental slope is found at a progressively lower elevation moving towards the southeast. The canyon itself is an integral part of the submarine delta formed from the Kuban and Don Rivers. The canyon runs parallel to the Russian Black Sea coast from a depth of 200 m to approximately 1,500 m. A further two stable canyons have been identified running down the continental slope and merging with the Anapa canyon at its mouth. The northern slope of the Anapa canyon is steep and itself incised by smaller canyons. The floor of the canyon is further incised by a trough. The canyon is shown in Figure 7.37. The interpreted geomorphology where the Pipeline route crosses the canyon is shown in Figure 7.38.

The upper slope is shown in Figure 7.39. The gullied terrain has rugged topography. The gullies are dendritic (Figure 7.40). The sidescan sonar images (Figure 7.41) suggest the present of coarse sediment in the upslope part of the dendritic gullies (Ref. 7.36). Locally bedrock is exposed in the gully walls (Figure 7.42). Gully system heads form a characteristic 'cauliflower' shape (Ref. 7.36). Upslope, most gullies gradually shallow and die out just below the continental shelf edge. However, some terminate in a distinct headwall scarp that suggests that gullies can propagate upslope by headward erosion (Ref. 7.36).

Downslope, the broad valleys have steep downslope gradients (8 to 10^{0}) but relatively smooth floors. The valley flows are characterised by sediment waves oriented across the slope. There are frequent large boulders (Figure 7.43) covered only by a thin intermittent sediment drape (Ref. 7.29).

Small carbonate mounds related to fluid seepage can be identified at a few locations along the Russian shelf break at depths between 110 and 140 m (Ref. 7.36); a small number are in relatively close proximity to the Pipeline route (Figure 7.44). These carbonate mounds are usually associated with gas seeps. Gas seeps have been documented in the Black Sea. Some of these seeps are associated with flare reaching up to 500 m from the sea floor, although the majority are between 50 and 130 m high (Ref. 7.36). The majority of gas seeps occur along the shelf break and are often associated with faulting. The principal biogeochemical process forming the concretionary carbonates at the seeps is the sulphate-dependent anaerobic oxidation of methane. This can create reef structures several metres in height. These structures release methane bubbles.

The lower Russian continental slope (Figure 7.45), extending from 1,500 m to about 2,000 m, is generally relatively smooth with a decreasing gradient. The exception to this smooth slope is a marked incision where the Anapa Canyon cuts across the slope, creating a series of scarps at about 1,650 m water depth.

Figure 7.37 Schematic Diagram of Anapa Submarine Canyon (Ref. 7.28)

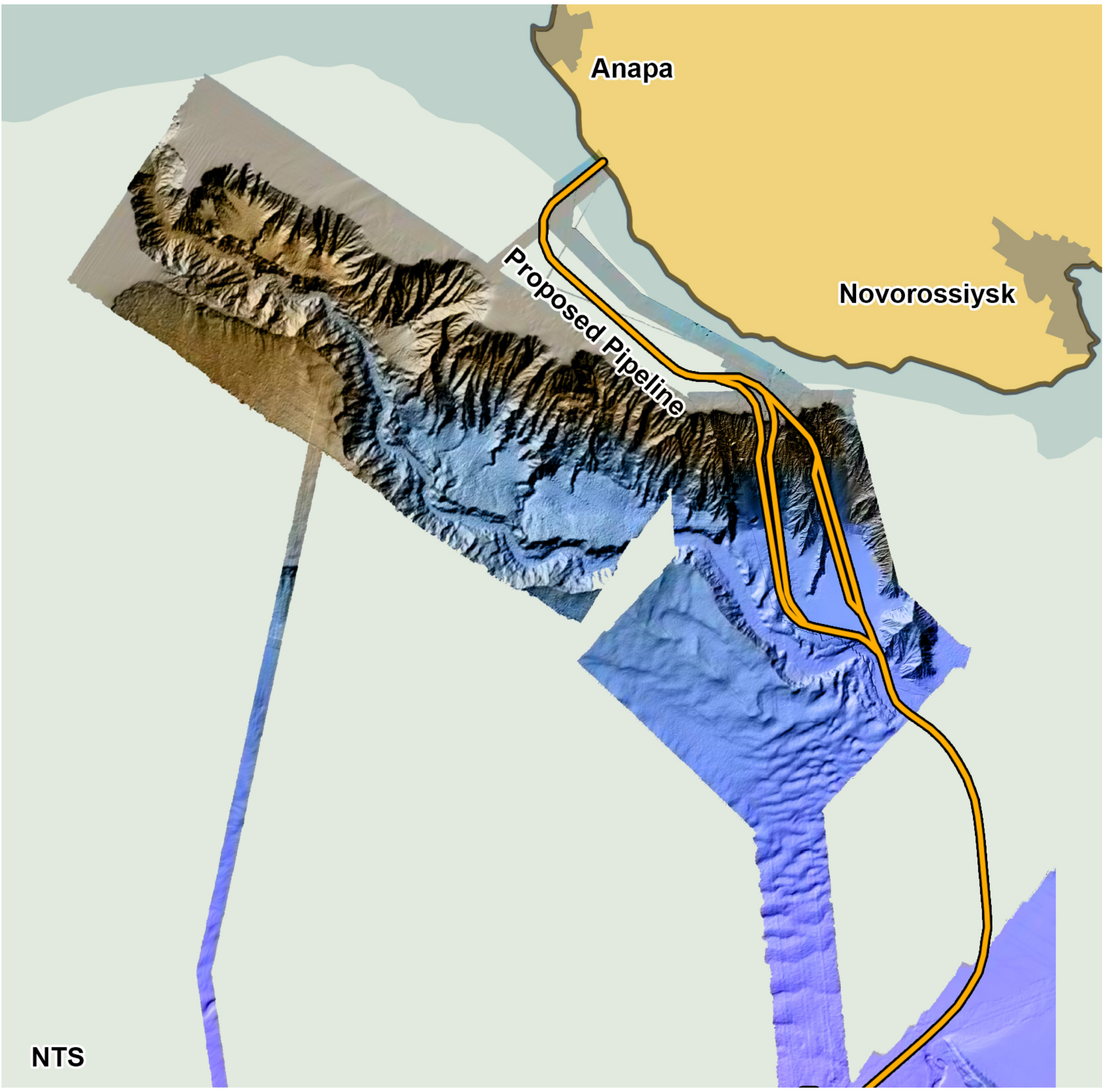


Figure 7.38 Summary Interpretation of Geomorphological Features on Upper Russian Slope (Ref. 7.36)

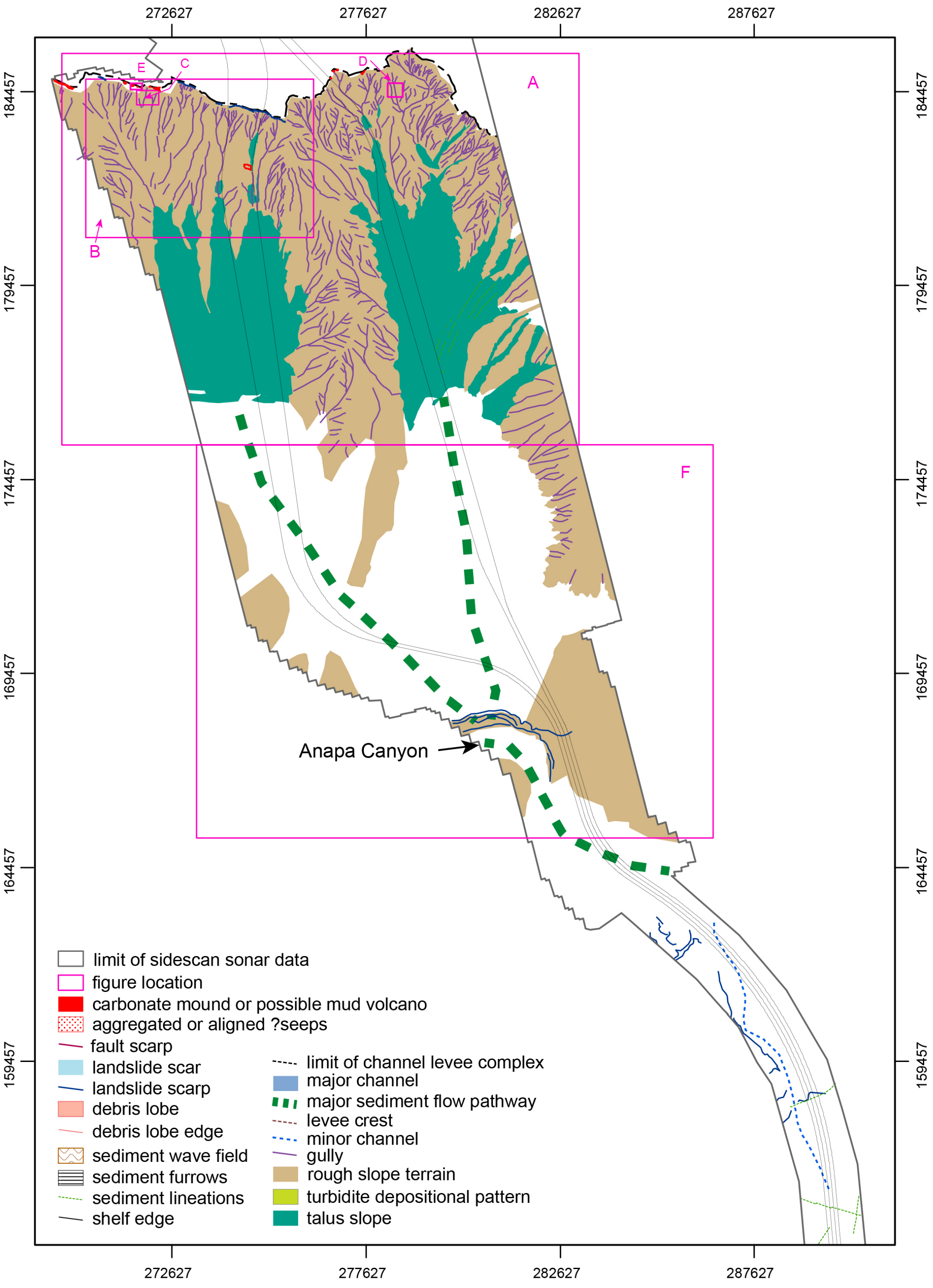


Figure 7.39 3D Representation of the Upper Russian Slope (Location A) (Ref. 7.36)

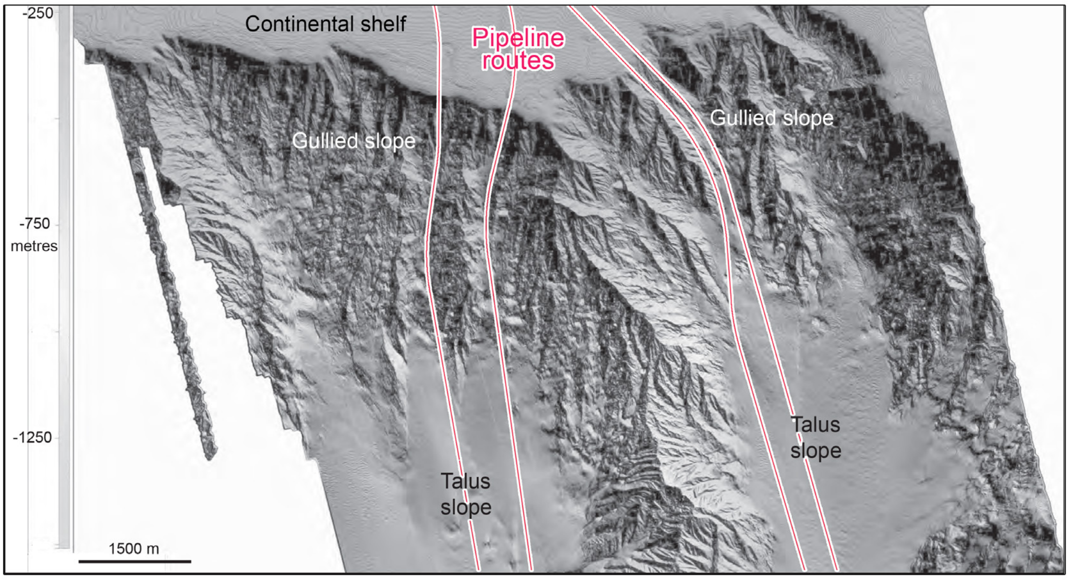


Figure 7.40 Sidescan Sonar Image of Dendritic Gully Systems on Upper Russian Slope (Location B) (Ref. 7.36)

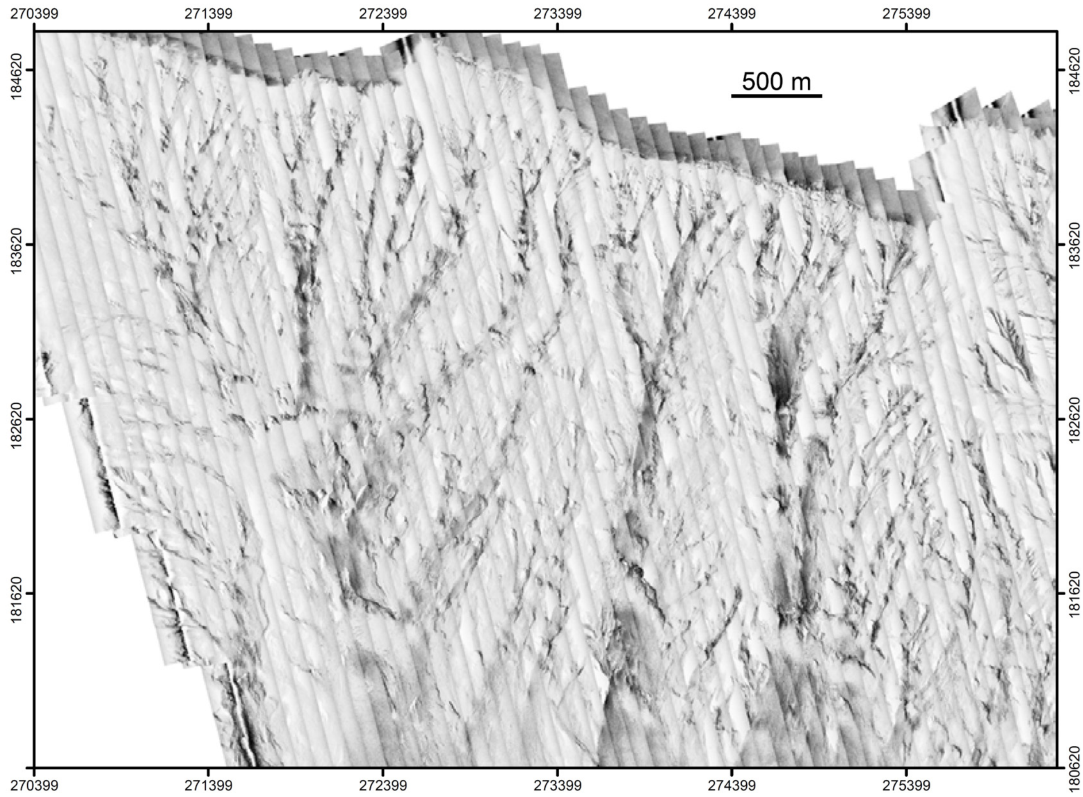


Figure 7.41 Sidescan Sonar Image of Upslope Part of Dendritic Gully System (Location C) (Ref. 7.36)

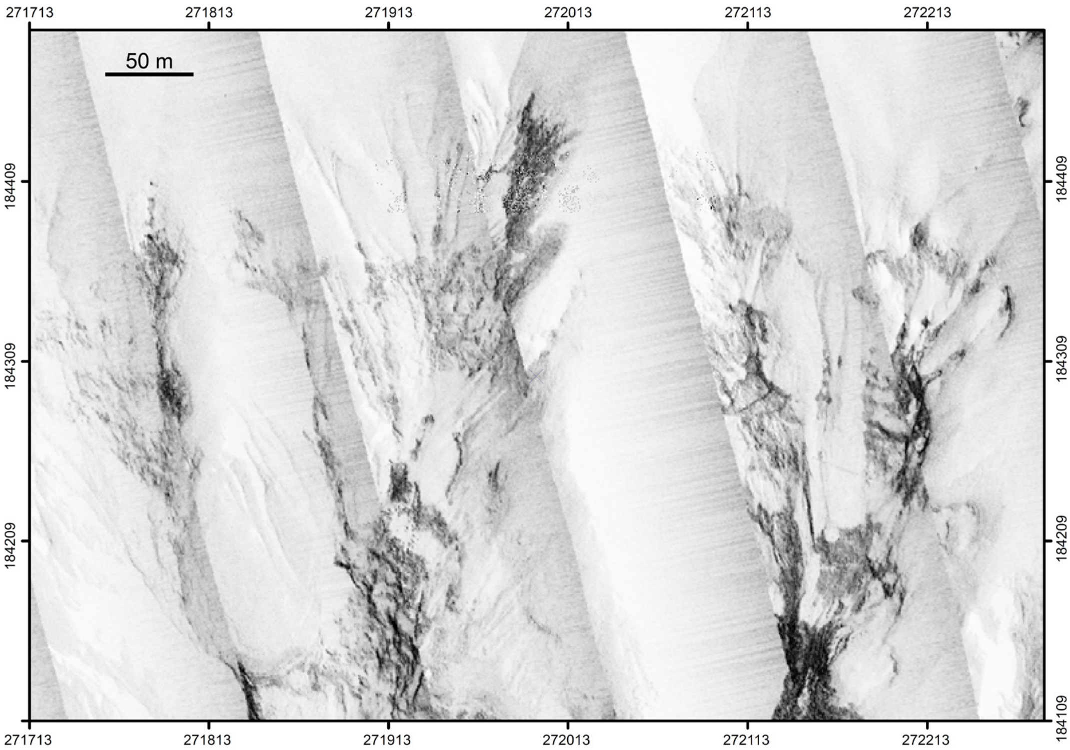


Figure 7.42 Sidescan Sonar Image of Outcropping Bedrock on Gully Walls (Location D) (Ref. 7.36)

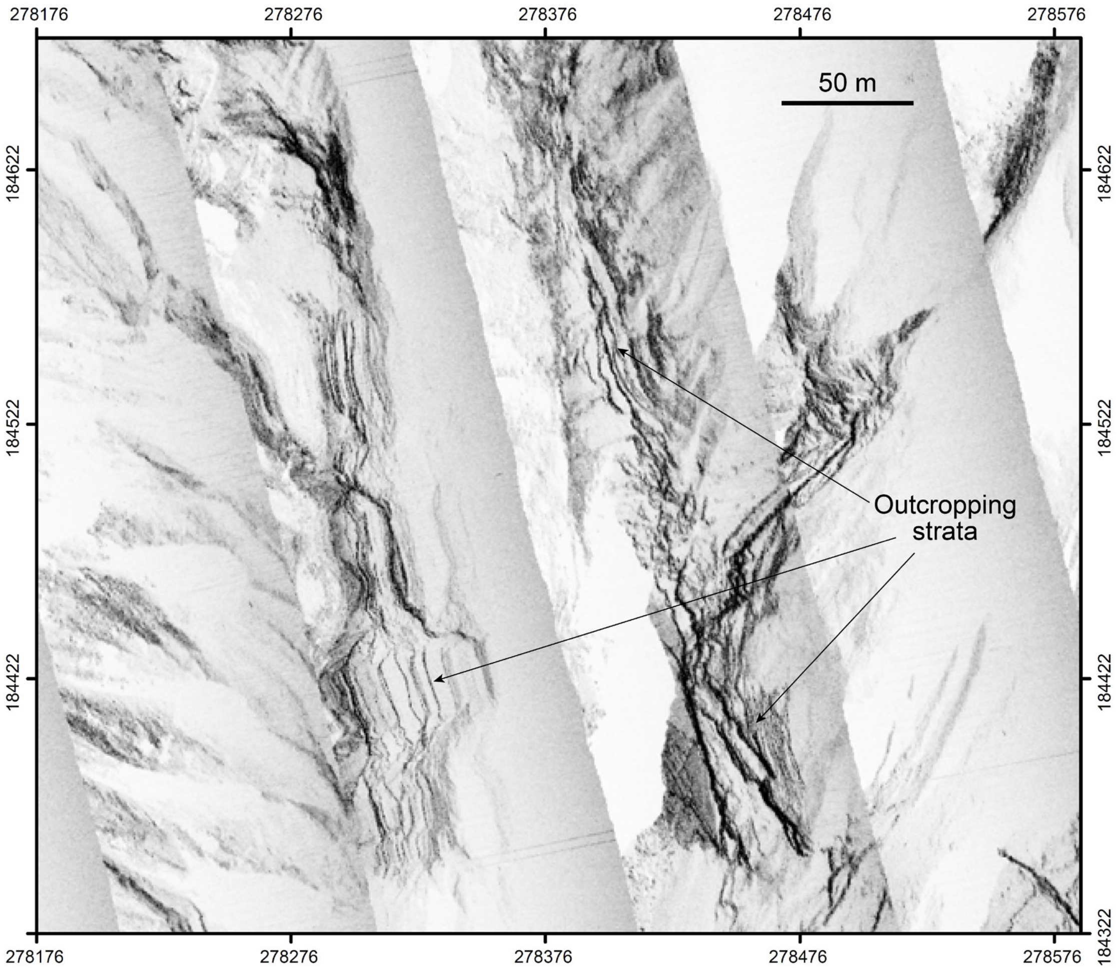


Figure 7.43 ROV Survey Images of Boulders on Upper Russian Slope (Ref. 7.36)

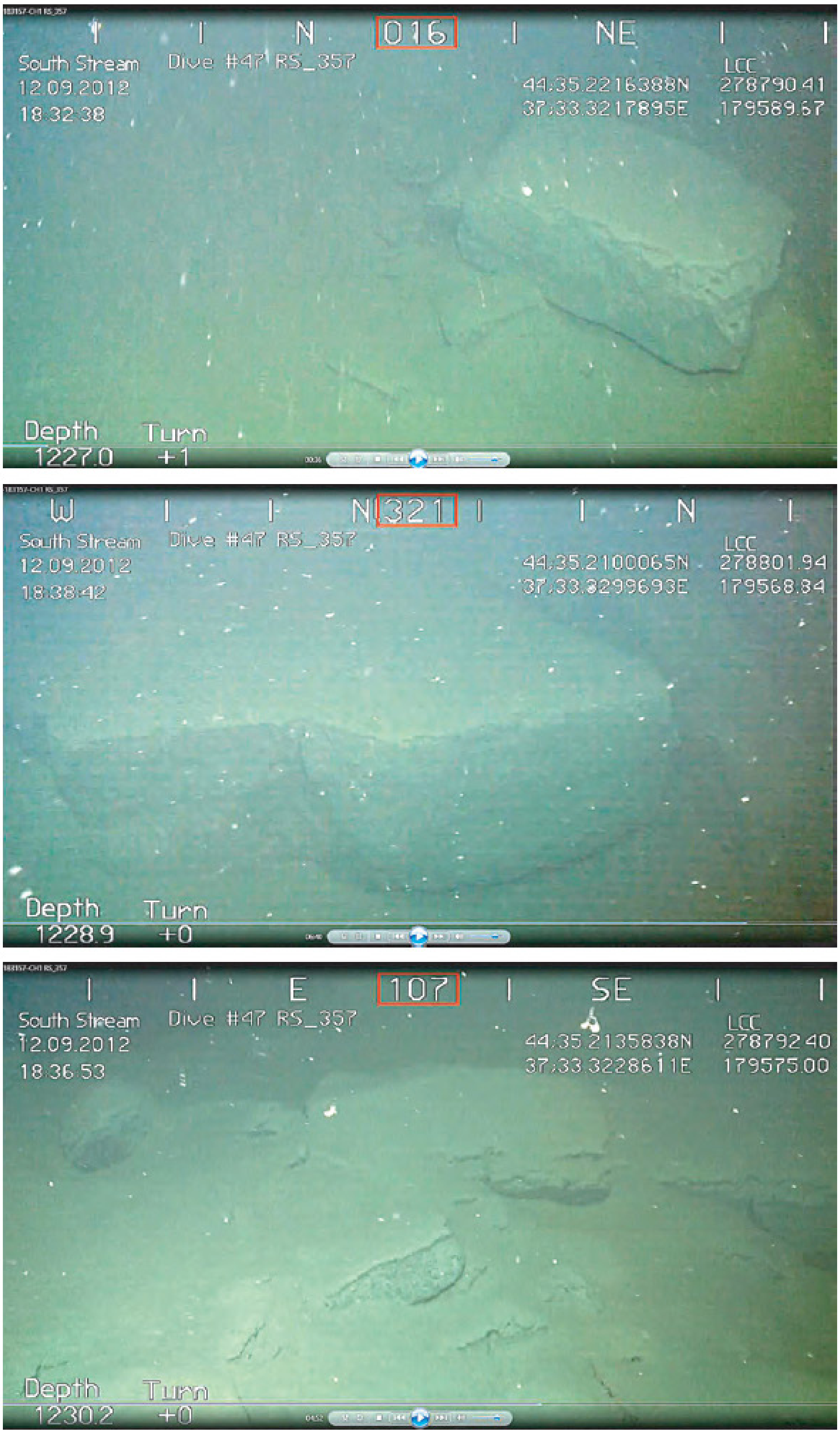


Figure 7.44 Sidescan Sonar Image of Small Carbonate Mounds near Shelf Break (Location E) (Ref. 7.36)

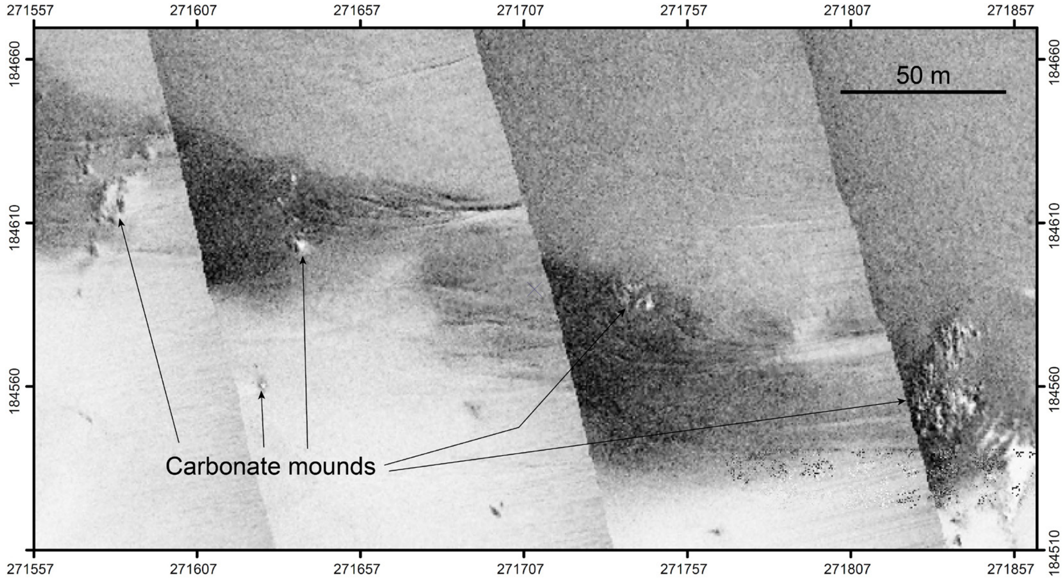
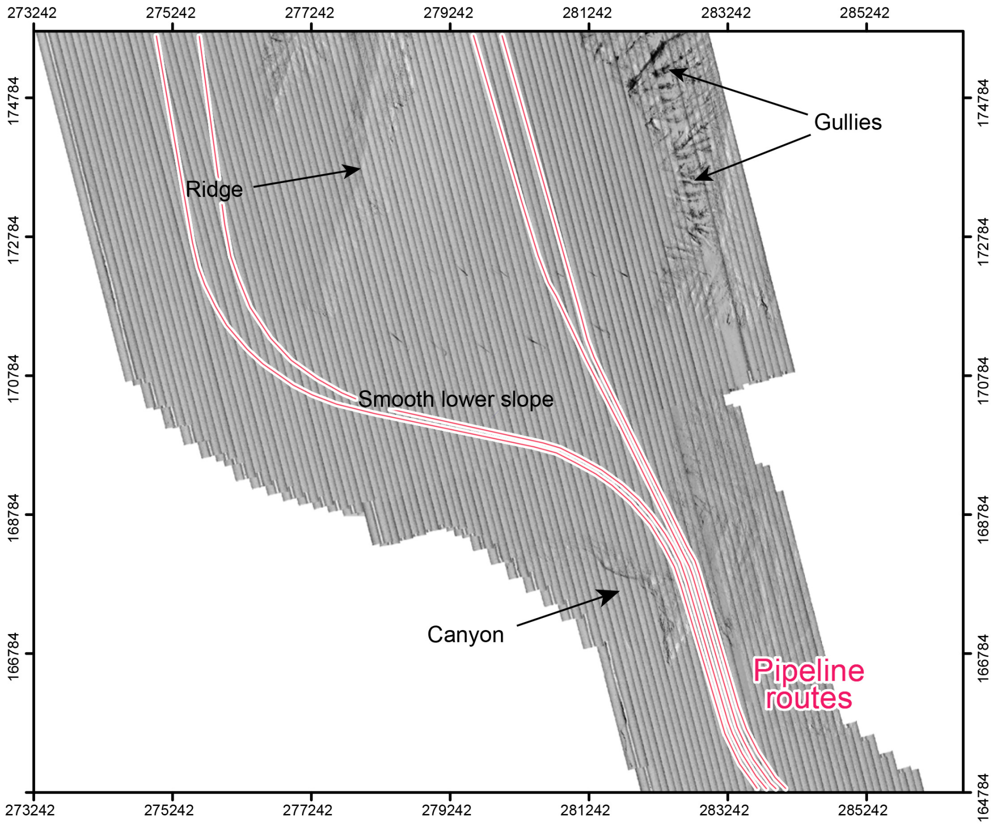


Figure 7.45 Overview of Sidescan Sonar Data for Lower Russian Slope (Location F) (Ref. 7.36)

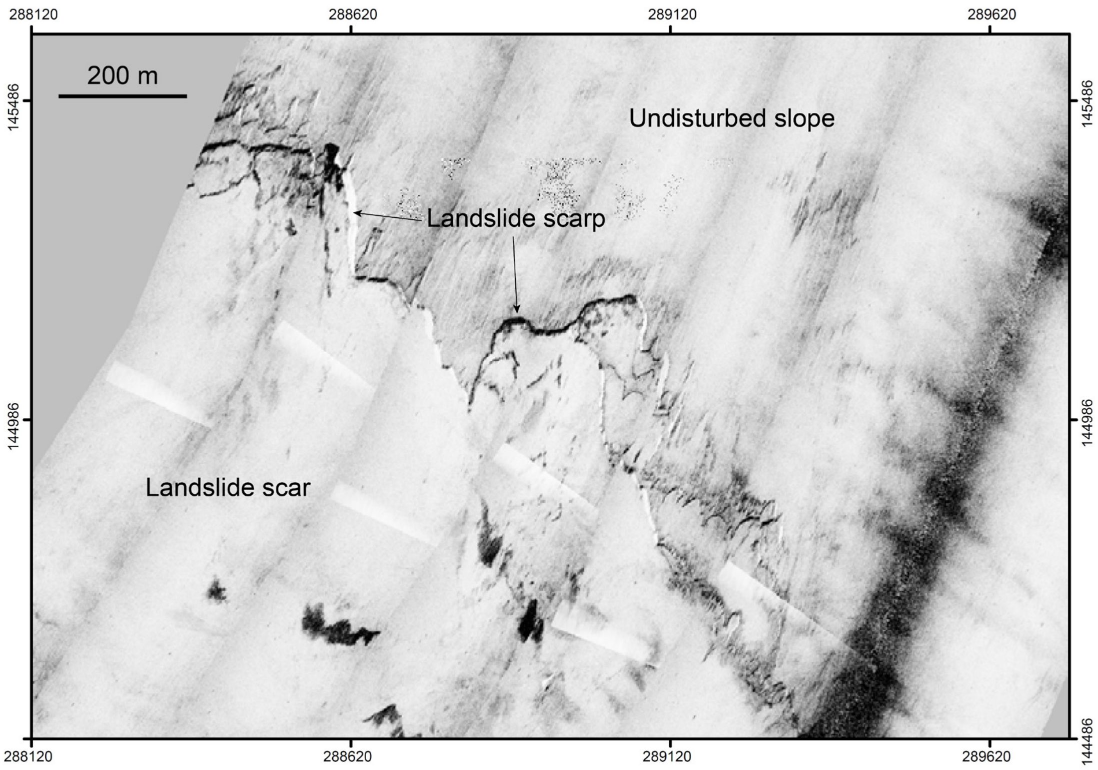


The Anapa Canyon and associated channel is covered by soft sediment, suggesting it is not an active conduit for turbidity currents at the present time. The sedimentary drape is about 1 to 2 m thick, suggesting limited turbidity current activity during the last few thousand years.

The Anapa Canyon appears to continue as a stream of fine sediment extending to the abyssal plain. The regional data shows the channel extends beyond the limits of the continental slope and that sediments from the canyon affect the morphology of the Holocene portion of the Kuban Delta. Recent sediment may be creeping slowly under gravity down the slope in this area of the continental rise.

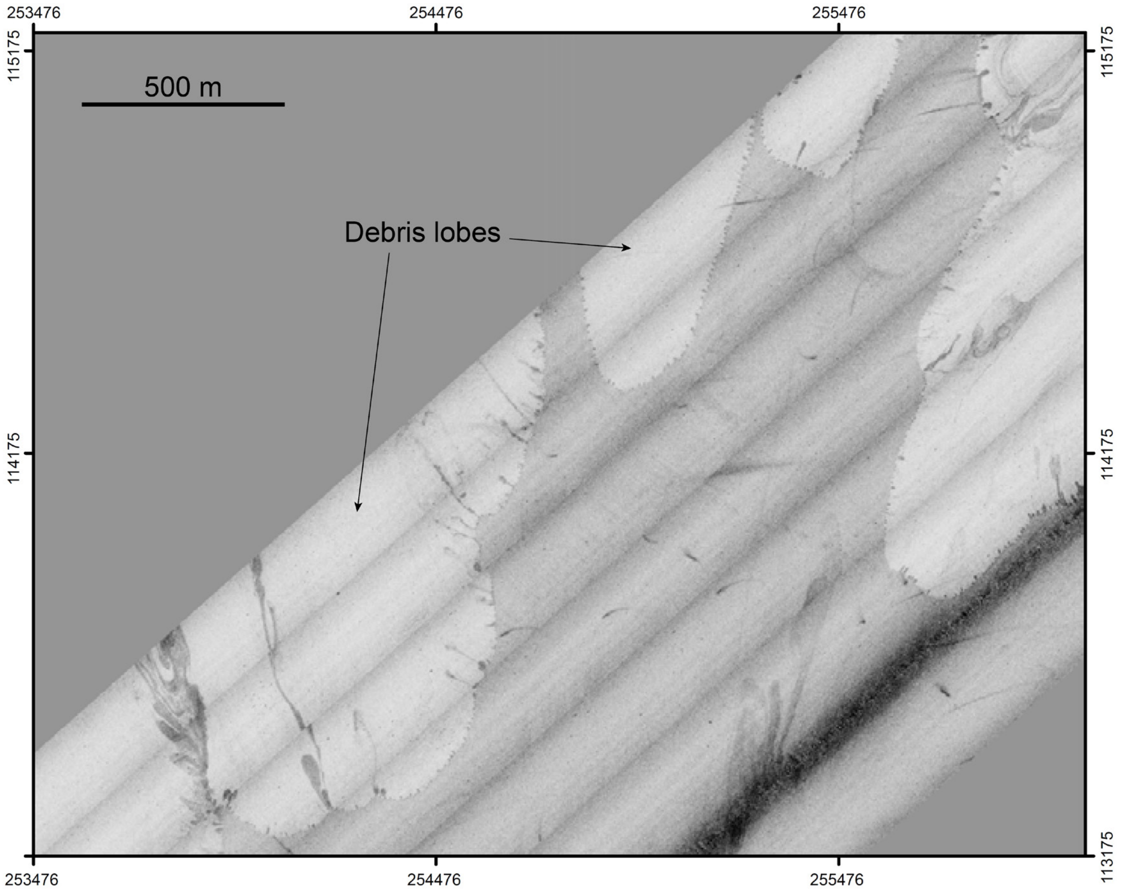
Downslope from the Anapa Canyon, the slope is characterised by landslide scars and depositional detritus lobes. These are all low relief features with slide scarps typically only a few metres high (Ref. 7.36). Figure 7.46 shows a landslide scarp on the lower Russian slope. This scarp is 2 to 4 m high and may represent a palaeocoastal feature. Figure 7.47 shows debris lobe features on the lower Russian slope. The lobe edges exhibit typical frond-like patterns.

Figure 7.46 Sidescan Sonar Image of Landslide Scarp on Lower Russian Slope (Ref. 7.36)



The seabed in the continental slope area is generally characterised by unstable sediments and is often subject to dynamic processes, including gravity flows of sediment towards the abyssal plain (e.g. submarine slumps and associated "turbidite" flows). Instability of the seabed sediment is often triggered by seismic activity and, to a lesser extent, by the sedimentation process itself.

Figure 7.47 Sidescan Sonar Image of Debris Lobes on Lower Russian Slope (Ref. 7.36)



Sediment cover typically comprises very soft clays with some shells, overlaying an unconformity of debris flow deposits and layers of stiff clays and fine sands. The thickness of sediments on the slope is variable, from no sediments present to >20 m of sediment cover. The lower part of the continental slope was denuded in the Pleistocene. There are locally outcrops of basement rocks.

The Anapa canyon has been identified as a key engineering constraint on the continental slope. As described in **Chapter 4 Analysis of Alternatives**, in order to spread the risk associated with the seabed instability on the continental slope, the pipeline route is split such that two pipelines are to be laid down in each of the two stable canyons, with the four pipelines converging again at the mouth of the Anapa canyon.

Landslide activity is most intense in the upper part of the continental slope due to the steeper slope angle. As described in **Chapter 4 Analysis of Alternatives**, the alignment of the pipeline route has been selected following geohazard mapping; the pipeline route is designed to utilise areas with comparatively stable submarine topography as far as is possible.

The pipeline crossing relative to the Anapa Canyon is illustrated in Figures 7.48 and 7.49.

Figure 7.48 Anapa Canyon Crossing

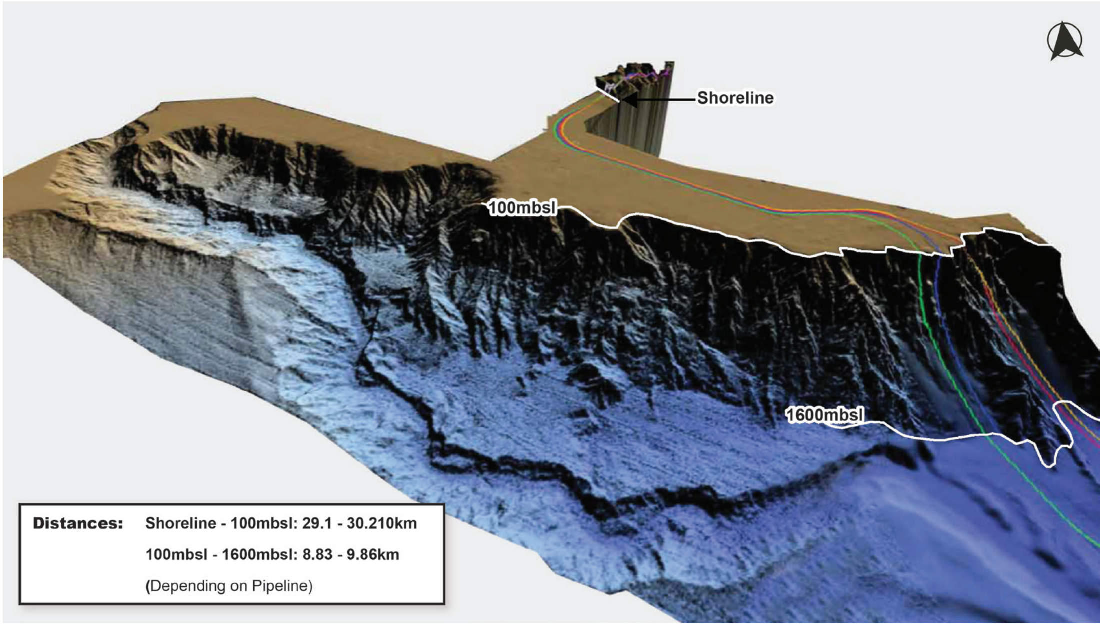
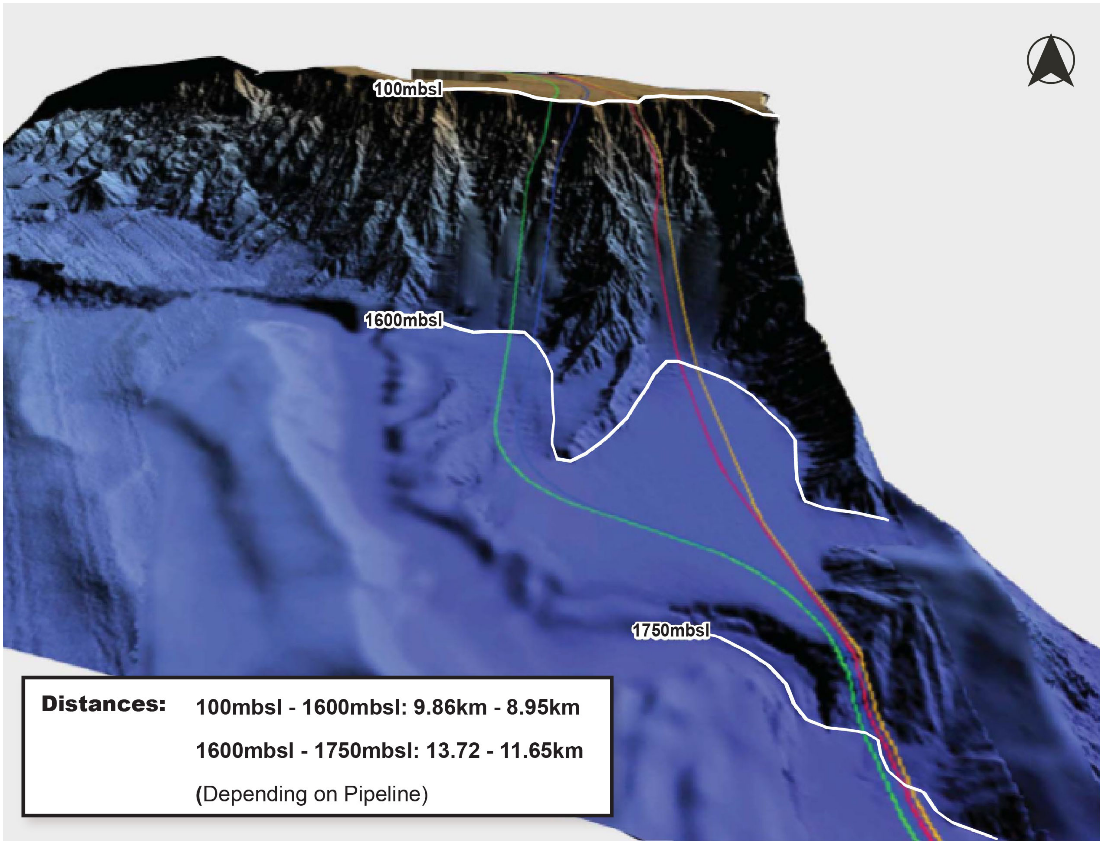


Figure 7.49 Continental Slope Crossing

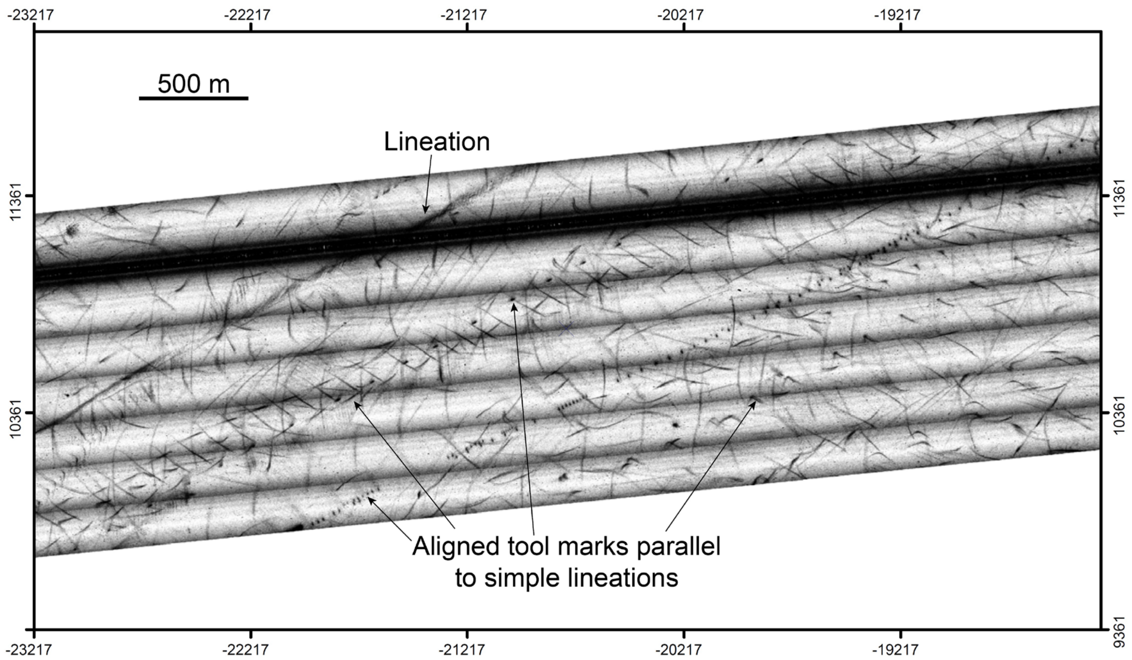


7.5.4.3 Abyssal Plain

The abyssal plain lies at the base of the continental slope and gently slopes to the west to a maximum depth of approximately 2,200 m. From the base of the continental slope, the pipeline route extends across the abyssal plain towards the border of the Russian EEZ with the Turkish EEZ. There is no clear slope break marking the boundary between the lower continental slope and the abyssal plain.

Figure 7.50 shows the typical conditions on the abyssal plain. The sea floor is essentially smooth and almost featureless across the entire area. There are lineations, predominantly trending west northwest approximately parallel to the contours. The pattern of lineations suggests that they are related to the inflow of dense saline water from the Mediterranean into the Black Sea (Ref. 7.36). These features have negligible bathymetric expression, suggesting that they are relatively old features buried by later sedimentation (Ref. 7.36). The lack of topographic relief on the lineations suggests that the process that created them is not currently active (Ref. 7.36). These lineations are associated with irregular marks, which are interpreted to be tool marks due to objects such as trees carried in bottom currents gouging the sea floor.

Figure 7.50 Sidescan Sonar Image of Abyssal Plain Showing Lineations and Tool Marks (Ref. 7.36)



The seabed within the abyssal plain is typically characterised by horizontal layers of carbonate rich silt and / or clay sized sediments.

7.5.5 Marine Sediments

This section presents a description of the sediment transport processes associated with the marine environment and the characteristics of sediments encountered in the nearshore and offshore sections of the Marine Study Area. Further discussion of sediments in the context of marine ecological receptors are presented in **Chapter 12 Marine Ecology**.

7.5.5.1 Sediment Transport

The main sedimentary processes in the Black Sea are associated with the deep-sea fans located off the major rivers, with downslope sediment transport by turbidity currents through canyon systems, with landslides on the continental margins and with the development of mud volcanoes.

Sediment transport processes within the Black Sea are presented below in Figure 7.51. In the offshore section of the Marine Study Area, a north westward drift is evident, while in the nearshore section of the Marine Study Area, the drift is easterly. In the Marine Study Area (nearshore section), littoral drift of eroded sediment occurs in a south-easterly direction with a net drift rate of 19,000 m^3/year (Ref. 7.1).

The majority of the seabed's surface is formed by Quaternary sediments. Due to the absence of major rivers in the coastal area, there is currently minor mass sediment transportation onto the shelf (Ref. 7.26). The main sources of sediment for the Anapa shelf are the Don and Kuban Rivers, which currently discharge through the Kerch Strait from the Sea of Azov (Figure 7.51). Secondary sources are the small rivers flowing from the southern slopes of the Greater Caucasus. Autumn and spring river surges may initiate submarine debris flows locally. High point sources of sediment can be introduced locally onto the shelf by large collapses of the coastal hills (Ref. 7.26). Additionally, a significant proportion of the sediment is of biogenic origin, forming within the marine environment.

The coastal processes where the pipeline route crosses the shore are predominantly represented by abrasion, sometimes complicated with rock falls and rock slides (Ref. 7.1). There is an accumulative relief zone in the coastal waters up to about 30 m water depth (Ref. 7.1) where wave activity transports sediments as is evidenced by the development of ripple marks.

The shelf in the Study Area comprises an abrasion-aggradation plain. Sediment transport at the shelf break and on the continental slope is predominantly due to mass wasting, including landsliding and density currents. On the Russian margin sediment transport via turbidity currents and debris flows was common during the last glacial period, but has been much reduced during the last 9,000 years (Ref. 7.36). Sediment creep has also been observed on the continental slope (Ref. 7.1).

Figure 7.51 Sediment Transport Processes within the Black Sea (Ref. 7.42)

Sediment drift system in the coastal zone
Suspended matter flows in the off shore zone

1 Rioni Depression Zone
2 East Caucasian Zone (Mzimta River - Kodori River)
3 West Caucasian Zone (Kudepsta River - Anapa)
4 Taman - Kerch Zone (Anapa - Feodosia)
5 South Crimean Zone (Feodosia - Balaklava)

Route of Proposed Pipeline

The MBSC may not have the capacity to initiate sediment motion on the seabed, but will influence a) the fallout patterns of fine suspended sediments entering the area and b) the residual trajectory of sediment suspended in the nearshore area by wave action.

Mud flows along the sea bed are characteristic of the south-eastern part of the Marine Study Area. They are common on the continental slope and the abyssal plain. These mud flows are fastest close to the sea bed, with maximum values of around 3 m/s but more typical values are less than 0.15 m/s.

Seismicity in the region is directly related to sediment transport processes:

- At the shelf break, deposits that have slowly accumulated over time can be 'shocked' into motion as sediment-gravity flows (liquefaction). Slumps occur, some on a very large scale, which may turn into turbidity currents which, through long periods of activity, carve the canyons that are found on the steep slope areas. This is an important process by which, over geological time, shelf sediments are transferred to abyssal depths;
- Fault movement below deep recent sedimentary deposits can cause bed surface features such as fault-aligned ridges, and mud volcanoes (faults triggering gas release). Faults also often control the alignment of major features (canyons, scarp slopes); and
- Fault movements can cause tsunamis, which produce sediment transport in littoral zones.

7.5.5.2 Sediment Composition

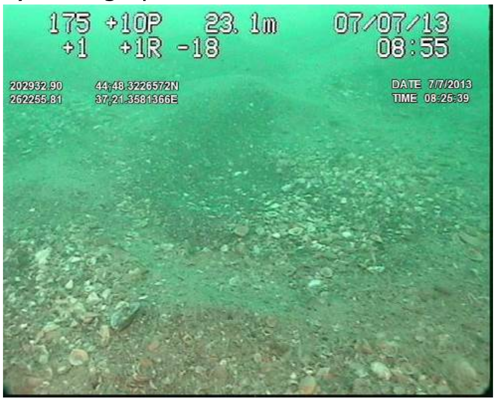
Typically the sediments of the Marine Survey Area (nearshore section) comprise a mix of stones, gravels and sands. The sands typically have a bulk density of 1.6 to 2.0 g/cm^3 and a porosity of 23 to 25% (Ref. 7.1). Bedrock outcrops locally in the shallow waters. Additional sediment type data were collected during the 2013 marine survey (Ref. 7.8). Photographs of the sea bed taken during the survey are presented in Figure 7.52. Table 7.22 presents the sediment type of sampling locations based on the classification proposed by Folk (Ref. 7.41), which groups sediment grains into mud, sand and gravel on the basis of their diameter. The relative proportion of the sediment grains in the three categories is then used to describe the sediment.

Coastal sample locations were dominated by rock and sand deposits. Continental shelf locations dominated by mud with a limited number of samples containing sand and gravel grains. The continental slope samples were all classified as mud.

In the fans of the Kuban and Don Rivers on the continental slope, contemporary and Upper Holocene (Nymph) sands are also occasionally encountered.

Figure 7.52 Photographs of Seabed Sediments in Coastal Waters (Ref. 7.8)

a) Photograph at N 44^{0}48.559' E 37^{0}21.435'. Water depth 10.1 m



b) Photograph at N 44^{0}48.322' E 37^{0}21.358'. Water depth 23.1 m

c) Photograph at N 44^{0}48.146' E 37^{0}21.080'. Water depth 33.7 m

Table 7.22 Sediment Type Groupings[8] of 2013 Marine Survey Sediment Type Data (Ref. 7.8)

Sediment Type	No. of Samples	Depth Range (m)	Average Depth (m)
Coastal (72 samples in water depth 0-25 m)			
Rock	46	3.7 – 19.7	10.4
Gravelly Sand	4	20.5 – 21.7	20.95
Sandy Gravel	4	21.7 – 22.2	22
Muddy Sandy Gravel	3	24.5 – 24.7	24.6
Gravel	14	19.4 – 26.7	23.8
Muddy Gravel	1	16.9	16.9
Continental Shelf (112 samples in water depth 33-113 m)			
Sandy Mud	12	33.2 – 68.6	56.3
Mud	82	50.6 – 110.8	71.2
Slightly Gravelly Sandy Mud	10	68.9 – 113.1	86.7
Slightly Gravelly Mud	4	89.7 – 91.1	90.4
Gravelly Mud	3	53.2 – 56	54.8
Muddy Gravel	1	52.9	52.9
Continental Slope (16 samples in water depth > 364 m)			
Mud	16	364.8 – 572.9	485.5

There are clays and clay loams in the lower strata of the Quaternary section, which locally intersect with the shelf's brow and the upper part of the continental slope, and also the lower part of the shelf.

The reported thickness of the clay and silt sediments in the Caucasian shelf reaches 10 m. In the Taman zone of the shelf the silts are 20 m or more thick. The clays are grey and dark-grey, silty and calciferous. The bulk density ranges from is 1.39 to 2.02 g/cm^3. The porosity is

[8] Based on Folk Classification (Ref. 7.41).

typically around 65% and the natural moisture content of the shelf muds ranges from 31 to 117% (Ref. 7.1). The typical composition of the clay sediments is summarised in Table 7.23.

Table 7.23 Typical Composition of Clay Sediments on Continental Shelf (Ref. 7.1)

Parameter	Category	Typical Proportion (%)
Grain Size (mm)	0.005 – 0.010	56 - 65
	0.01 – 0.05	29 - 36
	>0.05	3 – 8
Grain Type	Clays	52.4
	Quartz and Feldspars	8.5
	Rock Fragments	14.4
	Organic Material	2.3
	Authigenic Calcite	6.7
	Sulphides	20.5
Clay Minerals	Illite	63 - 69
	Chlorite and Kaolinite	25 - 29
	Montmorillonite	6 – 10

Within the continental slope and abyssal plain unconsolidated water-saturated organic silts dominate. The thickness of the sediments on the slope is variable from no sediments present to several metres of sediment cover. The thickness of these sediments penetrated by the sampling is 6 m. The sediments in the deep abyssal plain typically have a high rate of sedimentation in the eastern Black Sea of between 0.2 – 0.4 m per thousand years (Ref. 7.5).

The variations in sea level over the history of the Black Sea (Section 7.4.4) are reflected in the marine sediment profile on the continental slope and abyssal plain (Ref. 7.36). In summary the most recent pelagic sediment layers in the Black Sea can be divided into:

- Unit I, the upper horizon approximately 30 cm thick, is a micro-laminated sediment, rich in plankton derived carbonates (coccoliths), with relatively low levels of organic carbon. This unit was deposited in oxygen depleted bottom waters;

- Unit II sediment (ca. 30 to 70 cm below the surface) is a micro-laminated sapropel[9] deposited under anoxic marine conditions between approximately 2,700 and 7 to7,700 years ago in waters deeper than 200 m. The onset of Unit II is characterized by the occurrence of thinly laminated layers rich in aragonite crystals and by a sharp increase in Total Organic Carbon;
- Transitional unit, marking the transition from lacustrine to marine conditions. This unit varies across the basin; and
- Unit III sediment, below approximately 70 cm, is older than 7,000 years and was deposited when the Black Sea was an oxic freshwater lake, and are characterised by mix of organic-poor clays and silts. Unit III sediments have organic contents <1%.

Above Unit I sediments lies a discrete proto-white lamina layer (about 2 cm thick), and above this lies a discrete benthic flocculant layer, also known as flocs or as the "fluff layer", also about two cm thick. The flocculant layer has been observed to be largely composed of lithogenic material derived from the surrounding rivers (47%), carbonates derived from coccoliths (31%) with the remains of diatom and silicoflagellete blooms (7%) and particulate organic carbon, e.g. faecal pellets (6%). The proto-white laminae layer is composed of coccoliths (46%), lithogenic material (33%), the remains of diatom and silicoflagellate blooms (4%) and particulate organic carbon (7%). On the abyssal plain, the most recent flocs form black, mat-like aggregations form black, mat-like aggregations, sometimes with an outer lighter-coloured rim, that collect in subtle bathymetric lows (Ref. 7.36).

The transition from the continental slope to the abyssal plain is typically characterised by a smooth transition in sediment geology, with the sediments of the abyssal plain being characterised by a higher mineral composition.

The surface horizon of the silts (Unit I) alternates between terrigenous aleuropelite silts with a thickness up to 5 to 7 cm and coccolith-sapropel pairs with a thickness ranging from 1 to 3 mm up to 2 to 3 cm (Ref. 7.1). These are also known as "turbidite" deposits. The layer of sapropel silt contains up to 20% organic carbon. The turbidite deposits are green-grey and dark grey and range from indistinctly stratified to finely layered. The sediment is viscous at the surface and soft plastic at depth. There is a characteristic hydrogen sulphide odour.

The silts often include inclusions of hydrotroilite, coccolith ooze, sapropel, and shell and plant detritus. The latter are usually sulphidised with micro-crystals of pyrite. Gas is present as bubbles and is also evident through sediment bulking. Again, there is a characteristic hydrogen sulphide odour. The typical composition of the silts is summarised in Table 7.24.

The majority of the deep water sediments are clays and silts. There is a regular compacting process of the silts with depth in the sediment profile. In the depth interval 0 to 0.1 m from the seabed, the silts are viscous and viscous-plastic; with depth the sediments are compacted, gradually becoming soft-plastic (Ref. 7.1).

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[9] Sapropel (organic-rich sediment) is produced when high levels of surface water productivity deposit organic matter into oxygen depleted bottom waters where the organic matter cannot be consumed.

Table 7.24 Typical Composition of Silt Sediments on Continental Slope (Ref. 7.1)

Parameter	Category	Average Proportion (%)
Grain Size (mm)	0.005 – 0.010	45
	0.01 – 0.05	55
	>0.05	0.38
Grain Type	Clays	13
	Quartz and Feldspars	34
	Rock Fragments	6
	Organic Materials	14
	Secondary Minerals (mica, terrigenous calcite, glauconite, chlorite, epidote-zoisite, amphiboles, pyroxenes)	10
	Accessory Minerals (garnet, tourmaline, sphene, apatite, zircon etc.)	0.2
	Authigenic Calcite	3
	Sulphides	19

The organic-rich sapropel and coccolith horizons are described as micro-layered jelly-like viscous sediments. Carbonate concentrations range between 1 and 57%. Organic matter content ranges from 4 to 36%.

The geotechnical properties of the silt depend on the degree of compaction, which, in turn, is related to the depth of the sediments. Sediment density increases with depth in the sediment profile. The viscosity coefficient of the sediments also decreases with depth. The bulk density of the abyssal plain deposits ranges from about 1.3 g/cm^3 at the sea bed to about 1.5 g/cm^3 at 50 cm depth. Moisture content also varies with lithology and depth. The natural moisture content of the abyssal plain sediments ranges from about 350% at the sea bed to about 125% at 50 cm depth. Sapropel sediments often have particularly high moisture contents, often exceeding 400% and sometimes reaching 550 to 600%.

Gas saturation of the sediments predominantly occurs in the silt deposits. Sources of gases may be migration flow of hydrocarbons from deeper parts of the section (particularly in the Taman Shelf), the gas draining from gas hydrate formations, or the build-up of diagenetic gases due to an excess of organic matter along buried palaeo shore lines (particularly along the shelf between Novorossiysk Bay to Sochi). Carbonate mounds, which are likely to be associated with gas seeps, have been locally identified near the shelf break.

Gas hydrates are commonly present in water depths below about 620 m although occasionally they have been identified in shallower waters (Ref. 7.36).

The concentration of gases (primarily methane) in the sediments is variable, ranging from 0.0107 to 7.1169 cm^3/kg with a typical local background value of 0.0285 cm^3/kg. With depth, the gas content rises by a factor of 1.5 to 2.5 but concentrations can be locally anomalously high, with concentrations being orders of magnitude higher than typical background values.

7.5.5.3 Sediment Quality

A known feature of the Black Sea basin is the presence of hydrogen sulphide (H_2S). The widespread presence of H_2S at depths over around 100 m is controlled by the redox environment. The shelf sediments are typically oxidised whereas the slope sediments are typically poorly reductive (Eh values -100 to +50 mV) but locally poorly oxidising (Eh values +50 to +300 mV); the latter are thought to be due to the influence of landslides and sediment wash. The sediments on the abyssal plain and in the fan of the Kuban and Don Rivers are highly reducing (Eh <-300 mV).

Contemporary Black Sea sediments together with their significant content of organic matter are characterised by high values of concentrations of sulphur and its reduced forms. The main form of accumulation of reduced sulphur in these sediments is pyrite (FeS_2). Pyrite is formed in the process of the sediments' diagenesis from hydrotroilite ($FeS \bullet H_2O$) under its reaction with molecular sulphur.

In deep-water sediments, around 90% of the aggregate amount of reduced sulphur is present in the form of pyrite, which sometimes forms microconcretions (Ref. 7.1). In the silts on the continental slope, where there is an intense sulphate reduction process, there is an upper layer with a significant amount of hydrotroilite and free hydrogen sulphide. The latter's content in the slopes' silts reaches 100 mg/kg, while in deep-water sediments it is usually 3 to 5 mg/L. In the majority of sediments, the molecular-sulphur content is 200 to 300 mg/kg, or 6 to 8% of the aggregate content of sulphur compounds.

The pH of the continental slope sediments ranges from 6.98 to 8.12 with an average value of 7.54. The pH of the abyssal plain sediments is relatively even, ranging from 7.43 to 7.77 with an average value of 7.57.

Previous surveys in the area have identified the presence of contaminants in the marine sediments. Contaminants previously identified include petroleum hydrocarbons, phenols, anionic surfactants and heavy metals. Concentrations were typically highest near the coast, particularly in the vicinity of the main towns.

In addition, some heavy metals (e.g. iron, manganese) are naturally present in relatively high concentrations in the marine sediments in deep waters owing to the prevailing redox environment.

The level of sea bed pollution depends on many factors. These are mainly the lithological type of the deposit, particle sizes, the depth of the sea, the properties of the polluting substances (pollutants) and the level of their arrival from the coast, hydrological conditions, the system of currents, etc.

For the Caucasian coast of the Black Sea, which has a narrow shelf, pollutants in suspension are carried beyond the shelf, to the foot of the slope, where, as a rule, their greatest concentrations occur. In the shallow water of the coastal zone the highest concentration of terrigenous material is found. In this zone there is a greater degree of disturbance of sediment and a greater amount of oxidation taking place. This results in a more intensive self-purification of the sediment; these factors become weaker with distance from the shore.

Sediment sampling was undertaken in the 2010, 2011 and 2013 surveys (Ref. 7.1, 7.8) to assess concentrations of potential pollutants; the results are summarised in Table 7.25 (2010 and 2011 samples), Table 7.26 (2013 grab samples) and Table 7.27 (2013 sediment cores). In the absence of appropriate Russian standards for the assessment of marine sediments, international standards for contaminated sediments (target values of the "Dutch List") (Ref. 7.18) were used to benchmark the quality of marine sediments. The values selected are referred to here as adopted marine sediment standards (AMSS).

Elevated phenol concentrations were identified in the majority of the samples. Concentrations of phenol were typically higher in the deep water samples compared with those from the nearshore environment. The elevated phenols may be derived from anthropogenic sources or may also be associated with natural organic matter in the sediment.

Anionic surfactants were detected in every sediment sample. Concentrations were typically higher in the deep water samples compared with those from the nearshore environment; concentrations were observed to rise with distance from the shore. The anionic surfactants are likely to be derived from anthropogenic sources.

Petroleum concentrations did not exceed the AMSS in the coastal sediment samples. Petroleum concentrations exceeded the AMSS in three out of six samples from the continental shelf and in two out of eight deep water samples. The elevated concentrations of petroleum may be derived from anthropogenic sources or may also be associated with natural organic matter in the sediment or natural hydrocarbons (oil and gas) beneath the Black Sea.

Whilst heavy metals have been detected in the marine sediments and locally exceed the AMSS, the results should be reviewed in the context of the natural geochemical setting. Organic silts and clays in reducing conditions might be expected to naturally have some heavy metals present - e.g. iron is naturally present in the form of pyrite and troilite. The sediment quality data should be viewed in this context. Metal concentrations were typically higher in the shelf and deep water samples than in the coastal samples. This is likely to reflect the change in sediment lithology and redox environment with increasing water depth and distance from the shore.

Table 7.25 Summary of Contaminants in Marine Sediments for 2010-2011 (Ref. 7.1, 7.18)

Parameter	AMSS	Shallow Water Coastal Area		Continental Shelf		Deep Water (Continental Slope and Abyssal Plain)	
		Measured Range (mg/kg)	No. Exceeding AMSS (out of 15)	Measured Range (mg/kg)	No. Exceeding AMSS (out of 6)	Measured Range (mg/kg)	No. Exceeding AMSS (out of 8)
Phenol	0.05	0.05 – 0.40	14	0.01 – 0.37	5	0.40 – 0.68	8
Anionic Surfactants	NA	0.2 – 2.9	-	3.9 – 16.0	-	2.7 – 19.2	-
Petroleum Products	50	0.010 – 0.209	0	18 - 108	3	12 - 407	2
Arsenic	29	0.36 – 0.64	0	2.3 – 3.5	0	1.3 – 5.6	0
Cadmium	0.8	0.12 – 0.48	0	0.05 – 0.22	0	0.02 – 0.661	0
Chromium	100	5.24 – 8.75	0	5.5 – 21.11	0	8.75 – 20.7	0
Copper	35	3.26 – 8.56	0	5.73 – 34.15	0	12.9 – 50.8	6
Iron	NA	3.1 – 13.1	-	3.09 – 18.4	-	13.79 – 26.76	-
Lead	85	0.95 – 19.8	0	8.05 – 24.6	0	5.7 – 23.6	0
Manganese	NA	0.11 – 0.23	-	0.83 – 0.37	-	0.435 – 0.662	-
Mercury	0.3	0.007 – 0.037	0	0.014 – 0.087	0	0.017 – 0.084	0
Molybdenum	10	<0.001	0	0.001 – 0.008	0	0.001 – 0.007	0

Continued...

Parameter	AMSS	Shallow Water Coastal Area		Continental Shelf		Deep Water (Continental Slope and Abyssal Plain)	
		Measured Range	No. Exceeding AMSS	Measured Range	No. Exceeding AMSS	Measured Range	No. Exceeding AMSS
		(mg/kg)	(out of 15)	(mg/kg)	(out of 6)	(mg/kg)	(out of 8)
Nickel	35	1.3 – 9.0	0	0.95 – 31.48	0	13.7 – 38.3	2
Selenium	NA	<0.1	-	<0.1	-	<0.1	-
Zinc	140	12.9 – 28.1	0	16.4 – 75.4	0	26.9 – 69.5	0

Complete.

Copper concentrations exceeded the AMSS in six out of eight deep water samples. Nickel concentrations exceeded the AMSS in two out of eight deep water samples. Although these samples had concentrations that were elevated above the AMSS, the measured concentrations are within the typical range for Black Sea sediments and thus do not necessarily indicate anthropogenic pollution. Heavy metal concentrations were typically higher in the Gelendzhik / Anapa region of the shelf and slope than in the rest of the Marine Survey Area.

Table 7.26 Summary of Contaminants in Marine Sediments from 2013 Grab Samples (Ref. 7.8, 7.18)

Parameter	AMSS (mg/kg)	Shallow Water Coastal Area		Continental Shelf		Deep Water (Continental Slope)	
		Measured Range	No. Exceeding AMSS	Measure d Range	No. Exceeding AMSS	Measured Range	No. Exceeding AMSS
		(mg/kg)	(out of 14)	(mg/kg)	(out of 25)	(mg/kg)	(out of 4)
Aluminium	NA	450 – 1300	NA	3600 – 8300	NA	6900 – 9300	NA
Arsenic	29	5– 17	0	2.6 – 6.4	0	3.6 – 4.6	0
Cadmium	0.8	0.038 – 0.096	0	0.058 – 0.2	0	0.13- 0.33	0

Continued…

Parameter	AMSS (mg/kg)	Shallow Water Coastal Area		Continental Shelf		Deep Water (Continental Slope)	
		Measured Range	No. Exceeding AMSS	Measured Range	No. Exceeding AMSS	Measured Range	No. Exceeding AMSS
		(mg/kg)	(out of 14)	(mg/kg)	(out of 25)	(mg/kg)	(out of 4)
Chromium	100	2.2 – 4.1	0	4.5 – 8.3	0	6.5 – 8.1	0
Copper	35	2.4 – 7.7	0	4.9 – 27	0	18 - 33	0
Lead	85	1.8 – 5	0	6.6 – 26	0	8.1 – 27	0
Mercury	0.3	0.004 – 0.015	0	0.017 – 0.062	0	0.028 – 0.055	0
Nickel	35	2.3 – 9.9	0	7.3 – 21	0	18 – 22	0
Selenium	NA	<0.5	-	<0.5	-	<0.5	-
Zinc	140	14 – 42	0	29 – 99	0	46 - 70	0
Petroleum Products	50	<5 – 5.5	0	<5 – 110	6	<5 – 42	0
Total PCB (Sum 7)(µg/kg)	20 (µg/kg)	0.11 – 0.91	0	0.25 – 3.8	0	0.73 – 3.5	0
BETX (µg/kg)	NA	<10	-	<10	-	<10	-
Total PAH (Sum 10) (µg/kg)	1000 (µg/kg)	1.68 – 21.37	0	1.3 – 340.92	0	84.39 – 239.12	0

Complete.

From the 2013 sediment analyses petroleum products were the only parameter to exceed the AMSS in the grab samples (Ref. 7.8). The AMSS was exceeded at 6 out of 25 locations on the continental shelf with no exceedances from coastal or continental slope samples.

Similar to the 2010 and 2011 surveys, parameter concentrations increased with increasing water depth with the highest concentrations recorded in the continental shelf and continental slope samples with the exception of arsenic, which showed the highest concentration in coastal samples.

Table 7.27 Summary of Contaminants in Marine Sediments from 2013 Core Samples (Ref. 7.8, 7.18)

Parameter	AMSS	Shallow Water Coastal Area		Continental Shelf	
		Measured Range	No. Exceeding AMSS	Measured Range	No. Exceeding AMSS
		(mg/kg)	(out of 6)	(mg/kg)	(out of 8)
Aluminium	NA	640 – 990	NA	5000 – 9100	NA
Arsenic	29	11– 28	0	3.5 – 5.6	0
Cadmium	0.8	0.035 – 0.055	0	0.12 – 0.16	0
Chromium	100	2.9 – 3.4	0	6 – 7.4	0
Copper	35	2.6 – 11	0	16 – 26	0
Lead	85	2.8 – 4.7	0	8.3 – 21	0
Mercury	0.3	0.004 – 0.07	0	0.032 – 0.057	0
Nickel	35	4.5 – 9.7	0	16 – 22	0
Selenium	NA	<0.5	-	<0.5	-
Zinc	140	22 – 41	0	42 – 64	0
Petroleum Products	50	<5 – 150	1	<5 – 54	1
Total PCB (Sum 7)(µg/kg)	20(µg/kg)	0.12 – 0.2	0	0.17 – 1.74	0
BETX (µg/kg)	NA	<10	-	<10	-
Total PAH (Sum 10) (µg/kg)	1000(µg/kg)	1.24 – 11.58	0	18.47 – 146.58	0

Concentrations of petroleum products were again the only parameter to exceed the AMSS in the core samples from proposed areas of dredging and seabed intervention. Exceedances occurred in 1 of 6 samples from the coastal samples in the proposed dredging area (location 17, top half of core = 150 mg/kg) and 1 of 8 samples from the seabed intervention areas on the continental shelf (location 38, top half of core = 54 mg/kg).

7.6 Conclusion

This chapter has provided a description of the physical and geophysical environment associated with the Project. Further, detailed baseline studies have been undertaken as part of each of the assessments contained within Chapters 8 to 18 which follow.

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Chapter 8: Soils, Groundwater and Surface Water

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8 Soils, Groundwater and Surface Water

8.1 Introduction

This chapter presents the baseline characteristics of terrestrial soils, surface water and groundwater regimes within the terrestrial part of the landfall section of the South Stream Offshore Pipeline – Russian Sector (also referred to as 'the Project'). It describes the impacts that the Construction and Pre-Commissioning Phase, Operational Phase (including Commissioning Phase and Full Operational Phase), and Decommissioning Phase of the Project may have on these environments. It also identifies mitigation measures required in order to remove and/or minimise potentially adverse impacts to the environment.

The environmental attributes of the terrestrial part of the landfall section discussed in this chapter comprise:

- Soils;
- Groundwater; and
- Surface water.

Impacts to soils are assessed because vegetation will be cleared and topsoil removed during construction which increases the potential for soil erosion by wind and by surface runoff. There is also the potential to encounter existing soil contamination associated with past land use or for new contamination to occur through accidental leaks or spills, which could result in impact on soils and mobilisation of soil contamination into groundwater or surface water. In addition, the stockpiling of topsoil and subsequent re-profiling may result in change to the soil structure.

Impacts to groundwater and to surface water are assessed as there is the potential for water quality and quantity to be affected. For example, elevated levels of suspended solids may occur in runoff during construction or accidental leaks or spills may occur.

Where possible, the physical and chemical characteristics of the terrestrial soils and groundwater regime that are described in this chapter apply to the terrestrial part of the landfall section. Where specific soil, groundwater or surface water characteristics were observed to be variable across the terrestrial part of the landfall section, descriptions have been provided in further detail for localised zones.

8.2 Scoping

The scope of the soil and water impact assessment for the Project was defined through a scoping process which identified soil and water receptors and potentially significant impacts related to the Project. Baseline information which informed the scoping process largely drew on information gathered from studies undertaken for the South Stream Offshore Pipeline, including feasibility, engineering and environmental surveys carried out since 2008. Key steps in the scoping process for soil and water comprised the following:

- The Project description was reviewed to identify activities with the potential to significantly affect soil and water receptors;

- Soil and water receptors within the Project's Area of Influence (see Section 8.3.1 for definition) were identified through a process of secondary data review (see Section 8.4.2 for further detail), stakeholder consultation regarding abstractions, previous studies undertaken for the South Stream Offshore Pipeline and professional expertise; and
- A review of relevant national and international legislative requirements and lender requirements.

An Environmental Issues Identification (ENVIID) workshop, which involved Environmental and Social Impact Assessment (ESIA) specialists, South Stream Transport representatives and project engineers, was undertaken to assist in the identification of impacts and receptors. During this workshop, each activity was examined, drawing upon the experience of the technical specialists and their understanding of the extent and nature of the Project Activities and the natural environment, to understand:

- How activities were expected to interact with soil and water receptors, and whether this is likely to result in a beneficial or adverse impact (pertinent activities are described in Section 8.6.1.1); and
- Which receptors will potentially be impacted by each activity and the potential significance of those impacts (key receptors are described in Section 8.6.1.2).

The outcome of the ENVIID workshop was the production of an ENVIID register which identified the various elements of the Project and their interaction or potential impact on sensitive ecological receptors.

The assessment below has therefore been informed through this process of impact and receptor identification.

8.3 Spatial and Temporal Boundaries

8.3.1 Project Area

The Project Area (as described in **Chapter 1 Introduction**) is subdivided into three sections: the landfall, nearshore and offshore sections. This chapter assesses only the terrestrial part of the landfall section of the Project Area. This extends from the shoreline to the permanent landfall facilities including the Pipeline route (both buried and microtunnelled sections).

8.3.2 Study Area

The Study Area is a terrestrial zone extending up to approximately 1.5 km either side of the centreline of the Pipeline route (Figure 8.1) and landfall facilities boundary. The Study Area has been assessed within a regional context with respect to the geology and river catchments.

8.3.3 Survey Areas

The Survey Area for soil and water is the same as the Study Area and is the area in which surveys were undertaken for the Project.

8.3.4 Zone of Influence

The Zone of Influence has been assumed to be approximately equivalent to the Study Area plus the downstream stretches of the watercourses and the area around the abstraction well at Sukko.

The Zone of Influence includes new roads constructed or upgraded for the Project but not existing roads that extend outside the areas defined above.

The Study Area and Zone of Influence are the same for each Project phase i.e. Construction and Pre-Commissioning Phases; Operational Phase; Decommissioning Phase; and for the assessment of unplanned events (discussed in **Chapter 19 Unplanned Events**).

8.4 Baseline Data

8.4.1 Methodology and Data

In order to assess potential impacts on soil, groundwater and surface water, secondary (i.e. existing data based on desk-based research) and primary data regarding the relevant baseline characteristics have been identified and assessed. Following this, a gap analysis was undertaken to inform the need for additional primary data sources to fill the data gaps. Primary data was then collected during field surveys.

Data have been collected and presented at different spatial levels as appropriate according to the nature of the potential impact to be assessed and the baseline indicator in question.

The baseline characterisation considered:

- Soil:
  - Soil types; and
  - Soil chemistry.
- Groundwater:
  - Aquifer characteristics;
  - Groundwater levels; and
  - Groundwater chemistry.
- Surface Water:
  - Watercourse characteristics;
  - Surface water chemistry; and
  - Stream bed sediment chemistry.

8.4.2 Secondary Data

Contextual information on the regional setting with respect to soil and water was obtained through literature review. Published geological and topographical maps were reviewed to characterise the ground conditions and local geomorphological and hydrological setting. Meteorological data was based on published datasets.

Consultations with regulators and other stakeholders were undertaken as part of the initial assessment for the Study Area (Ref. 8.1 to 8.7). The consultees included:

- Kuban Basin Water Agency, regarding water consumers;
- Russian Ministry of Natural Resources, regarding sanitary protection zones;
- Russian Ministry of Public Health and Social Development, regarding sanitary protection zones;
- Russkaya Compressor station, regarding water supply;
- Supsekh Administration, regarding water supply; and
- Ministry of Defence regarding the existing water well at Sukko.

8.4.3 Data Gaps

The secondary (existing) data research exercise revealed that there were a number of data gaps. The data gaps were most acute in respect of the following themes:

- Soil characteristics and distribution at the Project-scale;
- Baseline soil, groundwater and surface water chemistry, including potentially existing contamination;
- Groundwater levels; and
- Details of nearby water abstractions, including locations, usage and abstraction rates.

These data gaps have been addressed through field surveys, the details of which are set out in Section 8.4.4.

8.4.4 Primary Data/Baseline Surveys

8.4.4.1 Overview

A number of baseline surveys have been undertaken in relation to soil and water.

Environmental surveys were undertaken in the Survey Area in 2010, 2011 and 2013 (Refs. 8.1, 8.8), and covered the following disciplines relevant to this chapter:

- Landscape;
- Soils;
- Groundwater;
- Surface water;
- Geomorphological geohazards; and
- Contamination.

The field surveys included mapping of soil, geomorphological and hydrogeological features. Samples were obtained of soil, groundwater, surface water and stream bed sediments for laboratory analysis to characterise their physico-chemical properties.

In addition to the environmental surveys described above, engineering surveys have been undertaken (Refs. 8.9, 8.10, 8.11 and 8.12) which included intrusive and non-intrusive geotechnical investigation. These geotechnical investigations included boreholes and geophysical profiling. This has provided additional information on local ground conditions, depth to bedrock, groundwater levels and geomorphology.

The baseline data presented in this chapter is predominantly based on information gathered during the environmental surveys (Ref. 8.1, 8.8).

The survey locations within the Study Area are shown in Figure 8.1.

8.4.4.2 Soil Survey

The purpose of the soil surveys (Ref. 8.1, 8.8) was to:

- Determine the soil spatial distribution, revealing the full range of dominant and associated soils,
- Assess the natural variation of their morphogenetic properties; and
- Assess the agro-chemical soil properties where applicable.

The soil studies were carried out according to requirements Russian standard SanPiN 11-207-97 and the All Union Instruction on Soil Investigation 1973 given in the Peter Gaz survey reports (Ref. 8.1).

The soil survey in the Study Area was undertaken along three linear survey lines oriented roughly perpendicular to the coast with a small number of additional sites in other areas. In total, 65 soil profile sections were undertaken using pits excavated to a depth of approximately 0.9 m.

The geomorphology of the Study Area was assessed by field mapping and profiling at selected locations. The geomorphological survey identified and assessed geomorphologically active features.

8.4.4.3 Soil Quality

The purpose of the soil quality surveys was to determine the baseline soil chemistry.

During the 2010 investigation (Ref. 8.1), 30 soil samples were collected from 16 locations at varying depths. During the 2013 investigation (Ref. 8.8), 10 soil samples were collected from five locations. Samples underwent laboratory analysis of physico-chemical properties and agrochemical nutrient levels.

To evaluate the potential for chemical contamination of soils, sampling was carried out on test plots within the Survey Area. Forty two composite soil samples were prepared by mixing equal volumes of not less than five samples taken from the test plot (no smaller than 5×5 m) uniformly throughout the depth of the layer 0 to 0.1 m. During collection, odour, texture, presence of films, oil stains, inclusions and organic content (presence of peat) were noted. Sampling, preservation, storage and transportation were carried out in accordance with the requirements of Russian standards; GOST 17.4.3.01-83 and GOST 17.4.4.02.84 (Ref 8.1).

8.4.4.4 Groundwater Quality

During the 2010 investigation a total of three water samples were collected from springs within the Survey Area in accordance with Russian standard SP 11-102-97. During the 2013 investigation a further three water samples were collected from additional springs in accordance with Russian standard SP 11-102-97. Sampling, preservation, storage and transportation of water samples were carried out in accordance with the requirements of Russian standards GOST 17.1.5.05-85 and GOST R 51592-2000 (Ref 8.1). The water was collected by hand in disposable plastic containers and glass bottles.

Air and water temperature were measured and field observations of colour, odour, turbidity, and taste were made. Immediately following sampling, the pH and dissolved oxygen content were determined. Samples were refrigerated (temperature 2 to 5°C) and delivered to the laboratory.

8.4.4.5 Surface Water Quality

During the 2010 investigation a total of four surface water samples were collected within the Survey Area in accordance with Russian standard SP 11-102-97 (Ref. 8.1). During the 2013 investigation a further two water samples were collected in accordance with SP 11-102-97. Sampling, preservation, storage and transportation of the samples were carried out in accordance with the requirements of Russian standards GOST 17.1.5.05-85 and GOST R 51592-2000 (Ref. 8.1). Water samples were collected at a depth of 0.2 to 0.5 m by hand in disposable plastic containers and glass bottles.

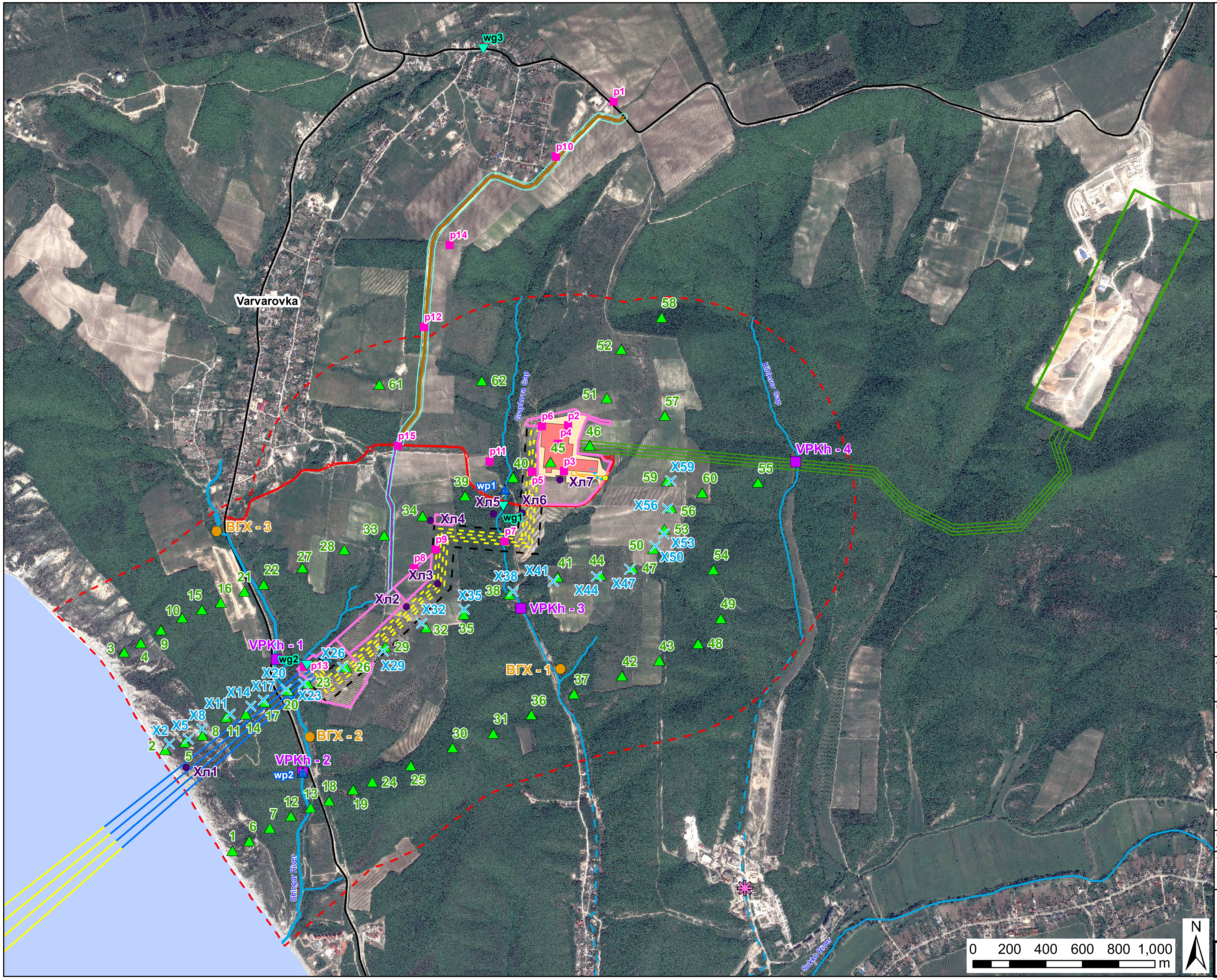
Air temperature, water temperature, water depth and water clarity were measured and field observations of colour, odour and turbidity were made. Immediately following sampling, the pH and dissolved oxygen content were determined. Samples were refrigerated (temperature 2 to 5°C) and delivered to the laboratory.

8.4.4.6 Stream Bed Sediment Analysis

Within the Survey Area a total of six stream bed samples were collected at the same locations as the surface water quality samples. Sampling, preservation, storage and transportation of the samples were carried out in accordance with the requirements of Russian standards GOST 17.1.5.01-80 and RD 52.24.609-99 (Ref. 8.1). The sediments were sampled from the depth 0 to 5 cm. During collection, odour, texture, presence of films, oil stains, inclusions and organic content were noted.

8.4.4.7 Laboratory Analysis

The laboratory analysis for the Survey Area soil and water samples was undertaken in the: Test Laboratory Centre (TLC GC RES LLC), the Environmental Analytical Laboratory of Peter Gaz, and the laboratory of the RSC Kurchatovskiy Institute.



LEGEND

Proposed water supply well

2011 Survey

Хл1 - Soil Sampling Point

2010 Survey

1- Soil and geomorphology survey point

X1 - Soil quality sampling point

B?X-1 - Groundwater sampling point

VPKh-1 - Surface water sampling point

2013 Survey

wp1 - Surface water sampling point

wg1 - Groundwater sampling point

p1 - Soil quality sampling point

Rivers

Inferred watercourses

Main roads

Study Area

Russian Sector of South Stream Offshore Pipeline

Proposed landfall section pipelines

Landfall facilities

Anode ground bed for cathodic protection of pipelines

Proposed microtunnels

Proposed offshore pipelines

Anode ground bed connection to landfall facilities

Construction corridor

Cut and fill side slopes

Temporary construction area for road construction

Construction sites

Permanent access road to be constructed by SSTTBV

Temporary access road constructed by SSTTBV

Varvarovka bypass road (used by Project during construction only)

United Gas Supply System

United Gas Supply System Pipelines

Russkaya compressor station

Permanent access road to be constructed by Gazprom Invest

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue

For Information

Client

South Offshore Pipeline Stream ENERGISING EUROPE

Project Title

SOUTH STREAM OFFSHORE PIPELINE

Drawing Title

SURVEY LOCATIONS IN STUDY AREA

Drawn	Checked	Approved	Date
DH	RW	MW	18 Feb 2014

URS Internal Project No.	Scale @ A3
46369082	1:20,000

URS Infrastructure & Environment UK Limited
Scott House
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Telephone (01256) 310200
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Drawing Number

Figure 8.1

Rev

Plot Date: 18 Feb 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 8 Soil and Groundwater\Figure 8-1 Survey Locations in Study Area (landfall section).mxd

8.4.5 Data Assumptions and Limitations

The available soil, water and sediment data are sufficient to inform the baseline of the study in order to determine the potential for impacts and undertake the assessment.

The following limitations apply to the baseline dataset:

- There is limited soil data on the exact route of the permanent and temporary access roads. However, it is considered there is sufficient data from the Survey Area as a whole to infer likely ground conditions along the new access roads;
- Groundwater and surface water quality was sampled on two occasions. However, groundwater and surface water quality may be subject to fluctuations and a single sampling event may not be fully representative of long-term water quality patterns. Parameters such as suspended solids and dissolved oxygen may vary naturally in response to flow rates and following rainfall events;
- Groundwater was sampled from springs rather than boreholes;
- There are limited hydrological flow regime measurements. The flow regimes of the surface watercourses vary in response to rainfall. Hydrological modelling based on catchment size and run-off estimates in small catchments with permeable bed sediments that are partially fed by springs tends to give results with a high degree of uncertainty. However, further quantification of the flow regime would not alter the outcome of the impact assessment;
- There is uncertainty over the exact locations of nearby abstractions (Refs. 8.3, 8.5). The nearest confirmed groundwater abstraction (which is associated with the Russkaya Compressor station) is understood to be at more than 5 km to the northeast of the Study Area; the Project does not lie within a sanitary protection zone of this abstraction (Ref. 8.3). Anapa Administration have confirmed there are no licensed abstractions in the vicinity of the Project Area (Ref. 8.7);
- The closest surface water abstractions to the Study Area are reported to be upstream of the Pipeline route (Ref. 8.5). There is a potential abstraction point from surface water upstream of the road crossing on Graphova Gap but there is no information as to the volumes or timings of abstraction at this location; and
- Information is available on the Russian Ministry of Defence water supply well located in Sukko proposed to be used by the Project but there is limited information on any other groundwater abstractions in and near Sukko. It has been assumed that the current abstraction licence limits for the proposed water source is adequately protective of other abstractors in the region.

8.5 Baseline Characteristics

This section first introduces the policy, regulatory and administrative frameworks and goes to identify the national and international standards relevant to soils, groundwater, surface water, and sediment. It provides a description of the baseline, i.e., "pre-existing" environment conditions, compares those conditions against the national and international standards, and then describes the existing status with respect to administrative frameworks.

8.5.1 Applicable Standards

The legal framework of relevance to the Project is outlined in **Chapter 2 Policy, Regulatory and Administrative Framework**. Additional, more specific regulations of relevance to soils, groundwater, surface water and sediment conditions include the following Russian national standards on soil and water quality:

- Russian standard GN 2.1.7.2041-06, on maximum permissible concentrations (MPCs) of chemical substances in the soil (Ref. 8.13);
- Russian standard GN 2.1.7.2511-09, on approximate permissible concentrations (APCs) of chemical substances in soil (Ref. 8.14);
- Russian standard GN 1.2.2701-10, on hygienic regulations of pesticides in the environment (list) (Ref. 8.15);
- Russian standard SanPiN 2.1.4.1175-02, on hygiene requirements for quality of water from non-centralised water supply systems. Sanitary protection of water sources (Ref. 8.16);
- Russian standard GN 2.1.5.1315-03, on MPCs of chemical substances contained in water of water bodies for economic-potable and social-domestic water use (Ref. 8.17);
- Russian standard SanPiN 2.1.5.980-00, on hygienic requirements for surface waters protection (Ref. 8.18);
- Order of the Federal Fisheries Agency No. 20 dated 18.01.2010, on approving the standards for water quality in fishing water bodies, including standards for maximum permissible concentrations of harmful substances in the water of fishing water bodies (Ref. 8.19);
- Russian standard SanPiN 2.1.4.1110-022.1.4 on drinking water and water supply of populated areas, zones of sanitary protection of water sources (Ref. 8.20);
- Article 65 of the Water Code of the Russian Federation (Ref. 8.21); and
- Russian standard SanPiN 2.1.7.1287 -03. Soil quality sanitary epidemiological requirements for industrial sites (Ref. 8.22).

Table 8.1, Table 8.2, Table 8.3 and Table 8.4 present the respective relevant soil, groundwater, surface water quality and sediment limits for the Project, based on the regulations detailed above and the World Health Organisation (WHO) Water Quality Guidelines (Ref. 8.23) as recommended by the International Finance Corporation (IFC) Environmental, Health and Safety General Guidelines (Ref. 8.24).

Russian national standards take precedence over international standards because they are generally more stringent and therefore national standards will be used to assess current baseline conditions.

The assessment criteria for soil quality have been based on the following guidance:

- The soil quality assessment has been made using Russian standard GN 2.1.7.2041-06 and Russian standard GN 2.1.7.2511-09. These standards define the MPCs and APCs respectively for various chemical substances permitted to occur in soils; and
- MPC levels specify the concentration of a harmful substance within soil below which there are no significant adverse impacts upon human health and which will not cause detrimental impacts to soil quality. Where MPC levels are not provided for specific pollutants, APC levels are typically used to determine upper limits for contaminants in the soil.

Table 8.1 Relevant Soil Quality Limits

Parameter	Unit	Russian National Limits for Chemicals in Soil*	
		MPC level (Ref. 8.13)	APC (Ref. 8.14)
pH	pH units	-	-
Arsenic, As	Milligrams per kilogram (mg/kg)	2	-
Cadmium, Cd	mg/kg	-	2
Copper, Cu	mg/kg	-	132
Chromium, Cr**	mg/kg	-	-
Nickel, Ni	mg/kg	-	80
Lead, Pb	mg/kg	32	-
Zinc, Zn	mg/kg	-	220
Mercury, Hg	mg/kg	2.1	-
Manganese, Mn	mg/kg	1,500	-
Iron, Fe†	mg/kg	-	-
Benzo(a)pyrene	mg/kg	0.02	-
Total Polychlorinated biphenyl (PCB) ±	mg/kg	-	0.06
Oil Product††	mg/kg	1,000	1,000
Phenols±±	mg/kg	-	-

Continued...

Parameter	Unit	Russian National Limits for Chemicals in Soil*	
		MPC level (Ref. 8.13)	APC (Ref. 8.14)
Hexachlorobenzene, HCB***	mg/kg	0.03	0.03
Hexachlorocyclohexane, HCH***	mg/kg	0.1	0.1
Heptachlor***	mg/kg	0.05	0.05
Total DDT (including DDD and DDE)***	mg/kg	0.1	0.1

* Russian APC levels vary depending on the soil type encountered (e.g. APC levels may vary depending on whether soils are silty-sandy and sandy soils, sandy loamy soils or loam soil etc.). APC levels presented in Table 8.1 above are representative of clayish and loamy soils with pH>5.5 which are representative of soils in the landfall section (Ref. 8.13).
** In the absence of a soil standard for chromium, the sediment standards (Table 8.4) shall be adopted.
† Soil standards are not applicable for iron as concentrations are primarily controlled by the underlying geology rather than reflecting anthropogenic influences.
± APC levels for total PCBs are taken from the Russian Order of the State Committee for Ecology of Russian Federation from 13.04.99 No. 165 (taken from Ref. 8.25).
†† Permissible Levels of Oil Products are taken from a Letter of the Ministry of Environment and Natural Resources (Ref. ±±8.2, provided within Peter Gaz report Ref. 8.1).
In the absence of a soil standard for phenols, the sediment standards (Table 8.4) shall be adopted. However, it is also*** noted that phenol in soil may be derived from natural materials as well as or instead of anthropogenic sources.

Complete.

The assessment criteria for groundwater quality have been based on the following guidance:

- Russian standard GN 2.1.5.1315-03, Russian standard SanPiN 2.1.4.1175-02, and WHO Water Quality Guidelines. These standards define the recommended maximum concentrations for various chemical substances in groundwater. These concentrations are based on human health considerations where groundwater is used for potable supply.

Table 8.2 Relevant Groundwater Quality Limits

Parameter	Unit	Russian National Limit Values		WHO Guidelines (Ref. 8.23)
		Sanitary Rules Standard value (Ref. 8.16)	MPC for Potable and Domestic Use (Ref. 8.17)	
Calcium, Ca^{2+}	Milligrams per litre (mg/l)	-	-	-
Magnesium, Mg^{2+}	mg/l	-	50	-
Potassium, K^{+}	Mg/l	-	-	-

Continued…

Parameter	**Unit**	**Russian National Limit Values**		**WHO Guidelines (Ref. 8.23)**
		Sanitary Rules Standard value (Ref. 8.16)	**MPC for Potable and Domestic Use (Ref. 8.17)**	
Sodium, Na^{+}	mg/l	-	200	-
Ammonium, NH_4^{+}	mg/l	-	1.5	-
Chloride, Cl^{-}	mg/l	350	-	-
Sulphate, SO_4^{2-}	mg/l	500	-	-
Phosphate, PO_4^{2-}	mg/l	-	3.5	-
Nitrate, NO_3^{-}	mg/l	45	-	50
Nitrite, NO_2^{-}	mg/l	-	3.3	3
Hydrogen carbonate, HCO_3-	mg/l	-	-	-
pH	pH units	6 – 9	-	-
Permanganate oxygen demand	mg/l	5 – 7	-	-
Total salinity level	mg/l	1,000 – 1,500	-	
Chemical Oxygen Demand (COD)	mg O_2/l	-	-	-
Dissolved O_2	mg/l	-	-	-
Mercury, Hg	µg/l	-	0. 5	6
Arsenic, As	µg/l	-	10	10
Chromium, Cr	µg/l	-	50	50
Silica, Si	mg/l	-	10	-
Cadmium, Cd	Micrograms per litre (µg/l)	-	1	3
Lead, Pb	µg/l	-	10	10

Continued…

Parameter	Unit	Russian National Limit Values		WHO Guidelines (Ref. 8.23)
		Sanitary Rules Standard value (Ref. 8.16)	MPC for Potable and Domestic Use (Ref. 8.17)	
Nickel, Ni	µg/l	-	20	70
Iron, Fe	mg/l	-	0.3	-
Manganese, Mn	µg/l	-	100	400
Copper, Cu	µg/l	-	1,000	2,000
Zinc, Zn	µg/l	-	1,000	-
Benzo(a)pyrene	µg/l	-	0. 01	7
Oil products	µg/l	-	0.3	(0.01)*
Organochlorine pesticides (OCPs)	µg/l	-	-	(0.03)**
Anionic surfactant	mg/l	-	0.5	-
Phenols	µg/l	-	100	-
Total polychlorinated biphenyl (PCBs)	µg/l	-	-	-
Hexachlorobenzene (HCB)	µg/l	-	1	-
Gamma-hexachlorocyclohexane (γ-HCH)	µg/l	-	20	2†
Dichlorodiphenyltrichloroethane (DDT) compounds (including dichlorodiphenyldichloroethylene (DDE) and dichlorodiphenyldichloroethane (DDD)	µg/l	-	100	1

* There is no WHO standard specified for petroleum hydrocarbons. The adopted value presented here is based on the WHO standard for Benzene (a common component found in petroleum hydrocarbons) and guidance on acceptability for potable supply based on taste and odour.
** There is no WHO standard specified for total organochlorine pesticides. The adopted value presented here is based on the WHO standard for Aldrin and Dieldrin, which is the most stringent of the available WHO standards for organochlorine pesticide compounds.
† WHO value for γ-HCH. No values for α-HCH or β-HCH given in WHO standards.

Complete.

The assessment criteria for surface water quality have been based on the following guidance:

- Russian standard SanPiN 2.1.5.980-00, Russian standard GN 2.1.5.1315-03, Order of the Federal Fisheries Agency No. 20, and WHO Water Quality Guidelines. These standards define the recommended maximum concentrations for various chemical substances in surface waters. These concentrations are based on human health, amenity and ecological considerations.

Table 8.3 Relevant Surface Water Quality Limits

Parameter	Unit	Russian National Limit Values			WHO Guidelines (Ref. 8.23)
		Permissible Level for Hygienic Requirements (Ref. 8.18)	MPC level for Potable and Domestic Use (Ref. 8.17)	MPC level Fishery Water Bodies (Ref. 8.19)	
Calcium, Ca^{2+}	mg/l	-	-	180	-
Magnesium, Mg^{2+}	mg/l	-	50	40	-
Potassium, K^{+}	mg/l	-	-	50	-
Sodium, Na^{+}	mg/l	-	200	120	-
Ammonium, NH_4^{+}	mg/l	-	1.5	0.5	-
Chloride, Cl^{-}	mg/l	-	350	300	-
Sulphate, SO_4^{2-}	mg/l	-	500	100	-
Phosphate, PO_4^{3-}	mg/l	-	3.5	0.15	-
Nitrate, NO_3^{-}	mg/l	-	45	40.0	<50
Nitrite, NO_2^{-}	mg/l	-	3.3	0.08	<3
Hydrogen carbonate, HCO_3^{-}	mg/l	-	-	-	-
pH	pH units	6.5 - 8.5	-	-	-
Permanganate demand	mg O_2/l	-	-	-	-
COD	mg O_2/l	15.0 - 30.0	-	-	-

Continued…

Parameter	Unit	Russian National Limit Values			WHO Guidelines (Ref. 8.23)
		Permissible Level for Hygienic Requirements (Ref. 8.18)	MPC level for Potable and Domestic Use (Ref. 8.17)	MPC level Fishery Water Bodies (Ref. 8.19)	
Dissolved O_2	mg O_2/l	>4	-	-	-
Total salinity level	mg/l	1,000	-	-	
Biological oxygen demand (BOD)	mg/l	2.0 – 4.0		-	-
Mercury, Hg	µg/l	-	0.5	0.01	6
Arsenic, As	µg/l	-	10	50	10
Chromium, Cr	µg/l	-	50	20	50
Silica, Si	µg/l	-	10	-	-
Cadmium, Cd	µg/l	-	1	5	3
Lead, Pb	µg/l	-	10	6	10
Nickel, Ni	µg/l	-	20	10	70
Iron, Fe	mg/l	-	0.3	0.1	-
Manganese, Mn	µg/l	-	100	10	400
Copper, Cu	µg/l	-	1,000	1	2000
Zinc, Zn	µg/l	-	1,000	10	-
Oil products	mg/l	-	0.3	0.05	(0.01)
OCPs	µg/l	-	-	-	(0.03)
Anionic surfactant	mg/l	-	0.5	0.5	-
Phenols	µg/l	-	100	1	-
Benzo(a)pyrene	µg/l	-	0. 01	0. 01	<7

Continued...

Parameter	Unit	Russian National Limit Values			WHO Guidelines (Ref. 8.23)
		Permissible Level for Hygienic Requirements (Ref. 8.18)	MPC level for Potable and Domestic Use (Ref. 8.17)	MPC level Fishery Water Bodies (Ref. 8.19)	
HCB	µg/l		-	1	-
HCH compounds	µg/l		-	20	2*
DDT compounds (including DDE and DDE)	µg/l		-	100	1

* Based on value for γ-HCH. No values for α-HCH or β-HCH given.

Complete.

In the absence of official Russian standards for stream bed sediments, the standards for the streambed sediments have been based on the current Dutch and Canadian guidelines (Refs. 8.26, 8.27 and 8.28). The Dutch guidelines apply to both soils and aquatic sediments and were derived primarily on human toxicological grounds; these values are widely used throughout Europe. It should be noted that these values are based on standard soil comprising 10% organic matter and 25% clay; the target values may be factored according to the measured organic matter and clay content of the individual sediment samples where sediments differ substantially from the assumed standard soil. The values based on the Canadian interim sediment quality guidelines apply solely for aquatic sediments and are derived primarily on ecotoxicological grounds. Using both standards allows characterisation of baseline sediment quality in the context of the environment in the Study Area.

Table 8.4 Adopted Stream Bed Sediment Quality Limits

Parameter	Unit	Target Level (Ref. 8.26)	Guideline Level (Ref. 8.28)
Arsenic, As	mg/kg	29	5.9
Cadmium, Cd	mg/kg	0.8	0.6
Lead, Pb	mg/kg	85	35
Mercury, Hg	mg/kg	0.3	0.17
Zinc, Zn	mg/kg	140	123
Chromium, Cr	mg/kg	100	37.3

Continued...

Parameter	Unit	Target Level (Ref. 8.26)	Guideline Level (Ref. 8.28)
Copper, Cu	mg/kg	36	35.7
Nickel, Ni	mg/kg	35	NA
Benzo(a)pyrene*	mg/kg	1	0.0319
Oil products	mg/kg	50	NA
Phenol	mg/kg	0.05	NA
Total PCBs	mg/kg	0.02	0.0341
Hexachlorobenzene, HCB	mg/kg	0.03	NA
α-HCH	mg/kg	0.003	0.00094
β-HCH	mg/kg	0.009	0.00094
γ-HCH	mg/kg	0.00005	0.00094
Heptachlor	mg/kg	0.0007	4
Aldrin	mg/kg	0.00006	NA
Dieldrin	mg/kg	0.0005	0.00285
DDT (total, including DDD and DDE)	mg/kg	0.01	0.00119

* The published sediment standard does not include specific limits for Benzo(a)pyrene. Therefore, the limits for Total Polycyclic aromatic hydrocarbons (PAHs) have been adopted here.

Complete.

8.5.2 Soils

8.5.2.1 Soil Types

Soil types in the survey area have been categorised according to the World Reference Base for Soil Resources (WRB) published by the Food and Agricultural Organisation of the United Nations, International Union of Soil Sciences and the International Soil Reference and Information Centre (Ref. 8.29). The soil types include: cambisols, phaeozems, arenosols, fluvisols, abrazems/regosols and anthropogenic soils, as described in Table 8.5. The soil cover is typically formed through the degradation of the underlying geology. **Chapter 7 Physical and Geophysical Environment** describes the geology and geomorphology of the Study Area.

The distribution of soil cover within the Study Area is presented in Figure 8.2 the distribution has been assessed through field mapping and soil logging. Locations of the soil survey points are shown on Figure 8.1. Bedrock is locally exposed on the steeper slopes of the river valleys and along the coast.

Agricultural areas (principally vineyards) in the Study Area are predominantly located on arenosols and abrazem/regosols. Vineyard development usually involves one-time ploughing to around 0.6 m followed by annual tillage to 0.3 m (Ref. 8.1).

Table 8.5 Summary of Soil Types within Study Area

Soil Type	Comments
Cambisols	Cambisols originate from the weathering of underlying parent rock material and form a residual weathered soil that comprises sandy silts and clays. Cambisols still retain some of the original rock structure (e.g. bedding or evidence of jointing/fracturing).
Phaeozem Soils	Phaeozem soils comprise a dark organic (humus) rich topsoil layer, covered in vegetation, including grass, plants and trees. These soils are typically 0.3 to 0.35 m thick in the Study Area (Figure 8.2) and have a high water absorption capacity and low permeability. Eluvial Phaeozem soils are derived from either the in-situ weathering of underlying bedrock or the weathering of bedrock combined with limited movement or accumulation of the soils due to gravitational creep on gently inclined slopes. Diluvial-Colluvial Phaeozem soils are derived from the erosion and removal of underlying bedrock by flood or landslide events. Diluvial deposits comprise soils which are deposited on alluvial floodplains as a result of sudden flood events, and colluvial deposits comprise typically loose, unconsolidated soils deposited in accumulation fans at the base of hill slopes by run-off, landslides or slope creep.
Arenosols	Arenosol soils are predominantly sandy in composition (typically >65%) and lack any substantial soil profile and structure. In the Study Area these are typically concentrated in areas associated with flat or gentle terrace slopes located between watercourses.
Fluvisols	Fluvisols soils are typically located on alluvial floodplains, river fans, valleys and tidal marshes. They form on alluvial soils and can be mixed in with flood surge deposits. Deposits include loam, silts and sandy clays to clayey sands.
Abrazems/Regosols	Abrazem soils are a poorly developed, unconsolidated (loose) soil, which exhibit no diagnostic horizons. Abrazems are formed as a result of erosion of loose rocks (such as loess, alluvium or sand deposits). Soils are typically formed through landslide and flooding events.

Continued…

Soil Type	Comments
Anthropogenic Soils	Anthropogenic soils are soils that have been modified by human activity. Within the Study Area, these include soils that have been reworked (not including agricultural activity like ploughing), imported man-made fill and other materials (such as pavements and hard-standing). These soils are typically confined to areas of urban construction and activity, such as the town of Varvarovka (to the north of the Pipeline route), and the coastal access road. No substantial areas of anthropogenic soils have been identified within the Study Area to date.

Complete.

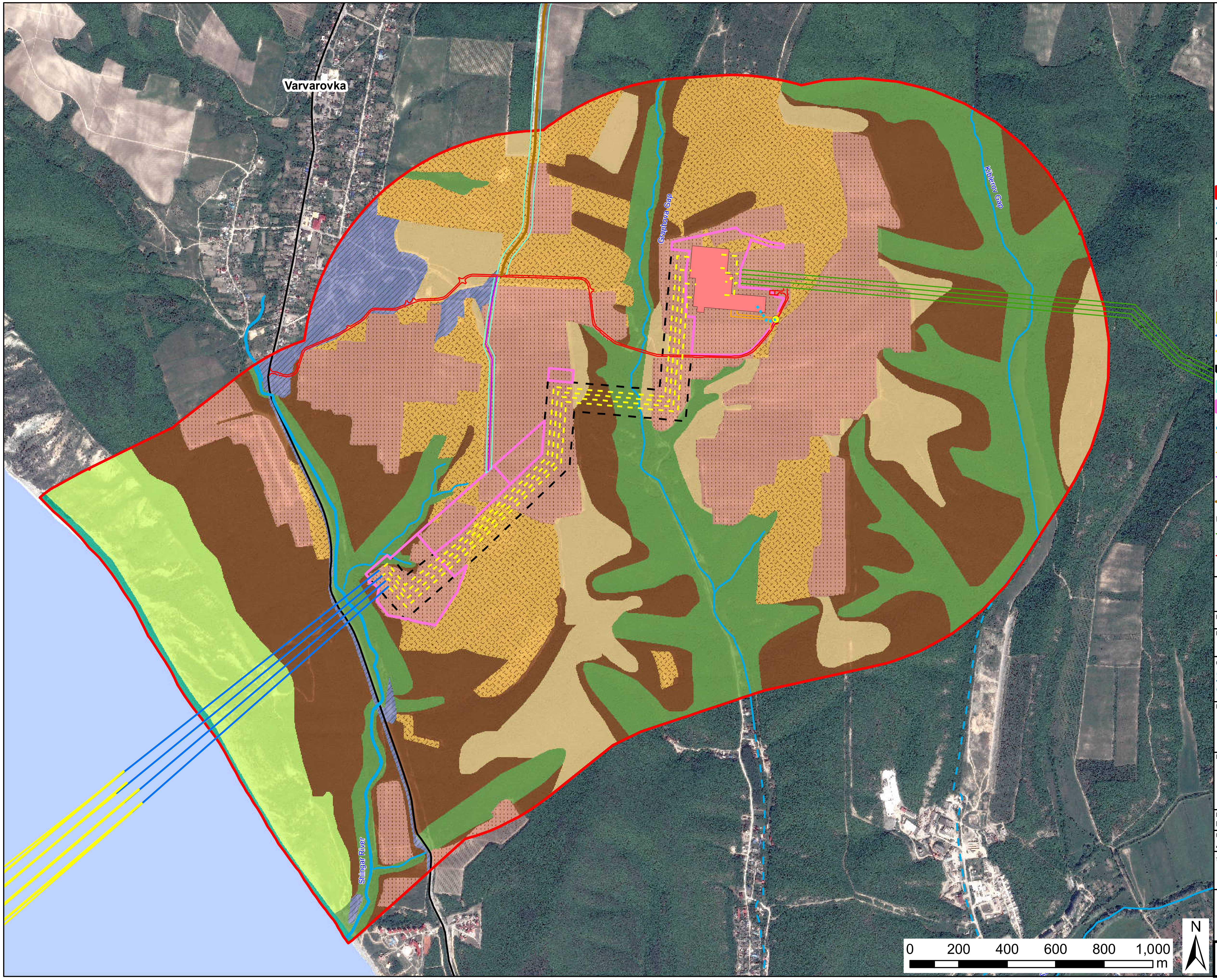
8.5.2.2 Soil Quality

The agrochemical assessment of soils in the Survey Area (Ref. 8.1, 8.8) included the testing of 40 samples from 21 locations. The soils are alkaline, with pH values ranging from 7.22 to 8.8. There was limited variation in soil salinity observed. The soils were typically loams, with fine-grained (<0.01 mm) sediment contents in the range 2.6 to 79.5% but typically around 50 to 75%; the agricultural soils tended to have lower clay contents.

The soils in the agricultural areas had humus content ranging from 1.8 to 6.62%. The phaeozems had humus contents of 3.8 to 7.42%. The fluvisols had humus contents of 3.07 to 5.82%. The soils are characterised by reasonably high nutrient levels (Ref. 8.1, 8.8).

During the 2010 and 2011 surveys, a total of 27 soil samples were also collected for laboratory testing of potential contaminants (Ref. 8.1). During the 2013 survey an additional 15 composite samples were also collected for laboratory testing (Ref. 8.8).

All soil samples were analysed to determine the presence and concentration of a suite of potential contaminants. The results of the analysis were compared with Russian MPC (Ref. 8.13) and APC (Ref. 8.14) levels (Table 8.1). The results of the laboratory analysis are shown in Table 8.6 and the locations of exceedances are shown on Figure 8.3.



LEGEND

Soil Type *

- Diluvial-Colluvial Phaeozems
- Eluvial Phaeozems
- Cambisols
- Anthropogenic Soils
- Fluviosols
- Seashore Deposits

Agricultural Soils

- Arenosols
- Abrazem/Regosol

* Majority of agricultural soils are arenosols and abrazem/regosols.

- Study Area
- Rivers
- Inferred watercourses
- Main roads

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Landfall facilities
- Anode bed for cathodic protection of landfall section pipelines
- Proposed microtunnels
- Proposed offshore pipelines
- Construction corridor
- Temporary construction area for road construction
- Construction sites
- Anode ground bed connection to landfall facilities
- Permanent access road to be constructed by SSTTBV
- Temporary access road constructed by SSTTBV
- Varvarovka bypass road (used by Project during construction only)

United Gas Supply System

- United Gas Supply System pipelines
- Permanent access road to be constructed by Gazprom Invest

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue
For Information

Client
South Stream Offshore Pipeline — Stream ENERGISING EUROPE

Project Title
SOUTH STREAM OFFSHORE PIPELINE

Drawing Title
DISTRIBUTION OF SOILS IN THE STUDY AREA

Drawn	Checked	Approved	Date
DH	RW	MW	18/02/2014

URS Internal Project No.	Scale @ A3
46369082	1:15,000

URS Infrastructure & Environment UK Limited
Scott House
Alençon Link, Basingstoke
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Telephone (01256) 310200
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Drawing Number
Figure 8.2

Rev

Plot Date: 18 Feb 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 8 Soil and Groundwater\Figure 8-2 Distribution of Soils in the Study Area (landfall section).mxd

Table 8.6 Soil Survey Results

Parameter	Unit	Range of concentrations recorded (minimum – maximum) (Ref. 8.1)	No. of exceedances of National Limit Values (Ref. 8.13 and 8.14)
pH	-	7.1 – 8.07	0
Arsenic, As	mg/kg	0.8 – 2.4	2 samples exceeded MPC levels (2 mg/kg)
Cadmium, Cd	mg/kg	0.14 – 1.03	0
Copper, Cu	mg/kg	12.2 – 194.0	3 samples exceeded APC levels (132 mg/kg)
Chromium, Cr	mg/kg	5.4 – 43	No soil standard but 2 samples exceed adopted sediment standard (37.3 mg/kg)
Nickel, Ni	mg/kg	10 – 31.7	0
Lead, Pb	mg/kg	3.6 – 380	1 sample exceeded MPC level (32 mg/kg)
Zinc, Zn	mg/kg	25 – 250	1 sample exceeded APC level (220 mg/kg)
Mercury, Hg	mg/kg	0.01 – 0.05	0
Manganese, Mn	mg/kg	140 – 409	0
Iron, Fe	mg/kg	6,500 – 15,580	n/a
PCB	mg/kg	<0.0005 – 1.2392	5 samples exceeded APC levels (0.06 mg/kg)
Phenols	mg/kg	0.17 – 25.34	No soil standard but all samples exceed adopted sediment standard (0.05 mg/kg)
Benzo(a)pyrene	mg/kg	<0.0012 – 0.025	4 samples exceeded MPC levels (0.02 mg/kg)
Oil Product	mg/kg	7 - 59	0

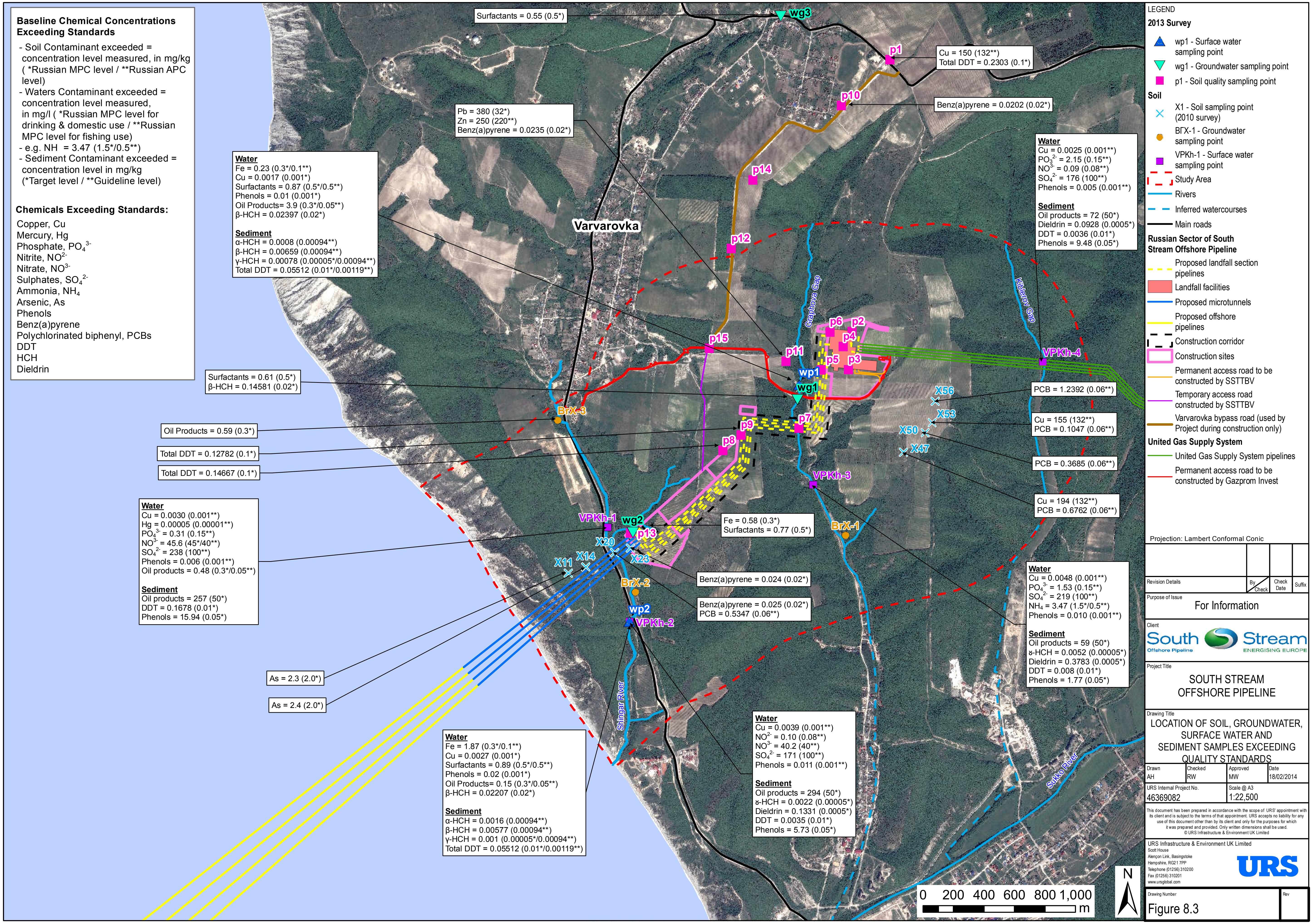
Continued…

Parameter	Unit	Range of concentrations recorded (minimum – maximum) (Ref. 8.1)	No. of exceedances of National Limit Values (Ref. 8.13 and 8.14)
HCB	µg/kg	<0.05 – 1.21	0
α-HCH	µg/kg	<0.05 – 3.16	0
β-HCH	µg/kg	<0.05 – 43.68	0
γ-HCH	µg/kg	<0.05 – 2.01	0
Total DDT (including DDD and DDE compounds)	µg/kg	0.006 – 0.230	3 samples exceeded MPC levels (0.1 mg/kg)

Complete.

The general pre-existing characteristics of the terrestrial soils in the Study Area are as follows:

- Elevated copper levels were measured in excess of the APC threshold in reworked soils. This may be associated with the use of agrochemicals in vineyard areas (in the northeast of the Survey Area, to the south of the connection pipes linking the onshore pipelines to the Russkaya Compressor station);
- Arsenic levels exceeded MPC thresholds in soil samples taken adjacent to the coastal road. A definitive source for the elevated arsenic has not been identified but a plausible mechanism is surface deposition associated with motor vehicle emissions;
- Benzo(a)pyrene levels exceeded MPC thresholds adjacent to the coastal road. Again this may be as a result of motor vehicle emissions;
- PCB levels exceeded the APC threshold level in the vineyard area in the northeast of the Survey Area, and in a single sample taken at the location of where the pipelines cross the Shingar River. A definite on-site source for the PCBs has not been identified, although the location of the exceedances suggests it may relate to agricultural activities;
- Lead and zinc exceeded the MPC and APC threshold, respectively, in a single sample taken from west of the landfall facility and Graphova Gap. Elevated levels of benzo(a)pyrene were also found in the same location;
- Pesticides were detected in three soil samples, all located in agricultural areas;
- It should be noted that the contamination concentrations for soil samples collected in valley bottoms may not necessarily be due to an immediately adjacent source but, may reflect transport of soils from upstream in the catchment through surface run-off or flood events; and
- In addition to the chemical testing above, local areas of informal waste deposition (‘flytipping’) have been observed, including an in-filled ditch (Ref. 8.30). The materials observed include demolition wastes. There is a potential for contaminants including asbestos to be present in these materials.



Plot Date: 18 Feb 2014
File Name: I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 8 Soil and Groundwater\Figure 8-3 Location of Soil, Groundwater, Surface Water and Sediment Samples Exceeding Quality Standards.mxd

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8.5.3 Groundwater

8.5.3.1 Hydrogeological Regime

The hydrogeology of the Study Area is characterised by local shallow alluvial aquifers overlying a carbonate aquifer within the bedrock (Ref. 8.1, 8.12).

The alluvial aquifer is present along the narrow (typically less than 200 m wide) river valleys of the Shingar River and an unnamed tributary of the Sukko River. The extent of the alluvial aquifers, in plan view, i.e. looking from above not in cross-section, is anticipated to broadly mirror the distribution of fluvisols (Figure 8.2).

The carbonate aquifer extends across the entire Study Area and beyond into the wider region. The aquifer may be locally subdivided by changes in lithology and faulting. The bedrock strata are locally exposed in the valley walls. The groundwater may be locally at or close to ground level at the base of the valleys. This is implied by the presence of springs. Borehole drilled along (Ref. 8.10, 8.12) the alignment of the proposed microtunnels confirmed that groundwater within the alluvial aquifers is within 10 m of ground level and is sometimes at or near ground level.

The hydraulic conductivity of the alluvium is up to 40 metres per day (m/d) and the saturated thickness of the alluvial aquifer in the Study Area is typically in the order of 4 to 6 m, but may be significantly thicker locally (Ref. 8.10, 8.12). Groundwater recharge to the alluvial aquifer is via rainfall and discharge from surface watercourses along their upper reaches. The alluvial aquifer is anticipated to be in at least partial hydraulic connection with the carbonate aquifer given the bedrock is locally at or near surface. The degree of connection will vary spatially and potentially also seasonally.

Groundwater flow within the underlying carbonate aquifer is controlled by a network of fractures within folded and fractured sedimentary bedrock deposits. The geology is dominated by marls[1] but there are also limestone and sandstone beds. Owing to the nature of the local geology, it is likely that the carbonate aquifer comprises a multi-layered aquifer system with varying permeability in the different lithologies present. Groundwater flow is likely to be predominantly through the more permeable horizons such as the sandstones and limestones compared with the lower permeability marls and argillaceous strata. Faults and fracture zones have been mapped within the Study Area as described in **Chapter 7 Physical and Geophysical Environment**; key areas include around the Marfovsky Fault, which crosses the Graphova Gap near the proposed road crossing, and around the Shingar valley (the valley is aligned with the Shingarsky Fault). Additional zones of higher permeability and of increased hydraulic connectivity between individual geological units may occur in these faults and the associated fracture and fissure zones. No evidence of karstic features, i.e. area of limestone in which erosion has produced fissures or caverns, has been observed in the Study Area (Ref. 8.1).

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[1] Assumed from description as "chalky clay"

The anticipated depth to the water table varies between ground level to a few metres deep along the valley floors (where groundwater is in hydraulic continuity between the alluvium and carbonate aquifers) and up to 100 m beneath the higher areas along the interfluves (Ref. 8.12). Water levels measured during drilling (Ref. 8.12) included strikes at multiple depths within the same borehole; this is consistent with a layered aquifer system.

Recharge to the aquifers is via rainfall, through groundwater flow from up-hydraulic gradient and recharge from the watercourses in the base of the valleys.

Groundwater discharges to the surface watercourses via ephemeral springs.

8.5.3.2 Abstractions

The groundwater abstraction associated with the proposed Russkaya Compressor station is located approximately 5 km to the northeast of the landfall section (Ref 8.3). The abstraction is used for drinking water and industrial purposes for the Russkaya compressor station. The Project does not lie within the designated sanitary protection zone for this abstraction.

The nearby vineyard, Agrofirma Kavkaz, sources the majority of its water from the Supsekh municipal water supply system with the remainder of the water being obtained from the unlicensed surface water abstraction (Section 8.5.5.3) (Ref. 8.4). This abstraction is understood to be upstream of the Project Area (Ref. 8.4).

The majority of the water supply for the neighbouring residential area of Varvarovka is sourced from the Supsekh[2] municipal water supply system with the remainder being supplied by the Kavgaz water supply system (Ref. 8.4).

The terrestrial part of the landfall section does not lie within a source (sanitary) protection zone associated with a groundwater abstraction.

The proposed source of potable water for the Project is from an existing water supply at Sukko. This water supply is understood to be owned by the Russian Ministry of Defence but is also utilised by third parties.

Information has been provided (Ref. 8.7) for three boreholes, named operational borehole No.2P (also referred to as No.2), No.4D (also referred to as No.4) and No.4P. The boreholes are located within the Kiblerova valley in the northern part of the town of Sukko; the bores are located is approximately 2 km south of the proposed landfall facilities. Records indicate that No.2P is furthest south, with No.4P and No.4D located further to the north. The boreholes are close to the unnamed tributary of the Sukko River and are about 600 m from the main Sukko River. There is a 50 m radius protection zone around the borehole.

The operational borehole, No.2P (Reference code 34629), was drilled to a depth of 60 m in 2003. The geological log indicates that the upper 32 m comprised clay loam, overlying 6 m of poorly sorted cobbles, gravel and sand (probably weathered and fractured bedrock or scree

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[2] Supsekh is located to the north of Varavrovka

deposited during the original erosion of the valley), in turn overlying 22 m interbedded mudstones, marls and fractured sandstones of Upper Cretaceous age. The geology is consistent with the conceptual model of the regional hydrogeology of alluvial aquifer in valleys over sedimentary bedrock aquifer.

The borehole construction of No.2P consists of 219 millimetres (mm) solid casing to a depth of 33 m, with a 4.5 m screened section to a depth of 37.5 m. The borehole is 190.5 mm diameter open hole from a depth of 38 m to the base of the hole at 60 m depth. Therefore, the water is abstracted primarily from the bedrock aquifer. Hydraulic testing of the borehole was undertaken in February 2003. Borehole No.2P was airlifted for 48 hours at a flow rate of 1.5 litres per second (l/s), around 130 cubic metres per day (m^3/day), which, created a drawdown of 8 m from the rest groundwater level of 13 m depth i.e. a pumping groundwater level of 21 m depth. Therefore the specific capacity of the borehole was estimated to be 0.19 litres per second per metre (l/s/m). It was recommended that the pump should be set at a depth between 25 and 30 m depth i.e. within the solid casing. However, it is uncertain if the current pump is installed within that depth range.

Borehole No.4D is an exploration borehole that was drilled in 1996; it is assumed that this borehole still exists. It had a diameter of 324 mm to 19 m depth and then a 219 mm diameter to the end of the borehole at 60 m depth, with screened horizons between 25 to 30 m and 52 to 57 m depth. The rest groundwater level before pumping was recorded as 0.3 m depth and the pumping water level as 15.5 m depth. However, the abstraction rate was not recorded.

Borehole No.4P is an exploration borehole for fresh water that was drilled in 1981; it is assumed that this borehole still exists. It has a diameter of 325 mm to 22.8 m depth and a 168 mm diameter to the end of the borehole at 27 m depth, with a screened horizon between 22.8 and 27.0 m. The rest groundwater level before pumping was 0.6 m depth and the pumping water level was 12.9 m depth. However, the abstraction rate was not recorded.

Abstraction from the Sukko source is seasonally restricted. Water may only be abstracted between October and April; it is understood that the restriction on summer abstraction is in place to prevent derogation of the aquifer.

8.5.3.3 Groundwater Quality

During the 2010 survey, groundwater samples were taken from three ephemeral springs (one sample per spring), the locations of which are shown in Figure 8.1[3]. During the 2013 survey, groundwater samples were taken from three additional springs, the locations of which are also shown on Figure 8.1. The springs are located in the valleys. There is uncertainty as to whether the groundwater emerges from the alluvial or bedrock aquifers; this may vary from spring to spring and may also change seasonally. The groundwater samples were analysed to determine the presence and concentration of a range of major ions, metals and organic compounds. The results were compared with Russian water quality standards for potable and amenity use (in Section 8.5.1); the results were subsequently compared with the WHO standards, where appropriate. The groundwater quality results are summarised in Table 8.7.

[3] The groundwater samples are labelled ВГХ on the figure for ease of comparison with survey data and with EIA.

Table 8.7 Groundwater Quality Results

Parameter	Unit	Range of concentrations recorded (minimum – maximum) 2010 (Ref. 8.1)	Range of concentrations recorded (minimum – maximum) 2013 (Ref. 8.8)	No. of exceedances of Quality Limit Values (Ref. 8.16, 8.17, 8.23)
Calcium, Ca^{2+}	mg/l	71.0 – 99.2	88.2 – 155	n/a*
Magnesium, Mg^{2+}	mg/l	10.44 – 22.94	12.7 – 19.8	0
Potassium, K^{+}	mg/l	2.7 – 11.6	-	n/a
Sodium, Na^{+}	mg/l	4.29 – 9.81	1.6 – 120**	0
Ammonium, NH_4^{+}	mg/l	0.15 – 0.17	0.21 – 0.81	0
Chloride, Cl^{-}	mg/l	55 – 103	41 – 106	n/a
Sulphate, SO_4^{2-}	mg/l	142 – 187	25 – 48	0
Phosphate, PO_4^{3-}	mg/l	0.31 – 0.92	<0.01	0
Nitrate, NO_3^{-}	mg/l	2.6 – 29.6	1.4 – 4.9	0
Nitrite, NO_2-	mg/l	0.06 – 0.07	<0.01 – 0.026	0
Hydrogen carbonate, HCO_3-	mg/l	378.2 – 463.6	376 – 429	n/a
pH	pH units	6.8 – 6.9	6.8 – 7.7	0
Permanganate demand, MnO4-	mg O2/l	4.7 – 5.5	1.03 – 3.1	0
COD	mg O2/l	<10	9.4 – 35	n/a
Suspended solids	mg/l	7.9 – 128.6	n/a	0
Dissolved O_2	mg/l	5.6 – 6.9	4.5 – 7.35	n/a
Mercury, Hg	µg/l	<0. 05	<0.01	0
Arsenic, As	µg/l	<5	<2	0
Chromium, Cr	µg/l	<1 –1	<0.3	0

Continued…

Parameter	Unit	Range of concentrations recorded (minimum – maximum) 2010 (Ref. 8.1)	Range of concentrations recorded (minimum – maximum) 2013 (Ref. 8.8)	No. of exceedances of Quality Limit Values (Ref. 8.16, 8.17, 8.23)
Silica, Si	mg/l	5.23 – 7.05	4.67 – 5.38	0
Cadmium, Cd	µg/l	0. 14 – 0. 23	<0.07 – 0.18	0
Lead, Pb	µg/l	<1	<1	0
Nickel, Ni	µg/l	<1	<3	0
Iron, Fe	mg/l	<0.05	0.12 – 0.58	1 sample exceeds domestic drinking and amenity MPC levels (0.3 mg/L)
Manganese, Mn	µg/l	<1 –6	<0.6	0
Copper, Cu	µg/l	0. 8 – 2.6	2.2 – 3.5	0
Zinc, Zn	µg/l	<55	<0.5 – 1.7	0
Oil products (hydrocarbons)	mg/l	0.08 – 0.59	0.17 – 0.27	1 sample exceeds domestic drinking and amenity MPC levels (0.3 mg/L)
Anionic surfactant	mg/l	<0.1	0.55 – 0.77	3 samples exceed domestic drinking and amenity MPC levels (0.5 mg/L)
Phenols	µg/l	3 –5	8 – 24	0
PCBs	µg/l	<0. 01	0.0013 – 0.00255	n/a
Benzo(a)pyrene	µg/l	<0. 0005 – 0. 001	<0.001 – 0.002	0
Total Salinity / Mineralisation	mg/l	656 - 764	n/a	0
α-HCH	µg/l	-	0.22 – 4.59	n/a

Continued...

Parameter	Unit	Range of concentrations recorded (minimum – maximum) 2010 (Ref. 8.1)	Range of concentrations recorded (minimum – maximum) 2013 (Ref. 8.8)	No. of exceedances of Quality Limit Values (Ref. 8.16, 8.17, 8.23)
β-HCH	μg/l	-	8.1 – 145.81	1 sample exceeded domestic drinking and amenity MPC (20 μg/L)
γ-HCH	μg/l	-	0.19 – 2.67	2 samples WHO standard (2 μg/L)
HCB	μg/l	-	0.2 – 0.26	0
2,4-DDE	μg/l	-	0.06 – 0.13	0
4,4-DDE	μg/l	-	0.95 – 8.65	2 samples WHO standard (1 μg/L)
2,4-DDD	μg/l	-	<0.05	0
4,4-DDD	μg/l	-	<0.05 – 2.09	2 samples WHO standard (1 μg/L)
2,4-DDT	μg/l	-	0.16 – 0.31	0
4,4-DDT	μg/l	-	0.84 – 1.21	2 samples WHO standard (1 μg/L)
Individual Pesticides†	μg/l	-	<0.05	None detected±
Total OCPs	μg/l	<0.01	-	0

* n/a: Not assessed, as no value provided in relevant standards.
** n/a: Total of potassium and sodium.
† Pentachlorobenzene, Heptachlor, Aldrin, Heptachlor Epoxy, Methoychlor, Trans-chlordan, Cis-chlordan, Trans-nonachlor and Mirex.
± Detection limit exceeded OCP standard of 0.01 μg/L.

Complete.

The general pre-existing characteristics of groundwater from the sampled springs in the Study Area are as follows:

- Typically clear in colour, pH neutral (pH 6.8 to 6.9), and is fresh in composition (salinity content 656 to 764 mg/l);
- Groundwater has a strong calcium hydrocarbonate chemical signature, indicating aquifers in the Survey Area typically comprise soils or rock rich in calcium carbonate;

- A single sample exceeded the iron MPC for drinking and domestic water quality standards (Ref. 8.17), where a level of 0.58 mg/l was recorded compared to a threshold value of 0.3 mg/l. No other heavy metals were detected at elevated concentrations;
- A single sample (taken 0.2 km south of Varvarovka) exceeded the hydrocarbon MPC for drinking and domestic water quality standards (Ref. 8.17), where a level of 0.59 mg/L was recorded compared to a MPC threshold value of 0.3 mg/l. All three samples exceed the WHO standard for benzene (0.01 mg/l), which has been applied as a surrogate standard in the absence of a WHO standard for petroleum hydrocarbon. Petroleum hydrocarbons at the measured concentrations may also not be suitable for potable supply on the grounds of taste and odour;
- All three 2013 survey samples exceeded the anionic surfactant MPC for drinking and domestic water quality standards;
- Pesticides were detected in two samples during the 2013 survey. These reflect the agricultural nature of the catchment; and
- There were no other exceedances where screening criteria are available (Refs. 8.16, 8.17 and 8.23). PCBs were detected, albeit in low concentrations, during the 2013 survey.

Water quality samples from operational borehole No. 2P at Sukko were recently tested to check for compliance against drinking water standards[4] (Ref. 8.6). Samples were collected from the "clear water reservoir" in May and July 2013. Additionally a sample was obtained from the "communal (network)" in July 2013. No groundwater quality data from July 2013 was provided. However, according to the data table for the May 2013 sample, the water quality measurements were within the acceptable range for potable use. The groundwater was slightly alkaline (pH 7.5), mineralised (838 mg/l) and of calcium bicarbonate type; the water quality was similar to that measured within the Survey Area[5]. The water quality at the Sukko water supply source is required to be monitored at least annually.

8.5.4 Surface Water

8.5.4.1 Surface Water Bodies

Two watercourses, the Shingar River and an unnamed tributary of the Sukko River that drains the Graphova Gap, will be crossed by the proposed Pipeline route within the Study Area. The locations of these surface watercourses are shown on Figure 8.4. Photographs of the Shingar River and the Graphova Gap are shown in Figure 8.5.

The Shingar River flows south across the Study Area and enters the Black Sea to the south-southwest of the microtunnel entry shaft site. The Shingar River is aligned with the Shingarsky Fault (**Chapter 7 Physical and Geophysical Environment**). The pipelines will be

[4] SanPin 2.1.4.1074-01 "Drinking water. Health and safety requirements on water quality of centralised water supply systems. Quality control"

[5] Note that the water quality testing for the Sukko borehole did not include testing for some of the types of contaminants detected in the Survey Area such as pesticides or oil products.

microtunnelled beneath the Shingar River. There is a tributary on the eastern side, immediately to the north of the microtunnel entry shaft site and adjacent to the temporary access road route.

The unnamed watercourse in the Graphova Gap runs south across the Study Area then continues to flow south until its confluence with the Sukko River in the town of Sukko. The pipeline will cross this watercourse in open-cut. The watercourse will also be crossed by an access road.

A third watercourse, a tributary which drains the Kiblerova Gap (referred to as the Kiblerova Gap) is located in the Study Area to the east of the landfall facilities. This watercourse does not cross the Project Area but crosses the connection pipeline route to the Russkaya compressor station. The tributary in the Kiblerova Gap enters the Sukko River upstream of the confluence with the Shingar River. The tributary runs close to the water abstraction source in Sukko.

A 50 m wide sanitary protection zone (Ref. 8.20) extends around each of the above watercourses. Within the protection zone all activities are controlled to prevent contamination and silting of the water body, and to conserve the habitat for aquatic biological resources and other flora and fauna.

In accordance with Paragraph 15 and Paragraph 16 of Article 65 of the Water Code of the Russian Federation, the following is prohibited within the borders of water protection zones:

- Use of sewage to fertilise soils;
- Cemeteries, animal burials, production and consumption waste disposal sites, chemical, explosive, toxic, poisonous and toxic substances, radioactive waste disposal facilities;
- Use of aviation to combat pests and plant diseases; and
- Traffic or parking of vehicles (except for special vehicles), with the exception of traffic on the roads and parking on the roads and in specially equipped paved areas.

8.5.4.2 Hydrological Regime

Limited information is available regarding flooding and hydrology associated with the watercourses within the Study Area. There is no long-term monitoring flow or level data. Anecdotal evidence and inferences based on topography and geomorphology have been used to assess the flow regimes.

The Shingar River is approximately 5.5 km long and flows into the sea to the southwest of the landfall section. The source of the river is a spring within the town of Varvarovka, to the north of the proposed Pipeline route. The catchment area upstream of the Pipeline crossing is estimated to be around 9.35 km^2 (Ref. 8.31). The average slope of the catchment is 176% and the slope of the channel in the landfall section is 15% (Ref. 8.31). In the area of the proposed Pipeline crossing, the Shingar River is approximately 1.5 to 3.5 m wide. The valley in the vicinity of the Pipeline route is around 55 to 65 m wide with a floodplain around 1 to 1.5 m above the bank of the river. The river has a weakly meandering form in this area; faulting in the area has influenced erosion patterns and thus the route of the river. The Shingar River has low flow during the summer and autumn months and a more substantial flow during the winter months.

Measured water depths were 0.6 m in December 2010 (Ref. 8.1) and 0.15 m in July 2011 (Ref. 8.31).

Downstream of the landfall section, the Shingar River passes beneath the road to Anapa. The crossing comprises a reinforced concrete overflow structure (4 m wide and 2.4 m high) (Ref. 8.31). The estimated mean low water flow rate is 0.004 cubic metres per second (m^3/s) whereas the estimated high flows are 29.03 m^3/s (10% occurrence) and 39.23 m^3/s (1% occurrence) (Ref. 8.31).

An unnamed tributary of the Sukko River is located 1.5 km to the east of the Shingar River in the Graphova Gap. This watercourse is approximately 2 to 4 m wide, and has ephemeral flow during the summer months and more substantial flow during the winter months. The Pipeline crossing at Graphova Gap is upstream of the mapped floodplain (Ref. 8.1). The catchment upstream of the Pipeline crossing is 1.8 km^2 (Ref. 8.31). The average slope of the catchment is 201% and the slope of the channel where the Pipeline route crosses the watercourse is 55% (Ref. 8.31). The measured water depth was 0.1 to 0.3 m in December 2010; in summer the watercourse is reported to be predominantly dry. The watercourses in the Study Area are typically ephemeral, which means they have a flow regime which is variable and directly related to rainfall patterns, with very low flows during periods of little or no rainfall. The ephemeral nature is primarily due to the small catchment size of the area and the seasonal patterns of precipitation. In addition, surface waters are partly recharged from high groundwater tables, often associated with springs that are encountered across the Study Area. There are springs upstream and downstream of the landfall section.

In addition to the natural watercourses, there are artificial drainage ditches locally within the Study Area. These are understood to be used to manage flood risk locally (Ref. 8.1).

Average annual rainfall in Anapa[6] is 539 mm. December, January and February are typically the wettest months, with precipitation occurring typically 15 days a month. Average monthly rainfall is less than 50 mm even in winter. The majority of precipitation falls as rain. Precipitation may include snow in winter, particularly between November and April. In contrast the monthly average rainfall in August is 15 mm and rain falls on average on six days of the month. The maximum recorded daily precipitation in Anapa is 85.9 mm.

During summer months when precipitation is less and evapotranspiration is higher, most surface water infiltrates the underlying soils with low flows being observed in the watercourses. This typically results in watercourses becoming dry or the formation of discrete pools of water within the river bed.

Surface water flows typically peak during winter months when rainfall is highest. Under extreme rainfall events, flash flooding may occur.

Both surface watercourses flow approximately north to south across the proposed Pipeline route. The route of the proposed Pipeline crosses the watercourses at right angles. The Pipeline will pass beneath the Shingar River in microtunnels; no surface works are planned at the river.

[6] The closest meteorological station to the Study Area, located about 10 km to the northwest

The watercourse in the Graphova Gap will be crossed by the Pipeline using open-cut construction techniques, as well as by the proposed access road to the construction site of the landfall facilities, as shown in Figure 8.4.

There are no licensed surface water abstractions for drinking water supply within the Study Area (Ref. 8.7). There is a small impoundment on the watercourse in the Graphova Gap located immediately upstream of the proposed access road crossing (Figure 8.5). This impoundment structure retains surface water flows to enable abstraction; it is probable the choice of location reflects the likely presence of springs[7] in this area.

8.5.4.3 Surface Water Quality

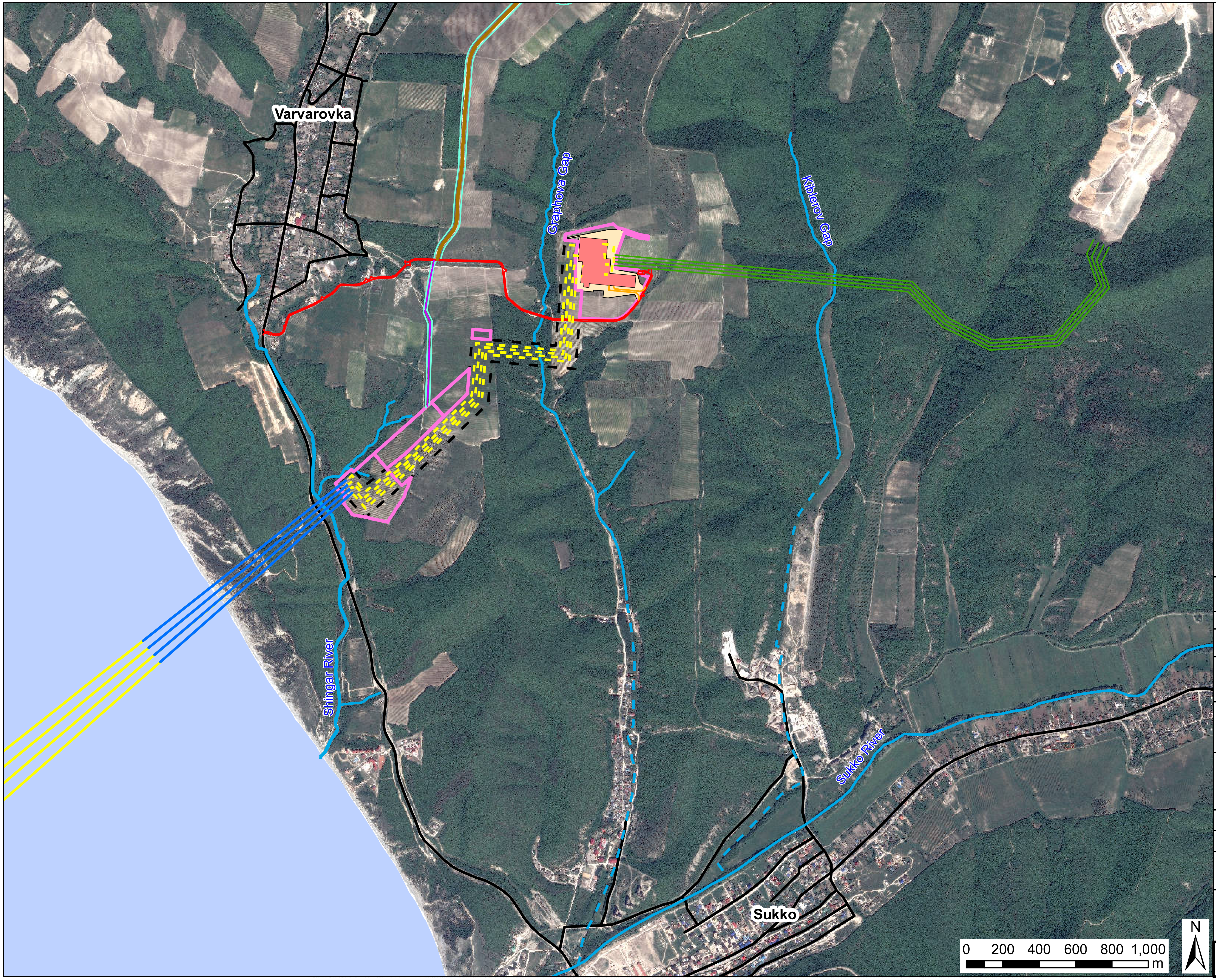
There are no long-term data available on surface water quality in the Survey Area. Spot sampling information on water quality has been obtained through the environmental monitoring undertaken in December 2010 (Ref. 8.1) and in June 2013 (Ref. 8.8). It should be noted that it was raining at the time the samples were collected in 2010. During the 2010 survey, four surface water samples were collected and analysed: two samples from the Shingar River (one sample taken from upstream (VPKh-1) and the other taken from downstream (VPKh-2) of the proposed Pipeline crossing), one taken from the Graphova Gap (VPKh-3) and one from the Kiblerova Gap (VPKh-4). Sampling locations are shown on Figure 8.1. Further details of the 2010 survey surface water sample points are given in Table 8.8.

Table 8.8 Surface Water Sampling Locations in 2010* (Ref. 8.1)

Sample	Location	Width of Watercourse (m)	Water Depth (m)	Estimated Flow Rate (m/s)	Water Temperature (°C)
VPKh-1	Shingar River (upstream of crossing)	1.5	0.6	0.2	9.1
VPKh-2	Shingar River (downstream of crossing)	1.5	0.6	0.2	9.0
VPKh-3	Graphova Gap	0.7	0.2	0.1 - 0.3	6
VPKh-4	Kiblerova Gap	1.2	0.4	0.3	7

* Similar water level and flow data was not reported from the 2013 survey (Ref. 8.8)

[7] The Marfovsky Fault crosses the Graphova Gap in this area. There may be springs in this area associated with fracturing within the fault zone.



LEGEND

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Proposed microtunnels

United Gas Supply System

- United Gas Supply System pipelines
- Landfall facilities
- Proposed offshore pipelines
- Varvarovka bypass road (used by Project during construction only)
- Permanent access road to be constructed by SSTTBV
- Temporary access road constructed by SSTTBV
- Permanent access road to be constructed by SSTTBV
- Permanent access road to be constructed by Gazprom Invest
- Construction corridor
- Cut and fill side slopes
- Temporary construction area for road construction
- Construction sites
- Inferred watercourses
- Rivers
- Existing roads

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue
For Information

Client
South Stream
Offshore Pipeline
ENERGISING EUROPE

Project Title
SOUTH STREAM OFFSHORE PIPELINE

Drawing Title
MAJOR SURFACE WATER FEATURES IN THE STUDY AREA

Drawn	Checked	Approved	Date
DH	RW	MW	18/02/2014

URS Internal Project No.	Scale @ A3
46369082	1:20,000

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Drawing Number
Figure 8.4

Rev

Plot Date: 18 Feb 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 8 Soil and Groundwater\Figure 8-4 Major Surface Water Features.mxd

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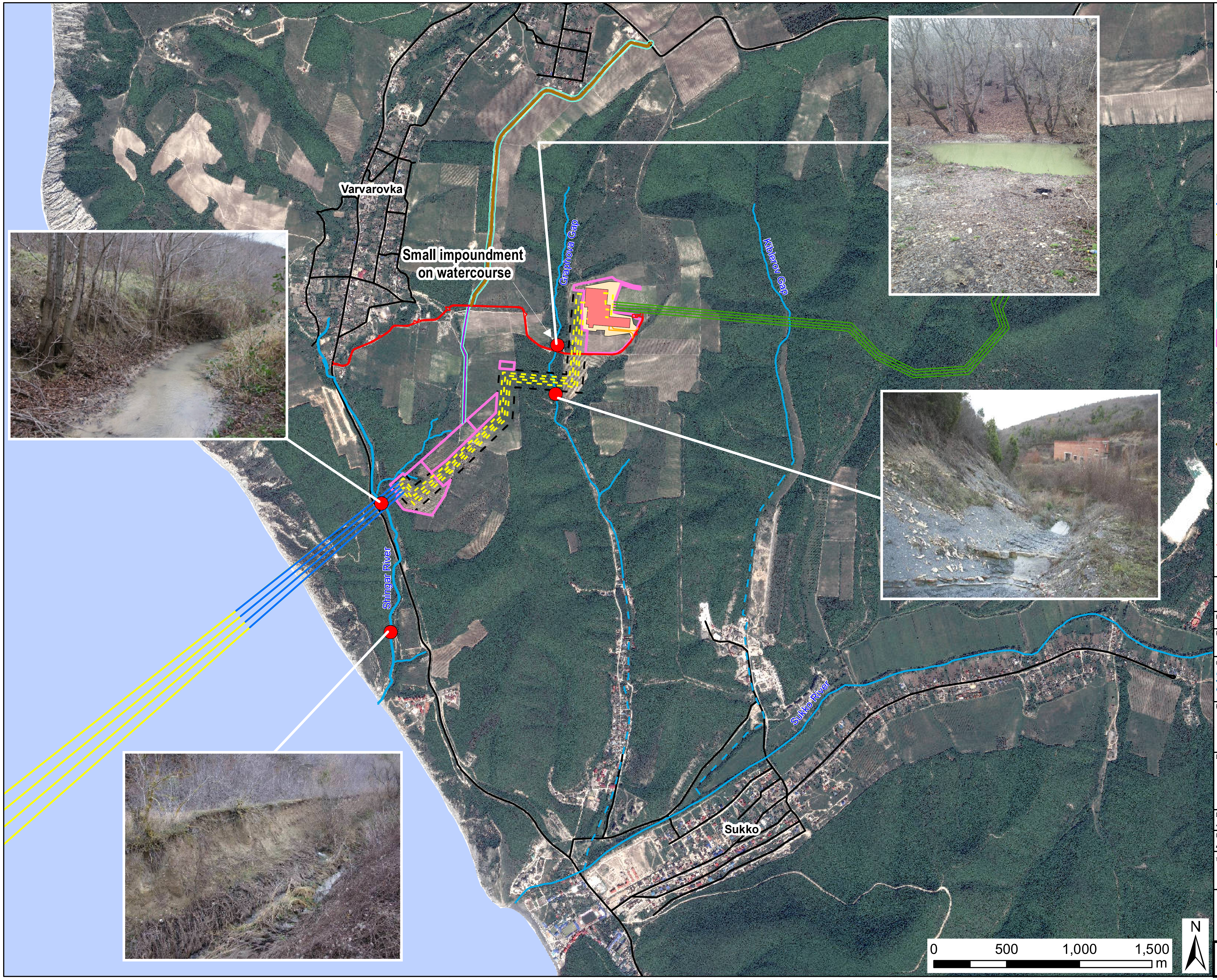

LEGEND

- Photo locations
- Inferred watercourses
- Rivers
- Existing roads

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Landfall facilities
- Proposed microtunnels
- Proposed offshore pipelines
- Construction corridor
- Cut and fill side slopes
- Temporary construction area for road construction
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- Permanent access road to be constructed by SSTTBV
- Temporary access road constructed by SSTTBV
- Varvarovka bypass road (used by Project during construction only)

United Gas Supply System

- United Gas Supply System pipelines
- Permanent access road to be constructed by Gazprom Invest

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: For Information

Client: South Stream Offshore Pipeline — Stream ENERGISING EUROPE

Project Title: SOUTH STREAM OFFSHORE PIPELINE

Drawing Title: PHOTOGRAPHS AND LOCATION PLAN

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Drawing Number	Rev
Figure 8.5	

Plot Date: 18 Feb 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 8 Soil and Groundwater\Figure 8-5 Photographs and Location Plan.mxd

During the 2013 survey (Ref. 8.8) two surface water samples were collected and analysed: one sample from the tributary running through Graphova Gap at the approximate location of the access road crossing (wp1) and the other taken from the Shingar River (wp2) in approximately the same location as VPKh-2, downstream from the Pipeline.

The surface water samples underwent field and laboratory analysis to assess water quality. The results were compared with Russian National Limit Values for surface water (Refs. 8.17, 8.18 and 8.19); where appropriate the results were also compared with the WHO guidelines (Ref. 8.23) (Table 8.3). The results of the water quality survey are shown in Table 8.9.

Table 8.9 Surface Water Survey Results

Parameter	Unit	Range of concentrations recorded (minimum – maximum) 2010 (Ref. 8.1)	Range of concentrations recorded (minimum – maximum) 2013 (Ref. 8.18)	No. of exceedances of Water Quality Limit Values (Ref. 8.17, 8.18 and 8.23)
Colour Index*	-	10 - 15	20 -41	n/a
Calcium, Ca_2+	mg/l	95.5 – 116.1	127 – 148	0
Magnesium, Mg_2+	mg/l	11.1 – 24.1	22.2 – 25.9	0
Potassium, K+	mg/l	3.2 – 15.5	-	0
Sodium, Na+	mg/l	8.78 – 11.08	0.75 – 68	0
Ammonium, NH_4+	mg/l	0.12 – 3.47	0.14 – 0.29	1 sample exceeds both domestic drinking and amenity MPC (1.5 mg/L) and Fisheries MPC levels (0.5 mg/L)
Chloride, Cl-	mg/l	106 – 108	40 – 125	0
Sulphate, SO_4^{2-}	mg/l	171 - 238	43 – 71	4 samples exceeded Fisheries MPC levels (100 mg/L)

Continued...

Parameter	Unit	Range of concentrations recorded (minimum – maximum) 2010 (Ref. 8.1)	Range of concentrations recorded (minimum – maximum) 2013 (Ref. 8.18)	No. of exceedances of Water Quality Limit Values (Ref. 8.17, 8.18 and 8.23)
Phosphate, PO_4^{3-}	mg/l	0.1 – 2.2	<0.01	3 samples exceeded Fisheries MPC levels (0.15 mg/L)
Nitrate, NO_3	mg/l	5.5 – 45.6	7.26 – 26.12	2 samples exceeded Fisheries MPC levels (40 mg/L), with 1 sample also exceeding domestic drinking and amenity MPC levels (45 mg/L)
Nitrite, NO_2-	mg/l	0.07 – 0.10	0.043 – 0.046	2 samples exceeded Fisheries MPC levels (0.08 mg/l)
Hydrogen carbonate, HCO_3-	mg/l	134.2 – 317.2	374 – 441	n/a
pH	pH units	7.0 - 7.1	7.2 – 7.5	0
Permanganate demand	mg O2/l	5.5 - 7.8	2.69 – 2.83	n/a
Chemical oxygen demand, COD	mg O2/l	<10	22 – 27	0
Dissolved O_2	mg/l	6.5 - 8.5	6.7	0
Dissolved O_2	%	58.4 - 76.4	-	0
Total mineralisation	mg/l	408 - 756	720 - 830	0
Suspended solids	mg/l	17.7 - 85.1	121-108	0

Continued...

Parameter	Unit	Range of concentrations recorded (minimum – maximum) 2010 (Ref. 8.1)	Range of concentrations recorded (minimum – maximum) 2013 (Ref. 8.18)	No. of exceedances of Water Quality Limit Values (Ref. 8.17, 8.18 and 8.23)
Biological oxygen demand, BOD	mg/l	0.7 - 1.1	0.95 – 2.9	0
Mercury, Hg	μg/l	<0.05 – 0.05	<0.01	1 sample exceeded Fisheries MPC levels** (0.01 μg/l)
Arsenic, As	μg/l	<5	<2	0
Chromium, Cr	μg/l	<1 - 5.8	<0.3	0
Silica, Si	mg/l	2.1 - 6.5	5.04 – 6.1	0
Cadmium, Cd	μg/l	0.12 - 0.26	<0.07	0
Lead, Pb	μg/l	<1 – 1.4	<1	0
Nickel, Ni	μg/l	<1 - 1.9	<3	0
Iron, Fe	mg/l	<0.050	0.23 – 1.87	2 samples exceeded Fisheries MPC levels (0.1 mg/L) 1 sample exceeded domestic drinking and amenity MPC (0.3 mg/L)
Manganese, Mn	μg/l	2.5 – 6.9	<0.6	0
Copper, Cu	μg/l	2.5 – 4.8	1.7 – 2.7	6 sample exceeded Fisheries MPC levels (1 μg/L)
Zinc, Zn	μg/l	<5 – 9.4	<0.5	0

Continued...

Parameter	Unit	Range of concentrations recorded (minimum – maximum) 2010 (Ref. 8.1)	Range of concentrations recorded (minimum – maximum) 2013 (Ref. 8.18)	No. of exceedances of Water Quality Limit Values (Ref. 8.17, 8.18 and 8.23)
Oil products	mg/l	0.05 – 0.48	0.15 – 3.9	3 sample exceeded Fisheries MPC levels (0.05 mg/L) 1 sample exceeded domestic drinking and amenity MPC (0.3 mg/L)
Anionic surfactants	mg/l	<0.1	0.87 – 0.89	2 samples exceeded Fisheries MPC levels (0.5 mg/L)
Phenols	µg/l	5 - 11	10 - 20	6 samples exceeded Fisheries MPC levels (1 µg/L)
PCBs	µg/l	<0.01	0.00208 – 0.00699	0
Benzo(a)pyrene	µg/l	<0. 0005 – 0. 0008	0.001 – 0.002	0
α-HCH	µg/l	-	2.01 – 3.43	0
β-HCH	µg/l	-	22.07 – 23.97	2 samples exceeded domestic drinking and amenity MPC (20 µg/L) and the WHO limit (2 µg/L)
γ-HCH	µg/l	-	0.26 – 1.38	0
HCB	µg/l	-	0.21 – 0.52	0
2,4-DDE	µg/l	-	<0.05 – 0.05	0

Continued…

Parameter	Unit	Range of concentrations recorded (minimum – maximum) 2010 (Ref. 8.1)	Range of concentrations recorded (minimum – maximum) 2013 (Ref. 8.18)	No. of exceedances of Water Quality Limit Values (Ref. 8.17, 8.18 and 8.23)
4,4-DDE	µg/l	-	1.09 – 2.25	2 samples exceeded the WHO limit (1 µg/L)
2,4-DDD	µg/l	-	<0.05 – 0.26	0
4,4-DDD	µg/l	-	<0.05 – 5.14	2 samples exceeded the WHO limit (1 µg/L)
2,4-DDT	µg/l	-	0.95 – 0.55	0
4,4-DDT	µg/l	-	1.49 – 2.11	2 samples exceeded the WHO limit (1 µg/L)
Individual Pesticides†	µg/l	-	<0.05	None detected±
Total OCPs	µg/l	<0.01	-	0

* Platinum-cobalt scale
** Level of detection for other two samples exceeded Fisheries MPC level, which constrains comparison of the results with the standard.
† Pentachlorobenzene, Heptachlor, Aldrin, Heptachlor Epoxy, Methoychlor, Trans-chlordan, Cis-chlordan, Trans-nonachlor and Mirex.
± Detection limit exceeded OCP standard of 0.01 µg/L.

Complete.

The general pre-existing characteristics of surface waters in the Study Area are as follows:

- Surface water colour is predominantly due to the presence of high concentrations of degraded organic material (humus) and the iron content of the soils;
- The surface waters are generally pH neutral (7.0 to 7.1);
- The surface waters are mineralised. The water quality data is consistent with a significant proportion of the observed surface water flow being derived from groundwater;
- The surface water quality contains evidence of anthropogenic pressures on the local water environment, predominantly relating to agricultural activity in the catchment;
- For all surface waters, elevated copper levels exceeded the standards for fisheries water bodies; elevated copper may be associated with surface water runoff from vineyard areas

(where copper-based agrochemicals are potentially used for controlling parasites). Copper levels were within the Russian standards for amenity and general use;

- Water in the Shingar River exceeded the relevant standards for several parameters including: phosphate, iron, copper, nitrites, nitrates, sulphates, mercury, phenols, oil products, pesticides and surfactants;
- Water sampled from the unnamed tributary running through the Graphova Gap exceeded the relevant standards for several parameters including: phosphate, iron, copper, sulphate, ammonia, phenols, oil products, pesticides and surfactants;
- Water sampled from the unnamed tributary running through the Kiblerova Gap exceeded the relevant standards for several parameters including: phosphate, copper, nitrite, sulphate and phenols;
- Water quality in 2010 and 2013 was broadly similar. The surface water was slightly more mineralised and alkaline in 2013. The 2013 samples were collected in summer whereas the 2010 samples were obtained in winter. Seasonal variations in baseflow component may have caused the variation in mineralisation;
- In the 2013 survey, water in the Shingar River and tributary running through the Graphova Gap had elevated concentrations of pesticides present. No pesticides were detected in 2010[8]. The difference may relate to the seasonal variations in agricultural activity in the catchment;
- PCBs were detected in the surface water samples in the 2013 survey. However, the measured concentrations were below the relevant standards;
- Some of the observed elevated concentrations, such as iron, sulphate and phenols, may be due to natural processes rather than to anthropogenic contamination; and
- Water quality, particularly with respect to parameters such as dissolved oxygen and suspended solids, is likely to vary in response to seasonal fluctuations in flow rates and in response to rainfall events.

The locations of known exceedances of surface water quality limits for both drinking and domestic use and fishery water bodies are shown on Figure 8.3.

8.5.4.4 Stream Bed Sediment Quality

Stream bed sediment samples were collected at the same locations as the surface water quality samples in 2010 and 2013 (Ref. 8.1, Ref. 8.8).

The samples were taken from the top 5 cm of the sediments. No visual or olfactory evidence of contamination was observed in the sediment during sampling. The sediments ranged from sands to silty clays. The proportion of fine-grained sediment (<0.01 mm) in the stream bed sediments ranged from 6.9 to 48.9%. The proportion of humus ranged from 3.3 to 8.9%.

[8] Note that the analytical methodology varied between the two monitoring rounds.

The stream bed sediment samples underwent laboratory analysis to assess sediment quality. The results were compared with the adopted guidelines (Table 8.4). The results of the stream bed sediment survey are shown in Table 8.10.

Table 8.10 Stream Bed Sediment Survey Results

Parameter	Unit	Range of concentrations recorded in 2010 (minimum – maximum) (Ref. 8.1)	Range of concentrations recorded in 2013 (minimum – maximum) (Ref. 8.18)	No. Samples Exceeding Standards (Ref. 8.26, 8.28)
pH	pH unit	6.9 – 7.1	7.35 – 7.40	n/a
Arsenic, As	mg/kg	0.9 – 1.6	1.1 – 1.3	0
Cadmium, Cd	mg/kg	0.67 – 0.70	0.19 – 0.25	4 samples exceeded the Guideline value (0.6 mg/kg)
Lead, Pb	mg/kg	6.1 – 14.8	6.1 – 9.7	0
Mercury, Hg	mg/kg	<0.02 – 0.03	0.016 – 0.021	0
Zinc, Zn	mg/kg	48.4 – 72.5	39 - 52	0
Chromium, Cr	mg/kg	25.2 – 27.6	6.6 – 9.2	0
Copper, Cu	mg/kg	44.2 – 97.5	30 - 33	4 samples exceeded the Target and Guideline values (36 and 35.7 mg/kg)
Nickel, Ni	mg/kg	21.2 – 22.8	14 - 18	0
Manganese, Mn	mg/kg	172.4 – 296.8	180 - 200	n/a
Iron, Fe	mg/kg	11530 - 13060	6900 - 9400	n/a
Benzo(a)pyrene	mg/kg	<0.005	0.0021 – 0.0092	0
Oil products	mg/kg	59 – 294	<5 - 21	4 samples exceeded the Target value (50 mg/kg)
Phenol	mg/kg	1.77 – 15.94	0.15 – 2.44	6 samples exceeded the Target value (0.05 mg/kg)

Continued...

Parameter	Unit	Range of concentrations recorded in 2010 (minimum – maximum) (Ref. 8.1)	Range of concentrations recorded in 2013 (minimum – maximum) (Ref. 8.18)	No. Samples Exceeding Standards (Ref. 8.26, 8.28)
Total PCBs	mg/kg	0.0094 – 0.2161	0.00145 – 0.00187	2 samples exceeded the Target value (0.02 mg/kg) and the Guideline value (0.0341 mg/kg)
Hexachlorobenzene	mg/kg	<0.0005 – 0.0012	0.00074 – 0.00105	0
α-HCH	mg/kg	<0.0005	0.0008 – 0.0016	1 sample exceeded the Guideline value (0.00094 mg/kg)
β-HCH	mg/kg	<0.0005	0.00577 – 0.00659	2 samples exceeded the Guideline value (0.00094 mg/kg)
γ-HCH	mg/kg	<0.0005 – 0.0011	0.00078 – 0.001	6 samples exceeded the Target value (0.00005 mg/kg) 1 sample exceeded the Guideline value (0.00094 mg/kg)
Heptachlor	mg/kg	<0.0005	<0.00005	0
Aldrin	mg/kg	<0.0005	<0.00005	0
Dieldrin	mg/kg	<0.0005 – 0.0805	-	3 samples exceeded the Target value (0.0005 mg/kg)
DDT (total, including DDD and DDE)	mg/kg	0.0009 – 0.0883	0.0055 – 0.1398	6 samples exceeded the Target value (0.01 mg/kg) and the Guideline value (0.00119 mg/kg)

Complete.

The general pre-existing characteristics of stream bed sediments in the Study Area are as follows:

- The stream bed sediments show evidence of anthropogenic impacts. Pesticides, PCBs, and oils have been detected in all samples at concentrations that exceed the adopted standards;

- Phenols were detected in the stream bed sediments at concentrations that exceeded the adopted standard. It is possible that the phenol concentrations are due, at least in part, to natural organic material in the sediment;
- Metals are also present in the stream bed sediments. Cadmium and copper are present in concentrations that exceed the adopted standards; and
- Comparison of the surface water quality and stream bed sediments suggests that some contaminants, such as PCBs, may be present at elevated levels in the sediments without necessarily adversely impacting water quality.

The locations of known surface water pollution exceedances in stream bed sediments in the Study Area are shown on Figure 8.3.

8.5.5 Baseline Summary

8.5.5.1 Soils

Soils in the Study Area comprise cambisols, phaeozems, arenosols, fluvisols, abrazems/regosols and anthropogenic soils.

Soils used for existing agricultural purposes, predominantly arenosols and abrazem/regosols, are important to local land users. The soils provide a substrate that has the physical qualities and/or degree of productivity to support agricultural use.

Of the soil types that will be crossed by the proposed Pipeline route, phaeozem soils are of particular note given that they are structurally prone to compaction and erosion, and vulnerable to contamination through surface spills. The soils typically comprise a soft organic rich topsoil layer, covered in vegetation. It is also noted that phaeozem soils have a high water absorption capacity and play a key role in water regulation.

Fluvisols are present in the valley bottoms and play a role in the hydrological cycle. As they are associated with watercourses and valley bottoms they may be in continuity with shallow groundwater and can act as pathways for movement of chemical contaminants into groundwater and surface water.

The other soil types (cambisols and anthropogenic soils) are less likely to be used for agriculture and are not typically as rich in organic materials as phaeozem soils.

Pre-existing elevated concentrations, i.e., above MPC thresholds, of arsenic, copper, lead, zinc, benzo(a)pyrene, PCBs and pesticides were measured in the soil.

8.5.5.2 Groundwater

The hydrogeology of the Study Area is characterised by shallow alluvial aquifers overlying a carbonate aquifer.

The alluvial aquifer is present along the narrow river valleys of the Shingar River and an unnamed tributary of the Sukko River located in the Graphova Gap. Groundwater flow within the underlying carbonate aquifer is controlled by a network of fissures within folded and fractured sedimentary bedrock deposits. There is the potential for a hydraulic connection between the alluvial groundwater and the carbonate aquifer.

Recharge to the carbonate aquifer is via rainfall, groundwater flow from up-hydraulic gradient and recharge from the shallow alluvial aquifers.

In the lower reaches of the valleys, groundwater is likely to discharge to the river system and ephemeral springs during periods of high rainfall and corresponding groundwater levels within the alluvium.

The groundwater abstraction associated with the proposed Russkaya compressor station is located approximately 5 km to the northeast of the landfall section (Ref. 8.3). The Project does not lie within the designated sanitary protection zone for this abstraction.

The nearby vineyard, Agrofirma Kavkaz, and the residential area of Varavrovka source the majority of their water from the Supsekh water supply system with the remainder of the water being obtained from the unlicensed surface water abstraction, located upstream of the Project Area (Ref. 8.4).

There is a groundwater source at the Russian Ministry of Defence site in Sukko about 2 km south of the landfall facilities. This abstracts groundwater from three boreholes in the bedrock aquifer. The water is fresh and potable. No abstraction from this source is permitted from May to September.

During the 2010 and 2013 surveys groundwater samples were taken from springs within the Survey Area. The groundwater is fresh and mineralised. Elevated concentrations of iron, oil, surfactants and pesticides have been detected.

8.5.5.3 Surface Water

Watercourses in the Study Area include two watercourses crossed by the proposed Pipeline route, the Shingar River and an unnamed tributary of the Sukko River within the Graphova Gap. There is a third watercourse within the Study Area, which is another tributary of the Sukko River within the Kiblerova Gap, but this is located outside the Study Area.

Watercourses in the Study Area are predominantly precipitation fed, with frequent and short floods. In addition, surface waters are partly recharged from high groundwater tables during the winter months. Surface water flows typically peak during winter months when rainfall is highest. During summer months watercourses may become dry or form discrete ponds or small lakes of water within the river bed. Flood events occur in response to storm events. Flooding may trigger geomorphological features such as mudflows and landslides.

There are no licensed abstractions from surface water in the Study Area. There is a small impoundment on the watercourse in the Graphova Gap immediately upstream of the proposed access road crossing. From consultation meetings held with Kavkaz Winery, it is understood that the impounded water is used to irrigate the winery.

Surface water quality samples were taken in 2010 and 2013 (Ref. 8.1 and Ref. 8.8). The water was fresh and mineralised, indicating a significant groundwater baseflow component. Elevated concentrations of contaminants have been detected in the surface waters, including ammonia, sulphate, phosphate, nitrate, nitrite, mercury, iron, copper, oil, surfactants, phenols and pesticides. Stream bed sediment samples were collected at the same locations as the surface water quality samples. Elevated concentrations of contaminants have been detected in the sediments, including cadmium, copper, oil, phenols, PCBs and pesticides.

8.6 Impact Assessment

8.6.1 Impact Assessment Methodology

The impact assessment methodology is based on the principles of source-pathway-receptor. The source in this context has been identified in relation to the planned project Activity. Owing to the complexity of the Project, there are multiple sources. The receptors under consideration relate to soil, groundwater and surface water. Indirect receptors that use soil, groundwater and surface water have also been considered. Pathways that could link the sources and receptors have been identified. Only where the complete linkage of source, pathway and receptor are present can impacts potentially occur.

An overview of the process followed in compiling the ESIA Report and the general methodology adopted in assessing impact significance is presented in **Chapter 3 Impact Assessment Methodology**.

While there are a number of national and international soil, water and sediment quality standards applicable to the Project, there is relatively little guidance available describing how the significance of potential impacts on soil, water and sediment should be assessed. Based on the general methodology outlined in **Chapter 3 Impact Assessment Methodology**, on professional judgement and experience, and on the applicable Project standards and regulations, a series of impact significance criteria were developed to assess potential impacts on soil, water and sediment. A summary of the receptor sensitivity and impact magnitude criteria used in the assessment is presented below.

The combination of the magnitude of impact and receptor sensitivity criteria is assessed in a sensitivity matrix within **Chapter 3 Impact Assessment Methodology** to generate impact significance categories (**High**, **Moderate**, **Low** or **Not Significant**).

Measures to avoid or reduce any **Moderate** or **High** category (significant) impacts are then developed (where such measures are practical) and any residual impacts of the Project are reported.

8.6.1.1 Project Activities

The potential impacts are derived through the activities of the Project. These are described in detail in **Chapter 5 Project Description**. Table 8.11 outlines the key activities that are likely to interact with the existing soil, sediment, groundwater and surface water receptors.

Table 8.11 Key Activities likely to interact with Soil, Groundwater and Surface Water conditions

Phase	Activity
Construction	Pre-construction surveys
	General construction activities, including: • Plant mobilisation to site; • Vehicle and plant operations on site; • Delivery of fuel and other hazardous substances; • Refuelling of plant and machinery; • Storage of fuel and hazardous materials including wastes; • Maintenance of plant and machinery; • Use of power generation sets; and • Water supply from Sukko well.
	Preparation of access road or upgrades to junctions of existing roads, including: • Land take and vegetation clearance; • Diversion or protection of existing utilities and drainage infrastructure; • Preparation of drainage; • Delivery of material for road surface; and • Surfacing of road.
	Establishment of temporary construction areas, including: • Land take and vegetation clearance; • Diversion of existing utilities and drainage infrastructure; • Preparation of temporary drainage; • Delivery, use and removal of temporary pre-fabricated facilities; • Generation of wastes and wastewaters; • Use of construction materials; and • Restoration.
	Microtunnel construction, including: • Excavation of microtunnel shaft; • Tunnelling using a tunnel boring machine (TBM) equipped with slurry pipe system and lubrication system; • Insertion of pre-fabricated concrete jacking pipes with use of crane and hydraulic jacks to line tunnel; and • Removal of drill cutting from slurry.

Continued…

Phase	Activity
	Pipeline pull-in through microtunnels, including: • Excavation of foundation area for pipe pull winches or sheaves within microtunnel construction area; • Shore pull of Pipeline from offshore pipe-lay vessel; • Welding of tie-in at microtunnel reception pit; and • Grouting of annular gap between Pipeline and tunnel case following pipeline installation and pre-commissioning tests.
	Open trench pipe-laying activities – from microtunnel entry shafts to landfall facilities, including: • Land clearance, grading, topsoil stripping; • Diversion of existing utilities and drainage infrastructure; • Excavation of trench and storage of excavated materials; • Padding of trench bottoms; • Dewatering of trench (if required); • Stringing of Pipeline; • Line up and bending of pipe; • Welding of pipe sections and coating of welding joints; • Pipe lowering in trench; • Backfill of trench; and • Restoration.
	Construction of landfall facilities, including: • Land clearance, grading, topsoil stripping; • Diversion of existing utilities and drainage infrastructure; • Excavation of foundations, underground chambers and areas for hardstanding formation; • Delivery of construction materials; • Formation of concrete structures and hardstanding areas; • Erection of buildings and structures; • Mechanical assembly and connections; • Welding of pipe sections and coating of welding joints; • Site surfacing; • Painting of infrastructure; • Restoration; and • Generation of wastes and wastewaters.
Pre-Commissioning	Pre-commissioning activities associated with pipeline testing, including: • Receipt of pipeline inspection gauges (PIGs); and • Hydro-testing of pipelines.

Continued…

Phase	Activity
Pre-Commissioning	Pre-commissioning activities associated with cleaning, gauging and drying Pipeline, including: • Insertion of PIG trains; and • Compressor operation.
Commissioning	Commissioning activities include: • Heating of the gas; • Injection of gas with and without a PIG; and • Pipeline pressurisation. The injection of gas and Pipeline pressurisation has no potential to impact soil, groundwater or surface water during this phase. Heating of the gas is necessary as the pressure of the gas from the Russkaya compressor station is much higher than that required for transport in the Pipeline. Hence, the gas is a lower temperature (see **Chapter 5 Project Description** for more details). During commissioning, the temperature of gas in the Pipeline will not be any higher than during operation. As such, no impact from this activity is anticipated on soil, groundwater or surface water and commissioning activities are not considered in the assessment.
Operational	General activities, including: • Maintenance of mechanical equipment; • Clearance of vegetation from permanent Right of Way (RoW) over Pipeline; and • Generation of wastes and wastewaters.
	Pigging
	Presence of access roads, landfall facilities, microtunnels and buried pipeline.
Decommissioning	General construction activities
	Establishment of Temporary Construction Areas
	Open trench pipe removal activities – from microtunnel entry shafts to landfall facilities
	Decommissioning of landfall facilities
Unplanned Events	Emergency events

Complete.

A number of design controls have been incorporated into the Project design which, reduce the potential impacts from a given Project Activity. Potential Construction and Pre-Commissioning Phase impacts are assessed on this basis. Additional mitigation and monitoring measures are then identified that can further reduce impacts to as low as reasonably practicable (ALARP), and the residual impact is identified.

Design controls are presented in **Chapter 5 Project Description**. Those of particular relevance to soil and water include:

- Microtunnelling below the Shingar River;
- Deepening of the Pipeline below the Graphova Gap to maintain sufficient Pipeline depth below the valley floor;
- Construction of a level platform for the landfall facilities, which will include stabilisation of the surrounding slopes;
- Drainage to manage surface run-off, which will be constructed along access roads and at the landfall facilities;
- The use of geotextiles in the construction of permanent and temporary access roads;
- Stripping and stockpiling topsoil (stockpiles will normally be less than 2 m in height) for later use during reinstatement;
- Backfilling of trenches, which will normally occur immediately after the Pipeline has been lowered;
- Reinstatement of the proposed Pipeline corridor, which will include restoration of original land contours as closely as possible, except grading of slopes at the Graphova Gap to manage slope stability;
- Dedicated mobile plant and refuelling areas. Fuel storage tanks will be double-walled. Secondary containment by bunding will surround the tanks;
- Provision of water storage facilities so that seasonal constraints on abstraction of groundwater at Sukko can be accommodated;
- Provision of wastewater collection systems and offsite disposal by licensed waste management operators;
- Chemical storage areas, which will be constructed on hardstanding with bunding; and
- Benching or grading along trench to enable safe working.

8.6.1.2 Impact Assessment Criteria

Receptors

A summary of the most sensitive soil, groundwater and surface water receptors is provided below.

Table 8.12 presents a summary of the identified receptors together with the respective sensitivity ranking. The justification for these sensitivity levels is presented in subsequent sections of this chapter.

Table 8.12 Summary of Receptor Sensitivity

Receptor Type	Receptor Name	Sensitivity
Soil	Agricultural Soils (arenosols and abrazems/regosols)	Moderate
	Phaeozems	High
	Fluvisols	High
	Other Soils (cambisols and anthropogenic soils)	Low
Groundwater	Alluvial (Superficial) Aquifers	Moderate
	Carbonate Aquifer	Moderate
	Sukko Groundwater Resource	High
	Russkaya abstraction	Negligible
Surface Water	Shingar River	Moderate
	Unnamed tributary of the Sukko River in Graphova Gap	Moderate
	Existing unlicensed surface water abstraction	Moderate
Human Health	Construction Workers	High*

* Human health sensitivity was not calculated based on the criteria given in this chapter. It is assumed that human health is highly sensitive to contamination impacts from soil, groundwater and surface water

Soil and water receptors cannot be considered in isolation as they are interdependent; for example:

- Groundwater and surface water may experience secondary impacts associated with primary impacts to soils;
- Surface waters may experience secondary impacts associated with primary impacts to groundwater; and
- Soil and groundwater may experience secondary impacts associated with primary impacts to surface water.

Humans may experience secondary impacts associated with primary impacts to groundwater or surface water that subsequently affect abstractions. Note that where substances measured in water meet the respective drinking water standards, the health of existing or potential abstractors is not considered to be at significant risk.

Ecological receptors may experience secondary impacts associated with primary impacts on soil or water. The impacts to ecological receptors are assessed in **Chapter 11 Terrestrial Ecology**.

Pathways

Pathways are the means by which an activity can affect a receptor. In some cases this may be a physical migration pathway, such as a movement of contamination through a drain connecting two water features, or it may be the inherent nature of the activity itself; for example, excavation of soil will have a physical impact on the soil. For the purpose of this assessment some activities (such as excavation) are considered as an activity and a pathway.

Only where an activity, a pathway and receptor are present can an impact occur. The pathways considered in the ESIA process are summarised below:

- Physical disturbance of soils;
- Erosion and transport of soils by surface run-off;
- Changes to groundwater levels, for example, by forming lower permeability barriers or higher permeability preferential pathways;
- Groundwater and surface water interaction;
- Run-off into surface water;
- Movement of sediment within surface watercourses;
- Deposition of sediment onto soils adjacent to watercourses during flood events;
- Direct release of contaminants to soil and surface water;
- Leaching of contaminants from soils into groundwater;
- Migration of contaminants in groundwater;
- Migration of contaminants (in water and/or sediment) in surface water; and
- Ingestion, dermal contact and inhalation of contaminants in soil and sediment by construction workers.

Receptor Sensitivity

A series of impact significance criteria were developed to assess potential impacts on soil, water and sediment based on the general methodology outlined in **Chapter 3 Impact Assessment Methodology**, on professional judgement and experience, Good International Industry Practice (GIIP), and on the applicable Project standards and regulations.

The sensitivity of a soil or water receptor is a reflection of how vulnerable that receptor is to changes in chemical or physical attributes. The less sensitive receptors are those that are more resilient (less vulnerable) to change.

The concept of sensitivity also considers receptor value by capturing how important the receptors are to users of the environment (e.g. sustaining of ecosystems and humans via ecosystem services).

Sensitivity assessment criteria have been developed, using four categories of high, moderate, low and negligible.

Where the value and vulnerability assumptions are markedly different for an individual receptor, the more conservative category has been adopted.

Soil Receptor Sensitivity

Receptor sensitivity of soils is primarily related to the geochemical nature of the soils and the hydrological and nutrient cycling process of which they are a part (e.g. whether the soils are prone to erosion, fertility of soils, etc.). Similarly, the sensitivity depends on land-uses and ecosystems present. Soil sensitivity is also related to the presence of contaminants in the soil. This chapter focuses on the impacts to the soil baseline conditions. The associated risks to human health from baseline soil characteristics have also been assessed, as a link between humans and unknown soil contamination could be introduced by the Project.

The associated potential impacts of soil as a pathway upon land usage, ecology and ecosystems services are assessed in detail in the relevant chapters of this ESIA Report, specifically **Chapter 11 Terrestrial Ecology**, **Chapter 13 Landscape and Visual** and **Chapter 17 Ecosystem Services**.

Table 8.13 presents the receptor sensitivity criteria adopted for soils. In the absence of defined national guidance, the definitions for sensitivity criteria were informed by the GIIP US Guidelines for Soil Quality Assessment in Conservation Planning (United States Department of Agriculture) (Ref. 8.32).

Table 8.13 Soil Receptor Sensitivity

Sensitivity	Description
High	Highly vulnerable to physical disturbance, structurally prone to compaction or erosion, and taking >10 years to recover. Highly leachable and amenable to contamination. The soil provides a substrate that has the physical qualities and/or degree of productivity to support the development of important (in terms of nature conservation or concentration of biomass) and/or indigenous species of flora and fauna. The soil is intrinsically linked to the hydrological cycle; water is fundamental to its structure; and the soil plays a key ecosystem role in water regulation.

Continued…

Sensitivity	Description
Moderate	Vulnerable to physical disturbance but able to recover by mitigation measures within a period of 10 years. Moderately leachable. The soil provides a substrate that has the physical qualities and degree of productivity to support the development of species of flora and fauna in some abundance and levels of diversity. The soil has some capacity for water retention and regulation and plays some role in the hydrological cycle in terms of a degree of water regulation and as a substrate for channelling run-off.
Low	Resilient to physical disturbance and/or impermeable to contamination. The soil constitutes no particular favourable substrate for the development of floral habitats, invertebrates and other fauna. The soil plays little or no role in the hydrological cycle or regulation of water.
Negligible	This category is included in **Chapter 3 Impact Assessment Methodology** but is considered not applicable to soil quality.

Complete.

Soils used for existing agricultural purposes, predominantly arenosols and abrazems/regosols, are a moderate sensitivity receptor due to their importance to local land users, although they may be resilient to physical disturbance from construction activities. The soils provide a substrate that has the physical qualities and/or degree of productivity to support agricultural development.

Phaeozem soils are a high sensitivity receptor. These soils are soft and are structurally prone to compaction or erosion, and prone to contamination through surface spills. Subsequently, they have a low resilience to impacts, and do not readily return to their natural state. It is also noted that phaeozem soils have a high water absorption capacity and play a key role in water regulation.

Fluvisols are a high sensitivity receptor as they play a role in the hydrological cycle and support the highly sensitive Nikolski's tortoise (refer to **Chapter 11 Terrestrial Ecology**).

Within the Study Area, cambisols are only present above the microtunnel route and anthropogenic soils are locally present above the microtunnel route and beneath the access road route. Neither soil type is important for agriculture. These soils are low sensitivity receptors.

Existing unstable geomorphic features (**Chapter 7 Physical and Geophysical Environment**) are also a high sensitivity receptor. As active geomorphological features (erosion gullies, landslides and floodplains, etc.) typically already involve processes of physical disturbance to soils, they will continue to be highly vulnerable to further physical disturbance from activities associated with the Project.

Human Receptor Sensitivity

Construction workers are a high sensitivity receptor. As mentioned in Table 8.12, human health sensitivity was not calculated based on the criteria in this chapter; humans are considered highly sensitive to contamination from soil, groundwater and surface water.

Groundwater Receptor Sensitivity

The sensitivity of a groundwater body (the receptor) is typically based on three aspects: chemical quality, quantity and use of the groundwater resource. For example, a groundwater body may be valuable as a source of drinking water or as an integral part of a groundwater dependent ecosystem.

Table 8.14 presents the criteria used to classify groundwater receptor sensitivity based on the quantity and/or use of the resource, using the categories high, moderate, low, and negligible. It is noted that, based on the groundwater data currently available (Section 8.4.4), for conservatism the groundwater has been assumed to be a potential potable resource and to meet chemical quality criteria for potential potable use.

Table 8.14 Groundwater Receptor Sensitivity

Sensitivity	Description
High	Productive strata of high conductance and good chemical quality with significant resource availability, or being within source (sanitary) I or II of a drinking water supply sanitary protection zone. Presence of a groundwater dependent ecosystem of national and international importance within 1 km of the Project Area. The water resource is highly vulnerable to leaching and transportation of contaminants.
Moderate	Productive strata of medium conductance with limited resource availability and good chemical quality, or being within source (sanitary) III of a drinking water supply sanitary protection zone. Presence of a groundwater dependent ecosystem of national and international importance within 1 km of the Project Area. The water resource is vulnerable to leaching and transportation of contaminants.
Low	Unproductive strata of low conductance with low resource availability and good quality. No designated groundwater fed ecosystems within 1 km of the Project Area The water resource has low vulnerability to contamination.
Negligible	Aquifer with negligible vulnerability and resource availability.

The groundwater receptors within the Study Area are the shallow superficial aquifers, and the underlying carbonate aquifer (**Chapter 7 Physical and Geophysical Environment)**.

The aquifers are potentially potable water resources despite oil products being detected.

The superficial aquifer is of moderate sensitivity because the aquifer is vulnerable to pollution, the aquifer is relatively thin and thus vulnerable to changes in the flow regime, and the aquifer is expected to be in hydraulic connection with surface water, and in place, the deeper carbonate aquifer.

The sensitivity of the carbonate aquifer is moderate as it has the potential to be productive but is not currently exploited for the supply of its water within the Study Area. Elsewhere in the region, such as at Sukko, the bedrock aquifer is utilised for water supply. The carbonate aquifer may feed surface watercourses and the shallow alluvial aquifer via springs.

Mesophilic forest is present in the river valleys. The habitat is located adjacent to ephemeral watercourses; when surface water is absent in dry weather, groundwater will be of greater importance to this habitat. Springs also contribute towards the aquatic ecology associated with the watercourses. Fish and invertebrate species have been identified as being present in the watercourses when flowing. The sensitivity of the mesophilic forest habitat and the aquatic ecology within the watercourses, and the potential impacts on these ecological receptors due to the Project are assessed in **Chapter 11 Terrestrial Ecology**.

The groundwater abstraction for the Russkaya compressor station has negligible sensitivity because the Project does not lie within the designated sanitary protection zone for this abstraction (Ref. 8.3).

The source aquifer from which the Sukko wells abstract water has seasonal restrictions on its use and for this reason this groundwater resource is of high sensitivity.

Surface Water Receptor Sensitivity

The surface water receptors comprise the surface water bodies. This includes both the water and the stream bed sediments. The quality and abundance of water resources affects a wide variety of ecological habitats and ecosystem services. This section focuses primarily on the impacts to the surface water body baseline conditions. Associated potential impacts on ecological and anthropological systems are assessed, where appropriate, in the relevant chapters of this ESIA Report including **Chapter 11 Terrestrial Ecology**.

However, as there are secondary impacts associated with changes to the baseline conditions, these need to be considered in assessing the sensitivity of the primary surface water receptors. Table 8.15 presents a description of receptor sensitivity for surface water.

Table 8.15 Surface Water Receptor Sensitivity

Sensitivity	Description
High	A water resource making up a vital component of a protected habitat or assemblage of species, which may have designated conservation status at an international and national scale. The water resource supports important (e.g. protected and/or large populations) of flora and fauna. The water resource is highly important and relied upon locally or is important at a regional or transboundary level for providing services.
Moderate	The water resource supports populations of flora and fauna. The water resource has a local importance in terms of providing services, but there is ample capacity and/or adequate opportunity for alternative sources.
Low	The water resource has limited or no role in supporting flora and fauna. The water resource has little or no role in terms of providing services for the local community.
Negligible	This category is considered non-applicable to surface water.

There are two surface water receptors within the Study Area:

- Shingar River; and
- An unnamed tributary of the Sukko River flowing through the Graphova Gap.

Each of these watercourses is within a 50 m wide sanitary protection zone (Ref. 8.20), which restricts the activities that take place in order to prevent contamination and silting of the water bodies. These protection zones help conserve the habitat for aquatic biological resources and other flora and fauna.

The watercourses are generally compliant (Ref. 8.1) according to the standards for amenity and general use of waters (Refs. 8.17, 8.18 and 8.19), although oil, nitrate and ammonia levels were exceeded (Section 8.5.1). Downstream of the landfall section, the watercourses flow through sensitive ecological habitats as described in **Chapter 11 Terrestrial Ecology**. The Graphova Gap will be crossed by the Pipeline (Figure 8.4). The watercourses are typically ephemeral. Flows are expected to vary seasonally and the watercourses are likely to only have substantial flow during and immediately after rainfall events. The watercourses support flora and fauna of low sensitivity (**Chapter 11 Terrestrial Ecology**). Both watercourses have been conservatively assessed as receptors of moderate sensitivity.

The surface water abstraction in the Study Area is located upstream of the Pipeline crossing in Graphova Gap (Ref. 8.4). The abstraction is unlicensed. The abstraction is used to irrigate the Kavkaz winery. This receptor is considered to have moderate sensitivity.

Mesophilic forest is present in the river valleys. The habitat is located adjacent to ephemeral watercourses that experience natural fluctuations in flow rate. Fish and invertebrate species have been identified as being present in the watercourses when flowing. The sensitivity of the mesophilic forest habitat and the aquatic ecology within the watercourses and the potential impacts on these ecological receptors due to the Project are assessed in **Chapter 11 Terrestrial Ecology**.

Impact Magnitude Criteria

The magnitude criteria consider size, likelihood and duration of the impact, both in terms of duration of the cause and the subsequent effect.

Impact magnitude assessment criteria have been developed, using four categories of high, moderate, low and negligible.

The determination of the overall impact magnitude rating has been determined on the basis of professional judgement and GIIP, considering all characteristics collectively rather than any one characteristic alone.

The likely frequency of the impact occurrence is also taken into account in assigning the overall impact grade. Impacts that would definitely occur are given a higher magnitude rating than impacts that might occur (e.g. removal of soil during earthworks compared with minor leaks and spills.)

Soil Impact Magnitude

For soils, the magnitude of a potential impact is determined predominantly in terms of the extent of loss of soil or loss of soil function. Typical activities and pathways for soil include:

- A direct change in soil volumes (e.g. excavation and disposal elsewhere);
- A direct change in soil area (e.g. covering soils with hardstanding);
- A direct change in the physical properties of soil (e.g. compaction);
- Changes in soil and water interactions (e.g. erosion or leaching);
- Increased potential for geomorphological instability or activation of existing geomorphologically unstable features; or
- Introduction of contaminants into the soil.

In particular, changes to chemistry of soils may lead to the applicable soil quality standards being exceeded.

Table 8.16 presents a description of the magnitude of change for soils using the classifications high, moderate, low and negligible.

Table 8.16 Soil Event Magnitude

Magnitude	Description
High	The potential for soil quality and/or physical structure to be permanently impacted. The area affected by the activity is predicted to be large (>10 ha).
Moderate	The impact on soil quality and condition may recover through natural processes and the impact will be medium term (several years). The area affected by the activity is predicted to be a medium extent (>1 ha and < 10 ha)
Low	The impact on soil quality and condition is predicted to recover rapidly through natural processes and the duration of impact is short (limited to the Construction Phase). The area affected by the activity is predicted to be a minor extent (<1 ha)
Negligible	No changes distinguishable from natural variability.

Human Impact Magnitude

If there is a linkage between soil-bound contamination and/or soil gas and construction workers the impact magnitude is considered to be high, otherwise the impact magnitude is negligible.

Groundwater Impact Magnitude

For groundwater systems, the magnitude of a potential impact is determined predominantly in terms of the extent of groundwater loss to the groundwater body in question. Losses to a groundwater resource can occur in terms of either quantity or quality. Typical activities and pathways for groundwater losses include:

- A direct change in the groundwater level causing deterioration of a groundwater resource (e.g. direct water abstraction);
- A reduction in groundwater and surface water interaction (e.g. tunnel providing barrier to groundwater flow to a river);
- Salt water intrusion for coastal receptors; or
- Introduction of contaminants into the groundwater body.

In particular, changes to water quality of groundwater bodies may lead to the applicable water quality standards for groundwater being exceeded.

Table 8.17 shows the criteria used to classify magnitude of impact.

Table 8.17 Groundwater Event Magnitude

Magnitude	Description
High	There is a potential for water quality and/or quantity to be permanently impacted. There is a complete loss of integrity of a groundwater body or utilisation by receptors.
Moderate	Water quality and condition is likely to recover through natural processes and the impact is predicted to be medium-term (several years). There is a loss in integrity of a groundwater body or a loss of part of the groundwater body.
Low	Water quality and condition is predicted to recover rapidly through natural processes and the duration of impact is short (limited to the Construction Phase). There is a temporary impact on receptor.
Negligible	Results in an impact on receptor but of insufficient magnitude to affect its use and/or integrity

Surface Water Impact Magnitude

For surface waters, the magnitude of a potential impact is determined predominantly in terms of the extent of changes to the flow regime or to water quality. Typical activities and pathways for surface water impacts include:

- A direct change in the flow regime causing deterioration of a surface water resource (e.g. change in flow, channel characteristics);
- A change in groundwater or surface water interaction (e.g. change in baseflow);
- A change in water availability for ecosystems or water supply; and
- Introduction of contaminants into the watercourse.

In particular, changes to surface water or stream bed sediment quality may lead to the applicable quality standards for watercourses being exceeded. Table 8.18 presents a description of the criteria used to classify magnitude of impact for surface water.

Table 8.18 Surface Water Impact Magnitude

Magnitude	Description
High	The potential for natural recovery of water quality, quantity and/or physical disturbance through natural processes is limited and the impact is predicted to be long term (several years). Predicted to affect an entire watercourse downstream of the landfall section
Moderate	Water quality, quantity and the condition of the watercourse is likely to recover through natural processes and the impact is predicted to be medium term (a year). Predicted to affect multiple or elongated stretches of a watercourse.
Low	Water quality, quantity and condition is predicted to recover rapidly through natural processes and the duration of impact is short (limited to the Construction and Pre-Commissioning Phase). Predicted to affect a limited stretch of a watercourse.
Negligible	No changes distinguishable from natural variability. Predicted to affect a single pool of a watercourse.

8.6.2 Assessment of Potential Impacts: Construction and Pre-Commissioning Phase

8.6.2.1 Assessment of Potential Impacts (Pre-mitigation)

The impact magnitudes have been assessed against the impact magnitude criteria described above. This has been combined with the receptor sensitivity assessment using the matrix approach described in **Chapter 3 Impact Assessment Methodology**. The results are summarised in Table 8.19 to Table 8.21.

Soils

Soils in Study Area

The estimated area for temporary facilities and works during construction in the Study Area is 52.33 hectares (ha) as outlined in **Chapter 5 Project Description.** This includes construction areas and storage areas. All open-cut pipeline construction activities will be undertaken within a temporary construction corridor. The construction corridor will nominally be 120 m wide.

Storage and Use of Fuels, Chemicals and Wastes

During the Construction and Pre-Commissioning Phase, fuels and chemicals will be stored and used on site. The storage facilities proposed include embedded mitigation as described in **Chapter 5 Project Description**; for example the diesel and slurry storage tanks are double-walled with leakage protection. Waste materials will be temporarily stored on site prior to disposal. Additionally, process wastewaters will be generated from mobile plant equipment and facilities operation, cleaning and maintenance. The handling of waste products, including hazardous materials (e.g. oil) is discussed in **Chapter 18 Waste Management**.

Potential contaminants include fuels, lubricants, cement, concrete, grout and slurry additives and metals. Contamination of the soil may result through accidental leaks or spills during construction (e.g. during refuelling or waste handling). Depending on the size and nature of the spillage, and the physical properties of the soil (including soil porosity, soil potential for pollutant sorption, and soil saturation), this could lead to contaminant migration and impacts at some distance from the site. The likelihood of leaks and spills occurring is higher in the main storage, refuelling and construction areas than along the Pipeline construction corridor. Refuelling of the fuel bowsers or vehicles within the construction sites will only be undertaken within designated refuelling areas. All fuel tanks will be located within secondary containment, which will form an impermeable bund, sufficient to contain at least 110% of the stored volume. The impact of a fuel spill on soil quality and condition may recover through natural processes and the impact is likely to be medium term. The likelihood of leaks and spills of grouts and slurry is primarily restricted to the construction area around the microtunnel entry shaft sites.

Leaks and spills are a potential impact of moderate magnitude to the agricultural soils, phaeozem soils and fluvisols, resulting in **Moderate** significance impact for agricultural soils and **High** significance impact for the phaeozem and fluvisol soils. The potential impact on other soils in the Study Area is low magnitude given the limited areas of these soils within construction areas, giving a **Low** significance impact.

Accidental damage to existing utilities could occur during land clearance and earthworks. This may result in contamination of the soil. This is likely to be minor in extent and is a low magnitude, resulting in **Low** significance impact for agricultural soils, **Moderate** significance impact for the phaeozem and fluvisol soils and **Low** significance impact for cambisols and anthropogenic soils.

Agricultural Soils and Phaeozem Soils

Land Clearance and Earthworks

Temporary alterations to ground conditions during the construction period may occur as a result of the clearance of land for the access roads, temporary construction areas, trenching activities, landfall facilities and vehicle movements.

The removal of vegetation will expose bare soils to erosion and/or compaction by the movement of heavy machinery and vehicles. The release of soil particles into surface watercourses and general migration down slopes could occur as a result of erosional processes (particularly where soil stockpiles are present).

Earthworks and stockpiling of soils can lead to the mixing of different soil types, and also the changing of the soil structure. Such mixing can influence soil type and structure, which may influence ecosystems or agricultural usage. Similarly, mixing of excavated soil types can result in the contamination of previously clean soils by contaminated soils.

For the access roads (excluding the Graphova Gap crossing, which is discussed below) and landfall facilities, the impacts associated with land clearance and earthworks are medium extent and moderate magnitude impacts for agricultural soils and phaeozem soils as the areas are less than 10 ha and the impacts are reversible, resulting in **Moderate** significance for agricultural soils and **High** significance for phaeozem soils.

For the temporary construction areas and trenching corridor (excluding Graphova Gap crossing, which is discussed below), the impact magnitude for agricultural soils is high as the area is large and is more than 10 ha, giving a **High** significance, and the impact magnitude for phaeozem soils and fluvisols is moderate given the minor extent of impact involved, giving a **High** significance for phaeozem soils.

In the event that excavated spoil generated as part of pipeline trenching or excavations for the landfall facilities or microtunnel entry shafts is unable to be re-used as part of Project, removal of excess spoil may be required. It is estimated that up to 15,000 m^3 of surplus spoil will be left over from the installation of the four pipelines. Any surplus or unsuitable backfilling material (such as inert waste) will be removed from site and disposed of at an approved waste handling facility. The handling of waste materials is discussed in **Chapter 18 Waste Management**. The potential loss of soil from the Project Area as a result of this is of minor extent and an impact of low magnitude and **Low** significance.

Microtunnelling

In order to construct the Pipeline through the sea cliff, 1.4 km of the Pipeline will be housed in microtunnels. The tunnelling has the potential to introduce contaminating materials to soil, including grouts, slurries and lubricants, particularly near the entry shafts. Uncontrolled ingress of slurry or grout into the subsurface could occur during the microtunnelling works. This is most likely to affect the soil in the vicinity of the entry shafts as the majority of the tunnelling is within bedrock. However, slurry or grout may migrate locally from bedrock into the overlying soils via fractures and fissure zones. Given the minor extent, the potential impacts are of low magnitude and **Low** significance.

Hydro-testing

Hydro-testing will be undertaken as part of the pipeline integrity checks post-construction. Therefore, there is a possibility that pipeline sections with poor seals may be identified. Leakage may occur in these areas or the worst-case scenario would be uncontrolled discharge of the test waters into the subsurface may occur temporarily. During the hydro-testing, the test water may contain increasing concentrations of suspended sediment including metal particulates. Other contaminants such as hydrocarbons may also be present. Depending on the location of the leaks, this could permit test water to infiltrate through the soil, potentially contaminating soil. The effects are expected to be minor in extent and the Pipeline will be below the topsoil. The potential impact has low magnitude and **Moderate** significance.

Fluvisols

Land Clearance and Earthworks

Land clearance and earthworks construction, particularly for the access roads and the microtunnelling construction platform, may cause increased potential for erosion and compaction and may cause changes to soil properties. The impact magnitude is moderate given their minor extent and the significance for the fluvisols is **High**.

Open-cut Trench Crossing at Graphova Gap

The landfall section of the Pipeline to the east of the microtunnels will be constructed using open-cut techniques. The Pipeline will cross the Graphova Gap, through which a tributary of the Sukko River flows. The watercourse at this point is ephemeral, i.e. flow rates vary in relation to rainfall events. During the summer, the flows are typically low and the watercourses can be dry during low rainfall periods. Additional baseflow is provided by springs, but these are anticipated to also vary seasonally and in response to rainfall events.

For each of the four pipelines crossing the gap, a dedicated trench will be excavated perpendicular to the watercourse, such that the top of pipelines will be approximately 1.5 to 2 m below the bed of the watercourse. The Pipeline route has been locally deepened as a design control measure to reduce the risk of scour or erosion during flood events. The bottom of the trench will be approximately 2 to 3 m wide, with side slopes of approximately 45 degrees. Excavation of the pipeline trenches can be performed using standard hydraulic excavators and the Pipeline will be installed conventionally using standard pipe-laying equipment. During installation some pipe sections will undergo cold bending to ensure the Pipeline follows the contours of the watercourse crossing. After installation of the pipelines in the trench, protective measures will be installed as a design control measure to prevent possible flash floods from eroding the bed of the watercourse and exposing the external coating of the Pipeline. This protection can be achieved by installing a pre-cast concrete slab (approximately 1.2 m wide and 0.15 m thick) and suitable engineering backfill, i.e. graded material with rock fill (e.g. cobbles and boulders) on top of the Pipeline to prevent erosion, prior to backfilling. Following backfilling, the crossing will be reinstated, with banks rebuilt and seeded, or where additional stability is required, covered with a temporary geo-textile material or soil filled sacks where practicable. The modified slope angles created to aid slope stability during construction will be retained permanently post-reinstatement. All temporary works will then be removed.

Impacts on soils could include increased susceptibility to erosion due to vegetation clearance, the displacement of soils from the trenching process and the excavation and grading of the construction corridor due to the locally steep terrain, temporary stockpiling and storing of soil. The impact magnitudes for fluvisols taking into account the design controls are moderate given the works are localised but the effects may be medium term, giving a **High** significance.

Other Terrestrial Soils in Landfall Section (Cambisols and Anthropogenic Soils)

Land Clearance and Earthworks

Land clearance and earthworks during access road construction may cause increased potential for erosion and compaction and may cause changes to soil properties. The impact magnitudes and significance for the other soils in the Study Area are **Low** given their minor extent.

Geomorphologically Unstable Features

Impacts relating to ground instability are most likely to arise in areas of steep topography and where ground instability is already present due to natural weathering processes.

Land Clearance and Earthworks

Earthworks (including vegetation clearance, grading, soil stripping, trenching, and road access construction), stockpiles of excess spoil, construction of the land facilities and microtunnel entry shaft site have the potential to cause ground instability on slopes (either natural or man-made). This could lead to slope instability, associated ground subsidence and the formation of slope erosion features. Depending on the nature of the soil instability and ground movement, this could cause soil stability impacts that may extend over several years. The region is naturally subject to mudflows following intense rainfall events and materials from unstable slopes may be transported downstream during storm events. Ground instability of geomorphologically unstable features after the design controls are taken into account are of negligible magnitude giving a **Low** significance impact.

Open-cut Trench Crossing at Graphova Gap

As far as possible, the pipeline river crossing design at Graphova Gap takes the local topography into account to help manage ground instability risks. Ground instability of geomorphologically unstable features after the design controls are taken into account are of negligible magnitude giving a **Low** significance impact.

Microtunnelling

Microtunnelling beneath the Shingar River has reduced the likelihood of ground instability being caused by this aspect of the Project in the Shingar River valley and where the Pipeline crosses the coastal cliffs. Ground instability of geomorphologically unstable features after the design controls are taken into account are of negligible magnitude giving a **Low** significance impact.

Hydro-Testing

Potential leaks of water during hydro-testing could influence slope stability in areas of steeper terrain, predominantly associated with the valley sides. The effects are expected to be minor in extent and therefore the impact magnitude is low. The potential impact is of **Moderate** significance.

Human Health

Construction Workers

Elevated concentrations of contaminants that exceed published standards are known to occur in the soil within the Study Area (refer to the baseline in Section 8.5.1), albeit at comparatively low levels. The contaminants locally present in the soil may be harmful to human health under certain exposure scenarios. Contaminant concentrations in the soils appear to be highest in agricultural areas, at the watercourse crossings and near existing roads. Deposits of waste materials have been identified locally, including a ditch infilled with demolition materials that may contain asbestos. In addition to the known areas of contamination, the possibility exists that the Project may encounter currently unidentified, localised pockets of soil contamination, which may be disturbed by the earthworks. These may relate to past land use or uncontrolled waste disposal. However, the likelihood of encountering extensive unidentified contamination is relatively low given the current land uses in the Study Area.

Accidental leaks and spills during the works may also cause soil contamination (as discussed above).

Contaminated soil may affect construction workers through being inadvertently ingested or inhaled or through dermal contact. On the basis of the available information, the potential impact on human health before mitigation is of **High** significance given humans are a high sensitivity receptor and the magnitude is high due to a potential pollutant linkage being present between soil contaminants and humans.

Groundwater

Groundwater in Study Area

Potential impacts to the groundwater are likely to arise primarily in the Construction and Pre-Commissioning Phase through potential contamination from spills and leaks and potential disturbance of the flow regime during trenching and microtunnelling.

Storage and Use of Fuels, Chemicals and Wastes

During the Construction and Pre-Commissioning Phase, fuels and chemicals will be stored and used on site. The storage facilities proposed include embedded mitigation as described in **Chapter 5 Project Description**; for example the diesel and slurry storage tanks will have appropriate secondary containment for leakage protection. Waste materials will be temporarily stored on site prior to disposal. Additionally, process wastewaters will be generated from mobile plant equipment and facilities operation, cleaning and maintenance. Potential pollutants include fuels, lubricants, cement, concrete, grout and slurry additives and metals.

Construction workforce sewage and domestic wastewater will be generated. This includes wastewaters associated with ablution facilities, medical centres, showers, kitchens and other sewerage water mixed with drained water. The quantity of sewage and domestic wastewater produced depends on the number of workers present on onshore construction sites at any one time. All domestic wastewater shall be collected and tankered off-site to an appropriate waste treatment facility. Anticipated wastewater volumes and planned storage and disposal are further discussed in **Chapter 18 Waste Management**.

Accidental release of pollutants to groundwater may occur due to leaks or spills. Leaks and spills may contaminate the groundwater, either directly through infiltration and migration of wastewaters or liquid wastes, or indirectly by leaching of soil contamination. The removal of topsoil is likely to increase groundwater vulnerability. If the trench or excavation has intercepted groundwater, then the vulnerability of the groundwater to leaks and spills will be increased. The likelihood of leaks and spills occurring is likely to be higher in the main storage, refuelling and construction areas than along the main pipeline permanent RoW.

The majority of leaks and spills are likely to be relatively small in volume. Groundwater quality may be locally affected but is expected to gradually recover through natural attenuation over the medium term. The potential impact on groundwater quality associated with accidental leaks and spills is of moderate magnitude and **Moderate** significance for the aquifers in the Study Area. The impacts to the abstractions at Russkaya and Sukko are of negligible magnitude given the distance from the site and are **Not Significant**.

Accidental damage to existing utilities may occur during land clearance and earthworks. This could result in contamination of the groundwater, either directly or via the soil or surface waters. This is likely to be minor in extent and is a low magnitude impact of **Low** significance for the Study Area.

Concentrations of benzo(a)pyrene, arsenic, total PCBs and copper slightly exceeding screening criteria have been identified is parts of the Study Area. Whilst these concentrations exceed the screening criteria they are unlikely to be impacting groundwater in the underlying aquifers. Given the agricultural land use in the Study Area the likelihood of significant areas of unidentified contamination is considered to be low.

Land clearance including the removal of vegetation, topsoil, hardstanding or existing structures may increase the potential for infiltration of precipitation through the soil, increasing leaching of soil contaminants to groundwater. However, for low concentrations of contaminants this will be off-set in part by natural attenuation processes.

Based on the available baseline data on soil contamination, this is of minor extent and low magnitude impact of **Low** significance for the Study Area.

Land Clearance and Earthworks (Temporary Construction Areas)

If the pipeline trenches (except at the Graphova Gap, which is discussed below), access roads or excavations at the landfall facilities intersect the water table, then groundwater control (maintaining groundwater levels to enable dry excavation) may be required. Given the trench and excavation depths of only 2.5 m, dewatering is unlikely to be required along the entire Pipeline corridor. Similarly, access road construction is only expected to extend below the water table in the cuttings. However, locally there may be a requirement for groundwater control during construction. This may involve dewatering abstractions. The impacts will be temporary and recovery is expected to be rapid. The impact upon groundwater flows within the superficial and bedrock aquifers is low magnitude and **Low** significance.

Open-cut Trench Crossing at Graphova Gap

The open-cut trench crossing the watercourse at Graphova Gap is likely to intersect the water table in the alluvial aquifer; given the bedrock is locally exposed in the valleys the trench crossing may also intersect groundwater within the carbonate aquifer. Groundwater control (maintaining groundwater levels to enable dry excavation) is likely to be required. This may involve dewatering abstractions. The impact upon groundwater flows within the alluvial aquifer is low magnitude and **Moderate** significance as the impacts will be temporary and recovery is expected to be rapid. The degree of hydraulic connection between the superficial and carbonate aquifers is likely to be greatest in the valley bottom. However, given the trench depths compared with the aquifer thickness, the potential impact to the carbonate aquifer is anticipated to be negligible magnitude and **Not Significant**.

Microtunnelling

The tunnel entry shafts may intersect the water table. Groundwater control (maintaining groundwater levels to enable dry excavation) may be required. The shaft walls will act as a local barrier. Dewatering may also be required to manage groundwater during the excavation of the shafts. Any change in water level that occurs in response to dewatering will be temporary and recovery is expected to be rapid. The impact upon groundwater flows within the superficial aquifer is of negligible magnitude and **Not Significant** given the presence of the shaft walls. The impact on the carbonate aquifer is conservatively assessed to be low magnitude and **Moderate** significance; if dewatering is not required then this would drop to negligible and low respectively.

The tunnel is within the carbonate aquifer. The tunnelling itself is not expected to require groundwater control when below the water table as groundwater ingress will be controlled by operating the TBM in closed mode, which maintains a pressure system to actively support the tunnel face. Injection of grout into the formation will control groundwater ingress further. The impact on the flow regime in the carbonate aquifer during tunnelling taking into account the planned design controls is consequently of negligible magnitude and **Not Significant** as no changes to the groundwater flow regime are expected.

Tunnelling has the potential to introduce contaminating materials directly into groundwater in the form of lubricants and bentonite slurry. The volumes of lubricants that might enter groundwater accidentally during operation of the TBMs are expected to be low. Bentonite slurry[9] will be used to help stabilise the tunnels during excavation. Slurry may contain various additives to aid the tunnelling operations and some additives may contain hazardous chemicals. Under normal operating conditions, the slurry will form a filter cake around the edge of the tunnel excavation. This will help reduce losses of slurry into the surrounding ground. Where the microtunnels intersect fracture or fissure zones, slurry may be lost along individual fractures. Fracture zones may form preferential pathways linking to the alluvial aquifer or surface water features. Given the absence of known karstic features (Ref. 8.1), the distance slurry may travel along fractures is likely to be of the order of a few metres. Groundwater quality immediately

[9] Slurry may sometimes be referred to as mud.

adjacent to the slurry may be temporarily influenced. The majority of the slurry will be removed during grouting and no permanent impact on groundwater quality associated with slurry is expected. The impacts on the superficial aquifer and carbonate aquifer are low magnitude and **Low** significance.

As the tunnelling machine exits the tunnel, seawater will enter the tunnel. The residual slurry on the tunnel walls will reduce the ingress of seawater into the aquifer. The hydraulic gradient and differences in water density are expected to reduce the inland migration of saline water migration within the aquifer via the tunnel. During grouting, seawater remaining within the tunnel annulus will be gradually displaced in a seaward direction (**Chapter 5 Project Description**) but any seawater that has entered the aquifer surrounding the annulus may remain. Through the prevailing hydraulic gradient and differences in water density the balance in fresh water and saline water within the aquifer is likely to return to its original condition over time and mitigate any long term impacts post-construction. The impacts on the alluvial aquifer are negligible magnitude, because the aquifer is above sea level, and are **Not Significant**. The impacts on the carbonate aquifer are low magnitude and **Low** significance.

Subsurface grouting around the tunnels will occur. The majority of the tunnels are within the carbonate aquifer. Where the microtunnels intersect fracture zones, grout may be lost along individual fractures. Fracture and fissure zones may form preferential pathways linking to the alluvial aquifer or surface water features. Given the absence of known karstic features (Ref. 8.1), the distance grout may travel, along fractures and fissures, is likely to be of the order of a few metres. As grout goes off, it can temporarily and locally influence the chemical quality of the adjacent groundwater, changing the pH and level of mineralisation. Metal concentrations may also rise. The presence of the grout may locally reduce aquifer permeability around the tunnels. The impacts of grouting are expected to be localised. The impacts of grouting on the superficial and carbonate aquifers are of low magnitude and **Low** significance.

Hydro-Testing

As described in **Chapter 5 Project Description**, the pipelines will be cleaned prior to hydro-testing. Seawater and debris (consisting of rust, coating and weld debris) will be captured in temporary onshore water storage (break) tanks. The collected seawater will be stored for a sufficient length of time to allow the debris to settle to the bottom. The debris will be removed from site and disposed of through an approved waste disposal company. The seawater will be temporarily stored and then pumped back into the pipelines during hydro-testing. If leakage or spills from the storage tank occurred, saline water could infiltrate into the subsurface and migrate down into the aquifer. However, the event will be short-lived and temporary, and dilution within the groundwater will occur. Particulate matter, for example metal particles, is unlikely to migrate far. The impacts to both the superficial and carbonate aquifers are low magnitude and **Low** significance.

The hydro-testing of the pipelines will be undertaken using seawater. As described in **Chapter 5 Project Description**, the test water will be filtered seawater injected with an oxygen scavenger (sodium bisulphite)[10] to prevent internal corrosion of the Pipeline prior to dewatering at an injection rate of 250 parts per million (ppm). In the event that the hydro-test fails, the contractor will be required to detect the leak and then propose a repair method to South Stream Transport. The repair method will depend on the nature and location of the leak. The hydro-testing will then be repeated. Leakage from the Pipeline during a hydro-test failure would infiltrate through the subsurface and enter groundwater. As the pipeline will be buried or within a microtunnel, there may be minimal or no unsaturated zone present to attenuate any pollutants present prior to reaching groundwater. However, the event will be of short duration and dilution within groundwater will occur. Particulate matter, for example metal particles, is unlikely to migrate far. Locally the salinity of the groundwater would temporarily increase but then would gradually attenuate through natural processes such as dilution and dispersion. The impacts to both the superficial and carbonate aquifers are moderate magnitude and **Moderate** significance.

Following completion of the hydro-testing, the remaining seawater within the Pipeline will be discharged to the sea and the Pipeline will be dewatered.

The hydro-testing of the landfall facilities will be undertaken using fresh water. Leakage during a hydro-test failure at the landfall facilities would enter the site drainage system or infiltrate through the subsurface and enter groundwater. However, the event will be of short duration and dilution within groundwater will occur. Particulate matter, for example metal particles, is unlikely to migrate far. The impacts to both the superficial and carbonate aquifers are low magnitude and **Low** significance.

As described in **Chapter 5 Project Description**, it is possible that the filtered hydro-test water from the first pipeline segments will be collected and temporarily stored on site in tanks for use in hydro-testing the remaining three pipelines within the landfall facilities. If this is not possible, the filtered water (containing no particulates or chemicals) will be discharged into a sump constructed in an appropriate location within one of the temporary construction sites to allow the water to infiltrate into the ground. As the water used in the hydro-testing of the landfall facilities will be fresh and will be filtered, the impacts to both the superficial and carbonate aquifers are of negligible magnitude and are **Not Significant**.

Water Abstraction

Groundwater will be abstracted from the existing Ministry of Defence water supply in Sukko for freshwater supply during construction. An estimated total volume of 37,000 m^3 of freshwater is required for the microtunnelling process and 500 m^3 is required for hydro-testing of the landfall facilities. In addition, it is estimated that up to 25 m^3 per day freshwater will be used for general construction activities (domestic usages, wheel washing etc.) during peak periods. The water will be trucked to the construction areas from Sukko. There is a May to September (inclusive) exclusion period when water cannot be abstracted from the existing source at Sukko.

[10] Sodium Bisulphite is listed in OSPAR's list of additives that Pose Little or No Risk to the environment (PLONOR). OSPAR refers to the Oslo and Paris *Conventions for the Protection of the marine Environment of the North-East Atlantic* (OSPAR Conventions), 1992.

Due to this restriction, a large quantity of water (up to 10,000 m^3) may need to be stored at the western end of the Pipeline stringing area temporary construction site (adjacent to the microtunnel construction site). A much smaller quantity of water (no more than 800 m^3) may need to be stored at the landfall facilities site.

It is assumed that the licensed abstraction rate, including the seasonal exclusion period, has been set at a rate that will not cause the derogation, in terms of quality and quantity, of the aquifer resources, or of any other groundwater users within Sukko that utilise the same aquifer. The rate of abstraction during construction will not exceed the licensed rate and the impact to the groundwater resource is of negligible magnitude and **Not Significant**.

Surface Waters

Surface Waters in Study Area

Potential impacts to the surface watercourses are likely to arise primarily in the Construction and Pre-Commissioning Phase through potential spills and leaks, discharges and disturbance of soil and sediment leading to impacted surface water run-off.

Storage and Use of Fuels, Chemicals and Wastes

During the Construction and Pre-Commissioning Phase, fuels and chemicals will be stored and used on site. The storage facilities proposed include embedded mitigation as described in **Chapter 5 Project Description**; for example the diesel and slurry storage tanks are double-walled with leakage protection. Waste materials will be temporarily stored on site prior to disposal (**Chapter 18 Waste Management**). Additionally, process wastewaters will be generated from mobile plant equipment and facilities operation, cleaning and maintenance. Potential pollutants include fuels, lubricants, cement, concrete, grout, slurry additives and metals and waste waters (**Chapter 18 Waste Management**). As discussed for groundwater (Section 8.6.1.1), all domestic wastewaters are captured and transported by tanker to appropriate disposal sites.

Accidental release of pollutants to surface water may occur due to leaks or spills, either by entering watercourses directly, or through leaching from impacted soil to groundwater and subsequent migration in groundwater.

As described in **Chapter 5 Project Description**, stormwater drainage systems will be constructed at the landfall facilities site, the microtunnel construction site and the landfall construction site. The drainage systems will collect and manage surface water run-off. The drainage systems will incorporate measures to reduce suspended sediment concentrations and an oil separator and collection system.

The majority of leaks and spills are likely to be relatively small in volume. Long term potential impacts on surface waters are likely to be attenuated through natural processes such as dilution and degradation. Short term impacts may be more significant. Depending on the size and nature of the spillage, this could cause water quality or sediment quality impacts which affect elongated stretches of the watercourse and at some distance downstream from the site and it is therefore a potential impact of moderate magnitude and **Moderate** significance for the watercourses and the surface water abstractor.

Accidental damage to existing utilities may occur during land clearance and earthworks. This may result in contamination of the surface waters, either directly or via the soil or groundwater. This is likely to be temporary and limited in extent and is a low magnitude impact of **Low** significance for the watercourses and a moderate impact of **Moderate** significance for the assumed surface water abstractor.

Land Clearance and Earthworks

Temporary alterations to the surface water flow volumes and rates may occur as a result of trenching, land clearance, access road construction, development of the temporary construction areas and vehicle movements. It is likely that surface water run-off will temporarily increase in the temporary construction areas and permanently at the landfall facilities, due to the removal of vegetation, compaction of bare soils, and hardstanding at the landfall facility.

Increased sediment entering the surface watercourses could result from land clearance, excavation works and erosional processes (particularly on soil stockpiles and on access roads close to gullies until road drainage is established). The region is naturally subject to mudflows following intense rainfall events and materials from unstable slopes may be transported downstream during storm events. Increased sediment load may alter the flood capacity, increase water turbidity, and smother aquatic and riparian flora and fauna. The eroded sediment may also have a high nutrient or contaminant content which can contribute to the enrichment and contamination of downstream waters. Impacts on surface water quality will typically be of short duration (i.e. during and immediately after a storm event). It is considered that the watercourses will be able to recover relatively rapidly through natural processes; timescales are likely to be weeks to months depending on weather and the flow regime.

The impacts associated with land clearance and earthworks in the catchments of the Shingar River and the unnamed tributary in the Graphova Gap (except at the Graphova Gap crossing, which is discussed below) are likely to be medium term and of moderate magnitude and **Moderate** significance prior to mitigation for the watercourses and the assumed surface water abstraction.

Open-Cut Trench Crossing at Graphova Gap

Open cut trenching is proposed for the Graphova Gap pipeline crossing. Open cut trenching across the river will temporarily alter the flow during the installation works at the crossing and potentially result in flows during a flood event being diverted onto the surrounding floodplain. Given the nature of the topography at the crossing site with relatively steep valley sides, the impacts on the flow regime are likely to be local to the crossing. The crossing may also affect the sediment load and quality of the water at the crossing and along the downstream stretch of the watercourse. It is proposed that the construction be undertaken in dry weather when there is little to no flow in the ephemeral watercourse, which will reduce the likelihood of impacts. However, based on the worst case assumption that there are flows in the watercourse due to rainfall at the time of crossing construction, the impacts on the tributary in the Graphova Gap are medium term and is of moderate magnitude and **Moderate** significance. The assumed surface water abstraction is upstream and so should not be impacted.

Microtunnelling beneath the Shingar River

Microtunnelling is proposed for the Shingar River crossing. No direct disturbance of the Shingar River is expected as the microtunnels will be about 14 m below the base of the river. Indirect impacts may occur due to changes in groundwater quality resulting from slurry ingress and grouting during microtunnelling; these impacts are expected to be temporary and short lived. The impacts are of low magnitude and **Low** significance.

If failure of the slurry storage tanks occurred, slurry could directly enter the Shingar River via the tributary gully. If this happened, the consequences to water quality in the river could extend for a considerable distance downstream given the volumes of slurry being stored. However, the likelihood of this occurring is considered to be very low given the design controls in place, including bunded storage tanks with leakage protection (**Chapter 5 Project Description**). However, in the unlikely event that a major spill did occur, the impacts are of high magnitude and **High** significance.

Hydro-testing

As described in **Chapter 5 Project Description**, the pipelines will be cleaned prior to hydro-testing. Seawater and debris (consisting of rust, coating and weld debris) will be captured in temporary onshore water storage (break) tanks; the stored volume will be 100 m^3. The collected seawater will be stored for a sufficient length of time to allow the debris to settle to the bottom. The debris will be removed from site and disposed of through an approved waste disposal company. The seawater will be temporarily stored and then pumped back into the pipelines during hydro-testing. If leakage or spills from the storage tank occurred, saline water could directly enter the Shingar River via run-off or indirectly via groundwater. However, the event will be short-lived and temporary, and dilution will occur. Particulate matter, for example metal particles, is unlikely to migrate far in the short-term but will enter stream bed sediments. The impacts to the Shingar River are of low magnitude and **Low** significance.

The hydro-testing will be undertaken using treated seawater; the volume of seawater used for hydro-testing will be 2,000 m^3 per pipeline. As described in **Chapter 5 Project Description**, the test water will be filtered seawater injected with an oxygen scavenger (sodium bisulphite)[11] to prevent internal corrosion of the Pipeline prior to dewatering at an injection rate of 250 parts per million (ppm).

In the event that the hydro-test fails, the contractor will be required to detect the leak and then propose a repair method to South Stream Transport. The repair method will depend on the nature and location of the leak. The hydro-testing will then be repeated. Leakage during hydro-testing would be expected to infiltrate through the subsurface and may enter surface waters, usually via groundwater. This may temporarily affect surface water quality. The potential impacts in the tributary at the Graphova Gap may be medium term and are moderate magnitude and **Moderate** significance as leakage may enter surface waters directly at

[11] Sodium Bisulphite is listed in OSPAR's list of additives that Pose Little or No Risk to the environment (PLONOR). OSPAR refers to the Oslo and Paris *Conventions for the Protection of the marine Environment of the North-East Atlantic* (OSPAR Conventions), 1992.

Graphova Gap as well as indirectly via groundwater. At the Shingar River, the Pipeline is in a tunnel 14 m beneath the river but the indirect pathway via groundwater from elsewhere in the catchment may remain. The potential impacts at the Shingar River are short lived and of low magnitude and **Low** significance.

Following completion of the hydro-testing, the remaining seawater within the pipeline will be discharged to the sea and the Pipeline will be dewatered.

The hydro-testing of the landfall facilities will be undertaken using fresh water. Leakage during a hydro-test failure at the landfall facilities would enter the site drainage system or infiltrate through the subsurface and enter groundwater. The water may then reach the tributary of Graphova Gap. However, the event will be of short duration and dilution will occur. Particulate matter, for example metal particles, is unlikely to migrate far in the short-term but in the unlikely event that particulate matter was to reach the watercourse it may enter stream bed sediments. The impacts to the tributary within the Graphova Gap are of low magnitude and **Low** significance.

8.6.2.2 Mitigation and Monitoring

Potential impacts from Project Activities to soil, groundwater, surface water and human health have been identified. The significance of these impacts has been assessed based on the sensitivity of each receptor and the expected magnitude of the potential impacts. The results of this assessment are presented in Table 8.19, Table 8.20 and Table 8.22.

Where impacts are identified as being significant, mitigation measures will be required to minimise the impacts or reduce the likelihood of an impact occurring. Appropriate mitigation measures, recommended to be implemented in addition to the design controls described in **Chapter 5 Project Description**, are presented in this section.

Note that many of the proposed mitigation measures aim to reduce the likelihood of impacts occurring, for example impacts associated with accidental leaks and spills. The pathways may still be present and the scale and duration of the effects may not necessarily be reduced. However, the likely frequency of the potential impacts will be reduced.

The mitigation measures will be controlled through the Russian Landfall Construction Management Plan (CMP), which will be developed as part of South Stream Transport's Environmental and Social Management Plan (ESMP), outlined in **Chapter 22 Environmental and Social Management**. Monitoring will record how effective mitigation is and, if appropriate, may result in changes to the mitigation measures.

The construction contractor will ensure that site personnel are trained to be familiar with the current legislation and to comply with the requirements of the CMP. In particular, project staff will be made aware of:

- The relevant water and waste management requirements set out in the CMP and the contractors' own Waste Management Plan to address handling, transportation and storage of waste and discharges of wastewater;
- The relevant contractor's Spill Prevention and Response Plan for all chemicals, fuels and oils used during the Project; and

- The Project Overarching Environmental and Social Monitoring Programme and Project Emergency Preparedness and Response Plan.

Soils Mitigation (including Human Health)

A number of the design controls described in **Chapter 5 Project Description** aim to reduce the risks to soils during construction (Section 8.6.1.1). Additional mitigation measures are presented below to address significant impacts.

To reduce the potential impact from spills and leaks compliance with the Russian Landfall CMP is required. The control measures to be adopted by the Project will be defined within a Spill Prevention and Response Plan which will be developed and maintained by each Project contractor.

Specific mitigation measures required to maintain soil quality during the Construction and Pre-Commissioning Phase include spillage prevention, bunding and restrictions near drains and watercourses, to avoid impacts. Materials will be stored, where practicable, with secondary containment and a full method statement to address construction risks and avoid impacts.

Activities near to drains and exposed sensitive soil areas will be controlled appropriately and in accordance with requirements in the Russian Landfall CMP to avoid adverse impacts.

Appropriate storage and handling protocols will be required for fuels and other chemicals used on site. Refuelling will only be undertaken in designated areas.

There will be dedicated plant and vehicle refuelling areas within the construction sites, which will be situated away from surface waters, groundwater and surface water drains. Secondary containment will be provided by forming an impermeable bund (i.e. a wall) around the refuelling area to provide containment in the event of a spill or rupture. Both storage tank and secondary bunding will be sufficient to contain at least 110% of the volume of fuel being stored.

Strict procedures will be followed when refuelling to minimise the risk of spills to the environment. All refuelling activities will be undertaken in line with requirements set out in the Russian Landfall CMP. The requirements of the Russian Landfall CMP need to be met by both South Stream Transport and the appointed contractors (and sub-contractors). Other fuels, oils and chemicals will be securely stored in clearly marked containers in a contained area to prevent pollution. It will also be ensured that spill kits, containing clean-up and absorbent materials etc. are stored in close proximity to the refuelling areas and with any mobile fuel bowsers.

Chemicals and materials will be clearly labelled and Material Safety Data Sheets (MSDS) will be displayed at point of storage. Chemical and material storage areas will be well maintained, neat and tidy, with adequate inventory control. Chemical storage will be weather-proofed and on bunded hardstanding. The bunds and hardstanding will be impermeable and resistant to the materials being stored. Requirements for the chemical storage will be set out in the Russian Landfall CMP.

Spill kits shall be kept in accessible locations at all times during construction, and employees trained in their use and disposal. To reduce the potential impact from spills and leaks compliance with the Russian Landfall CMP is required. The control measures to be adopted by the Project will be defined within a Spill Prevention and Response Plan which will be developed and maintained by each Project contractor.

All bulk materials and wastes used in the construction activities with the potential to pollute will be stored within appropriate storage facilities (bunded, secondary containment) and procedures will be implemented for handling, storage, transport and transfer, in order to minimise the potential for leaks or spills.

The exact storage locations and dimensions of the water storage tanks will be finalised during the detailed design and will be agreed between the Contractor, South Stream Transport and the relevant local authorities.

To mitigate the potential risks to the health of construction workers, should soil contamination be identified, appropriate personal protection equipment will be used and hygiene facilities made available to all workers.

Mitigation measures that will increase the protection of existing soil quality and structure include:

- Spillage prevention, bunding and restrictions near artificial drains, sensitive soils (moderate/high sensitivity) and water bodies to minimise impact. Material will be stored away from sensitive soils and water bodies where possible, with secondary containment. Remediate as far as practicable any pollution of soil and water;
- Soil and ground disturbance will be restricted to the Pipeline construction corridor, the footprint of the temporary and permanent landfall facilities and construction of temporary and permanent access roads;
- Vehicle movements will be restricted to defined access roads and hardstanding areas as far as possible to minimise compaction of the soils and changes to surface water runoff rates and volumes;
- Area of ground excavation and exposed soils and spoil heaps will be limited as far as possible to reduce the potential for erosion and sediment run-off. Additionally, during heavy rainfall, potentially polluting activities will be limited, as appropriate;
- Limit quantity of excavated soil material as far as practical, prevention of contamination of stockpiled material through appropriate waste management (**Chapter 18 Waste Management**) and management of stored soils to prevent contamination and change of soil properties; increasing the potential for re-use of soils on site, and decreasing the need for removal of soils from the landfall section to landfill;
- Minimise loss of soil through the implementation of GIIP. Management of stored soils to prevent contamination and change of geotechnical properties. Increase the potential for re-use of soils on site, and decrease the need for removal of soils from the Project Area to landfill;
- Pre-construction surveys and GIIP will be used to reduce the risk of accidental damage to existing utilities that might cause contamination;

- Construction measures in accordance with GIIP will be used to reduce the potential for soils mixing due to earthworks or erosion of soils. This will also reduce the risk of soil-based contaminant migration during earthworks;
- Removal of anthropogenic materials from existing infilled ditch and disposal off-site to an appropriately licensed waste disposal facility. This material potentially contains asbestos. The risks to human health will be managed in accordance with GIIP during handling, storage and transport of the waste materials;
- In the event that previously unidentified contamination is encountered during construction, works in the affected area will cease and appropriate steps will be taken in accordance with the Contractor's Contingency Plan, developed as part of the Contractor's Emergency Response Plan;
- Areas disturbed during construction activities, will be rehabilitated in accordance with the Russian Landfall CMP. Construction site rehabilitation will be started as soon as practicable following construction to limit loss of soil through erosion;
- Sediment and erosion controls (e.g. cut-off drains, swales, detention and retention basins, mesh fencing, sandbags etc.) will be implemented at construction sites to limit the loss of soil from the site;
- Ensure silted water is appropriately managed prior to entering into any watercourses, attenuation measures to minimise soil erosion and impacts on water quality through potential disturbance of sediment;
- Soil excavated from Pipeline trenches will be stored on the uphill side of the trench, where possible, until re-use or disposal;
- No stockpiles will be located within 50 m of a watercourse. Stockpiles will generally be less than 2 m high. Stockpiles will not be located on unstable slopes. Stockpiles will be covered to prevent erosion as required. Run-off collection and management systems shall be used to remove pathways which enable the entrained sediment to enter watercourses;
- Geotechnical engineering methods will be used if necessary to help stabilise temporary and permanent slopes at the landfall facilities. The potential for slope failures to occur will be minimised through design, management and monitoring;
- Management of microtunnelling and grouting operations will reduce risk of uncontrolled movement of slurry or grout through subsurface;
- To avoid the damage of phaeozem soils and instability of slopes, the potential for such failures to occur will be minimised through design, management and monitoring (in particular of excavation works). This includes the management of drainage systems, prevention of soil loading by restricting the height of stockpiles to 2 m, risk-assessed allocation of phaeozem soil and spoil storage areas by contractor, and monitoring of soils, water bodies, watercourses and drainage paths;
- Appropriate construction management practices will reduce the probability of occurrence of slope instabilities, activation of landslides, collapsing and slope erosion. Use of geotechnical engineering measures to aid slope stability. Design, management and monitoring carried

out in line with the appropriate Construction Method Statements. Siting of stockpiles away from watercourses or unstable slopes;

- Appropriate tunnelling and grouting management practice to minimise loss of grout and slurry to the surrounding formation;
- Direct discharges from access road drains to watercourses will be avoided where sediment can collect within the drain and be discharged during high flows. In such cases discharge will be via a filter system (swale or silt trap). The receiving watercourses are to be identified and agreed with appropriate authorities. Discharge will generally be by gravity to avoid disturbance of settled silts in the cut-off trenches. All discharge points will be designed to minimise scour;
- Ditches and lateral drains alongside the construction works areas (including pipeline trench activities, foundations and access roads) will be sized to a 1 in 100 rainfall event;
- Mitigation measures will include the management of drainage systems, minimisation of soft soils loading, risk-assessed allocation of soil and spoil storage areas, monitoring of excavation and construction works and monitoring of watercourses and drainage paths;
- Surface water runoff control measures for earthworks will generally comprise infiltration and cut-off trenches, formed at suitable locations to intercept flows and reduce the velocity and sediment content. The gradient of the trenches will be as flat as possible to avoid high velocities during storm events;
- Throughout the lifespan of the Project periodic inspection and cleaning of blockages within the site drainage will be carried out;
- Areas disturbed during construction activities, will be rehabilitated. Construction site rehabilitation will be started as soon as practicable following construction to limit loss of soil through erosion;
- Reinstate soils and replant as soon as possible after construction and testing; and
- Safe working plans as set out in the Health, Safety, Security and Environment – Integrated Management System (HSSE-IMS).

Soils Investigation and Monitoring

Study Area:

- No additional pre-construction investigation or monitoring is required;
- During construction, a watching brief will be in place during earthworks. A remediation and contingency plan will be developed to deal with encountering soil contamination not identified during the pre-construction studies;
- Monitoring of soil quality will be undertaken during the Construction Phase. The monitoring shall include soil sampling at a small number of locations along the RoW. The sampling will be undertaken on an annual basis during construction and on completion of the land restoration along the RoW. The soil samples shall be analysed for basic soil properties such as pH and organic matter content, as well as measurement of nutrients and potential pollutants concentrations (including metals and petroleum hydrocarbons); and

- Monitoring of the active geomorphological features will be undertaken during the Construction Phase. The monitoring shall include route inspections of active geomorphological features on a quarterly basis and on completion of the land restoration along the RoW. Additional monitoring will be undertaken following natural events that might affect geomorphological stability such as seismic events or flooding.

Groundwater Mitigation

In addition to the design controls (Section 8.6.1.1) and mitigation measures for soil outlined above (Section 8.6.2.2), the following mitigation measures will be adopted to minimise the potential for adverse impacts to groundwater:

- Sanitary and process wastewaters generated during construction will be stored in temporary facilities (mobile installations for wastewater treatment or septic tanks) and then regularly transported and disposed of in a nearby licensed facility for disposal of wastewater;
- Where dewatering is required all necessary discharge consents will be put in place. The quality of the water being discharged will be in accordance with the agreed discharge standards. If necessary, the abstracted water will be treated prior to discharge;
- All necessary discharge consents will be put in place prior to the disposal of the fresh water from the hydro-testing of the landfall facilities. The quality of the water being discharged will be in accordance with the agreed discharge standards;
- Groundwater control measures appropriate to the ground conditions will be used. Low permeability walls will be constructed for the tunnel entry shafts prior to dewatering;
- During heavy rainfall, potentially polluting activities such as dewatering of excavations is to be limited;
- Abstraction rates during any required dewatering of excavations will align with permitted agreements for any existing boreholes in use and in particular derogation of other water users will be avoided;
- Excavations should be backfilled with material with a similar permeability to the natural formation to prevent creating barriers or preferential pathways for water movement through the subsurface;
- The Drilling Management Plan will include measures to control groundwater ingress and minimise drilling fluid or grout loss from the trenchless option into surrounding aquifers. Avoid use of additives containing hazardous chemicals in drilling fluid or grout. Non hazardous chemicals will not exceed drinking water standards. All used additives will comply with PLONOR and therefore will be with low toxicity;
- If the ground conditions encountered during the excavation works indicate that there is the potential for the Pipeline at the Graphova Gap to create a barrier to groundwater flow such that baseflow to watercourses will be significantly affected, then drainage will be designed to allow groundwater to by-pass the obstruction to groundwater flow;
- Choice of anode material. Materials that are non-hazardous are preferable. Position the anodes above the water table if possible;

- Excavations should be backfilled with material with a similar permeability to the natural formation to prevent creating barriers or preferential pathways for water movement through the subsurface;
- If leaks or pipeline failure occurs during hydro-testing, the test will be stopped immediately to minimise potential infiltration of test water into the groundwater; and
- The leaching of grouts and drilling fluids will not cause pollution of groundwater and Russian standard SanPiN 2.1.4.1175-02 and Russian standard GN 2.1.5.1315-03 will be complied with.

As outlined in **Chapter 5 Project Description**, any construction activities in the Graphova Gap will be undertaken during dry weather as far as is practicable, when the groundwater levels and surface water flows are expected to be lower.

Groundwater Investigation and Monitoring

Groundwater will be monitored during and following the construction works. The monitoring programme will be agreed with the Russian Federation and shall adhere with national requirements. The monitoring programme will be included in South Stream Transport's Environmental and Social Monitoring Programme discussed in **Chapter 22 Environmental and Social Management**.

Study Area:

- The groundwater monitoring network will include selected natural springs as well as monitoring boreholes adjacent to the microtunnels in the Shingar River valley. The monitoring will include measurement of groundwater levels (or flow rates from springs) plus the collection of groundwater samples. The samples shall be analysed for basic water chemistry, such as pH and electrical conductivity, as well as to assess potential pollutant concentrations (including metals and petroleum hydrocarbons);
- Pre-construction monitoring of groundwater in accordance with South Stream Transport's Environmental and Social Monitoring Programme. This will include a monitoring round immediately prior to the start of construction to confirm there has been no significant change in groundwater quality since the baseline studies;
- Construction monitoring of groundwater in accordance with the Environmental and Social Monitoring Programme. Monitoring of groundwater levels and quality shall be undertaken at regular intervals during construction, with the frequency increased during microtunnelling and construction activities within the Graphova Gap;
- During construction a watching brief will be held during excavations. A remediation and contingency plan will be developed in the Contractor's Emergency Response Plan to manage any groundwater contamination not identified during the pre-construction investigations; and
- Post-construction monitoring of groundwater in accordance with the Environmental and Social Monitoring Programme.

Surface Water Mitigation

In addition to the design controls (Section 8.6.1.1) and mitigation measures for soil and groundwater outlined above (Section 8.6.2.2), many of which are also relevant to potential surface water impacts, the following mitigation measures are also recommended to minimise the potential for adverse impacts to surface waters:

- Spillage prevention, bunding and restrictions near artificial drains, sensitive soils (moderate/high sensitivity) and water bodies to minimise impact. Material will be stored away from sensitive soils and water bodies where possible, with secondary containment. Remediate as far as practicable any pollution of soil and water;
- The timing of construction activities in the Project Area will be important in limiting the potential for adverse impacts to surface waters. Where possible, construction in the immediate vicinity of watercourses will be carried out during dry weather, when the nearby watercourses have low or no flow and surface water runoff will be minimal;
- Appropriate diversion channels, or alternatively over-pumping provision, will be incorporated during construction in the Project Area such that continuity of the stream flow will be maintained during the works in the event of low intensity rainfall events during construction;
- Silt fences and/or other suitable measures will be located along and adjacent to the Graphova Gap crossing, as required. Other mitigation measures such as entrapment matting will be used where necessary. In order to prevent direct unplanned discharge to watercourses, drainage pathways will be identified during construction works and silt fences, settlement ponds, sediment entrapment matting and straw bales installed as necessary;
- Natural drainage patterns, in particular in the vicinity of surface water crossings will, where necessary, be maintained. Natural flows will, where necessary, be maintained. Existing artificial drainage to be diverted maintaining gravity flows;
- At the Project Area direct discharge of surface run-off to watercourses will be avoided as far as possible. Surface water runoff control measures for earthworks will generally comprise infiltration and cut-off trenches, formed at suitable locations to intercept flows and reduce velocity and sediment content. Ditches and lateral drains alongside the construction works areas (including pipeline trench activities, foundations and access roads) will be appropriately sized through GIIP for design and construction. Drainage systems shall be generally designed to be gravity controlled to avoid disturbance of settled silts. Drainage systems will be aligned with natural drainage patterns;
- Surface run-off treatment systems will be implemented at the landfall facilities to control the quality of the surface run-off entering watercourses. The drainage systems for the landfall facilities and the microtunnel construction area will include stormwater treatment systems. The necessary consents will be in place prior to discharge commencing. The quality of the water being discharged will be in accordance with the discharge consent. The treatment standards will be aligned with national water quality standards (Table 8.3). Treatment of road and pipeline construction corridor stormwater will not be undertaken;
- All drainage discharge points will be designed to minimise scour;

- Throughout the lifespan of the Project, periodic inspection and cleaning of blockages within the site drainage will be carried out. Limiting the area of ground to be excavated and the areas of exposed soils or spoil heaps will reduce the potential for erosion and sedimentation. Additionally, during heavy rainfall, potentially polluting activities such as dewatering of excavations is to be limited;
- The gradient of the pipeline trenches will be as flat as possible to avoid high velocities during storm events;
- Sediment and erosion controls will be implemented at construction sites to limit sediment in runoff;
- Road edge drains will be led away by ditches into drainage swales via settlement lagoons and small ponds away from the road edges so that runoff is controlled to prevent sediment entering local surface waters;
- Direct discharges from the landfall facilities drainage systems to watercourses will be avoided;
- No stockpiles will be stored within 50 m of any watercourses;
- Any stockpiles that are to be left for some time will be covered to prevent erosion and silt fences used to remove pathways which enable the entrained sediment to enter watercourses;
- Inspection and cleaning of pipe sections before installation will reduce the quantity of sediments and contaminants present in the dewatering and cleaning effluent, as well as from dewatering of the sites; and
- Collection and recycling of the drilling fluid and grout used in microtunnelling, which reduces water consumption.

Surface Water Investigation and Monitoring

Surface water will be monitored during and following the construction works. The monitoring programme will be agreed with the Russian Federation and shall adhere with national requirements. The monitoring programme is further discussed in **Chapter 22 Environmental and Social Management**.

Study Area:

- The monitoring network will comprise upstream and downstream locations on the Shingar River and the watercourse in the Graphova Gap. The monitoring will include measurement of surface water flows plus the collection of water and stream bed sediments samples. The water samples shall be analysed for basic chemistry, such as pH, electrical conductivity, dissolved oxygen and suspended solids, as well as to assess potential pollutant concentrations (including metals and petroleum hydrocarbons). The sediment samples shall be analysed for basic properties, such as pH, particle size distribution and organic matter content, as well as to assess potential pollutant concentrations (including metals and petroleum hydrocarbons);
- Pre-construction monitoring of surface water will be undertaken in accordance with Environmental and Social Monitoring Programme. This will include a monitoring round

immediately prior to the start of construction to confirm there has been no significant change in surface water or sediment quality since the baseline studies;

- The Environmental and Social Monitoring Programme includes construction monitoring of surface water;
- Monitoring of surface water will be undertaken during the Construction Phase in accordance with Environmental and Social Monitoring Programme. Monitoring of surface water flows and water quality shall be undertaken at regular intervals during construction, with the frequency increased during construction activities within or immediately adjacent to the watercourses; and
- During construction a watching brief will be held. A contingency plan will be developed in the Contractor's Emergency Response Plan to manage surface water contamination not identified during the pre-construction investigations.

Post-construction monitoring of surface water in accordance with Environmental and Social Monitoring Programme.

8.6.2.3 Residual Impacts: Construction and Pre-Commissioning Phase

Table 8.19, Table 8.20 and Table 8.21 present a summary of the potential residual impact significance to soil and terrestrial sediment, groundwater and surface water arising from the Project following application of the identified mitigation measures (Section 8.6.2.2).

The assessment of the significance of residual impacts assumes full application and effectiveness of the mitigation measures.

Soils

The mitigation measures proposed reduce the significance of the residual impacts on soils and sediments to **Low**.

Groundwater

The mitigation measures proposed reduce the significance of the residual impacts on groundwater to being **Low** to **Not Significant**.

Surface Water

The mitigation measures proposed reduce the significance of the residual impacts on surface watercourses to being **Low** to **Not Significant**. The residual impact at the surface water abstractor is **Low**.

Human Health

The mitigation measures proposed reduce the significance of the residual impacts on humans to **Low**.

Table 8.19 Assessment of Soil and Human Health Potential Impacts: Construction and Pre-Commissioning Phase

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
General construction activities	Leaks and spills during use and storage of hazardous materials causing contamination of soil	Agricultural soils	Moderate	Moderate	Moderate	Spillage prevention, bunding and restrictions near artificial drains, sensitive soils (i.e., of moderate to high sensitivity) and water bodies to minimise impact. Material will be stored away from sensitive soils and water bodies where possible, with secondary containment. Compliance with the ESMP, and Project Emergency Preparedness and Response Plan	Low
		Phaeozem soils	High	Moderate	High		Low
		Fluvisols	High	Moderate	High		Low
		Other soils	Low	Low	Low		Low
	Accidental damage to existing utilities causing soil contamination	Agricultural soils	Moderate	Low	Low	Pre-construction surveys and Good International Industry Practice will be used to reduce the risk of accidental damage to existing utilities that might cause contamination. Compliance with the ESMP, and Project Emergency Preparedness and Response Plan	Low
		Phaeozem soils	High	Low	Moderate		Low
		Fluvisols	High	Low	Moderate		Low
		Other soils	Low	Low	Low		Low

Continued…

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
	Contact with contaminated soil posing a risk to human health	Construction workers	High	High	High	Use of appropriate personal protection equipment and provision of hygiene facilities. Removal of anthropogenic materials from existing in-filled ditch and disposal off-site to an appropriately licensed waste disposal facility. This material potentially contains asbestos. The risks to human health will be managed in accordance with Good International Industry Practice during handling, storage and transport of the waste materials. In the event that previously unidentified contamination is observed during construction, works in the affected area will cease until the contaminated material is tested and appropriate mitigation measures designed or an appropriate disposal processes identified.	Low

Continued…

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
	Loss of soils (removal)	Agricultural soils	Moderate	Low	Low	Limiting quantity of excavated soil material as far as practical, prevention of contamination of stockpiled material through appropriate waste management (**Chapter 18 Waste Management**) and management of stored soils to prevent contamination and change of soil properties; increasing the potential for re-use of soils on site, and decreasing the need for removal of soils from the landfall section to landfill. Re-use excess soils elsewhere within the landfall section if possible.	Low
		Phaeozem soils	High	Low	Moderate		Low
		Fluvisols	High	Low	Moderate		Low

Continued…

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Preparation of access road / upgrades to junctions of existing roads	Vegetation clearance causing increased vulnerability of soils to erosion and compaction	Agricultural soils	Moderate	Moderate	Moderate	Strip topsoil from working area and store in stockpiles. Stockpiles kept to agreed height, and free from disturbance. Stockpiles to be covered as required. Siting of stockpiles away from watercourses or unstable slopes. Design and management of site drainage to reduce risk of soil erosion in exposed subsoil areas or in stockpiles. Reinstate soils and replant along road verges as soon as possible after construction and testing.	Low
		Phaeozem soils	High	Moderate	High		Low
		Fluvisols	High	Moderate	High		Low
		Other soils	Low	Low	Low		Low
		Unstable geomorphic features	High	Negligible	Low		Low

Continued...

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Preparation of access road / upgrades to junctions of existing roads	Changes to soil properties through earthworks	Agricultural soils	Moderate	Moderate	Moderate	Strip topsoil from working area and store in stockpiles. Spoil handling protocols to avoid mixing different soil types. Topsoil to be stored separately to subsoil. Management of stored soils to prevent contamination and change of soil properties.	Low
		Fluvisols	High	Moderate	High		Low
		Other soils	Low	Low	Low		Low
	Earthworks influencing ground stability	Unstable geomorphic features	High	Negligible	Low	Appropriate construction management practices will reduce the probability of occurrence. Grading of slopes. Use of geotechnical engineering measures to aid slope stability. Design, management and monitoring carried out in line with the appropriate Construction Method Statements. Siting of stockpiles away from watercourses or unstable slopes.	Low

Continued...

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Establishment of Temporary Construction Areas	Vegetation clearance causing increased vulnerability of soils to erosion and compaction	Agricultural soils	Moderate	High	High	Strip topsoil from working area and store in stockpiles. Stockpiles kept to agreed height, and free from disturbance. Stockpiles to be covered as required. Siting of stockpiles away from watercourses or unstable slopes. Design and management of site drainage to reduce risk of soil erosion in exposed subsoil areas or in stockpiles. Reinstate soils and replant as soon as possible after construction and testing.	Low
		Phaeozem soils	High	Moderate	High		Low
		Fluvisols	High	Moderate	High		Low
		Unstable geomorphic features	High	Negligible	Low		Low
	Changes to soil properties through earthworks including stockpiling	Agricultural soils	Moderate	Moderate	Moderate	Strip topsoil from working area and store in stockpiles. Spoil handling protocols to avoid mixing different soil types. Topsoil to be stored separately to subsoil. Management of stored soils to prevent contamination and change of soil properties.	Low
		Phaeozem soils	High	Moderate	High		Low

Continued...

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Establishment of Temporary Construction Areas	Earthworks influencing ground stability	Unstable geomorphic features	High	Negligible	Low	Appropriate construction management practices will reduce the probability of occurrence. Grading of slopes. Use of geotechnical engineering measures to aid slope stability. Design, management and monitoring carried out in line with the appropriate Construction Method Statements. Siting of stockpiles away from watercourses or unstable slopes.	Low
Microtunnel construction	Uncontrolled slurry ingress into subsurface	Agricultural soils	Moderate	Low	Low	Appropriate tunnelling and slurry management practice. Compliance with the Project Emergency Preparedness and Response Plan and Russian Landfall CMP is required.	Low
	Tunnelling influencing ground stability	Unstable geomorphic features	High	Negligible	Low	Appropriate tunnelling management practice	Low
Pipeline pull-in through microtunnels	Uncontrolled grout ingress into subsurface	Agricultural soils	Moderate	Low	Low	Appropriate grouting management practice Compliance with the Project Emergency Preparedness and Response Plan and Russian Landfall CMP is required.	Low

Continued...

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Open trench pipe-laying activities – from microtunnel entry shafts to landfall facilities	Vegetation clearance causing increased vulnerability of soils to erosion and compaction	Agricultural soils	Moderate	High	High	Strip topsoil from working area and store in stockpiles. Stockpiles kept to agreed height, and free from disturbance. Stockpiles to be covered as required. Siting of stockpiles away from watercourses or unstable slopes. Design and management of site drainage and grading of slopes to reduce risk of soil erosion in exposed subsoil areas or in stockpiles. Reinstate soils and replant as soon as possible after construction and testing.	Low
		Phaeozem soils	High	Moderate	High		Low
		Fluvisols	High	Moderate	High		Low
		Unstable geomorphic features	High	Negligible	Low		Low
	Changes to soil properties through earthworks including excavation of trench and stockpiling	Agricultural soils	Moderate	High	High	Strip topsoil from working area and store in stockpiles. Spoil handling protocols to avoid mixing different soil types. Topsoil to be stored separately to subsoil. Management of stored soils to prevent contamination and change of soil properties.	Low
		Phaeozem soils	High	Moderate	High		Low
		Fluvisols	High	Moderate	High		Low

Continued…

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
	Earthworks influencing ground stability	Unstable geomorphic features	High	Negligible	Low	Appropriate construction management practices will reduce the probability of occurrence. Grading of slopes. Use of geotechnical engineering measures to aid slope stability. Design, management and monitoring carried out in line with the appropriate Construction Method Statements. Siting of stockpiles away from watercourses or unstable slopes.	Low
Construction of landfall facilities	Vegetation clearance causing increased vulnerability of soils to erosion and compaction	Agricultural soils	Moderate	Moderate	Moderate	Strip topsoil from working area and store in stockpiles. Stockpiles kept to agreed height, and free from disturbance. Stockpiles to be covered as required. Siting of stockpiles away from watercourses or unstable slopes. Design and management of site drainage to reduce risk of soil erosion in exposed subsoil areas or in stockpiles. Reinstate soils and replant around the permanent landfall facilities as soon as possible after construction and testing.	Low
		Unstable geomorphic features	High	Negligible	Low		Low

Continued...

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
	Changes to soil properties through earthworks	Agricultural soils	Moderate	Moderate	Moderate	Strip topsoil from working area and store in stockpiles. Spoil handling protocols to avoid mixing different soil types. Topsoil to be stored separately to subsoil. Management of stored soils to prevent contamination and change of soil properties.	Low
	Earthworks influencing ground stability	Unstable geomorphic features	High	Negligible	Low	Appropriate construction management practices will reduce the probability of occurrence. Grading of slopes. Use of geotechnical engineering measures to aid slope stability. Design, management and monitoring carried out in line with the appropriate Construction Method Statements. Siting of stockpiles away from watercourses or unstable slopes.	Low
Pre-commissioning activities associated with pipeline testing	Leaks of test water during testing influencing soil quality	Agricultural soils	Moderate	Low	Moderate	Inspection of pipe sections before installation. Design, management and monitoring carried out in line with the appropriate method statements for hydro-testing. Halt hydro-testing immediately if leakage is detected and remediate as far as practicable any pollution of soil or water.	Low

Continued...

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
	Leaks of test water during testing influencing soil quality	Phaeozem soils	High	Low	Moderate	Inspection of pipe sections before installation. Design, management and monitoring carried out in line with the appropriate method statements for hydro-testing. Halt hydro-testing immediately if leakage is detected and remediate as far as practicable any pollution of soil or water.	Low
		Fluvisols	High	Low	Moderate		Low
		Other Soils	Low	Low	Moderate		Low
	Leaks of water during testing influencing slope stability	Unstable geomorphic features	High	Low	Moderate	Design, management and monitoring carried out in line with the appropriate method statements for hydro-testing. Halt hydro-testing immediately if leakage is detected, monitor for ground instability and remediate as far as practicable, if necessary.	Low

Complete.

Table 8.20 Assessment of Groundwater Potential Impacts: Construction and Pre-Commissioning Phase

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
General construction activities	Leaks and spills during use and storage or pollutants causing contamination of groundwater (directly or indirectly via soil or surface water)	Superficial aquifer	Moderate	Moderate	Moderate	Spillage prevention, bunding and restrictions near artificial drains, sensitive soils (moderate/high sensitivity) and water bodies to minimise impact. Material will be stored away from sensitive soils and water bodies where possible, with secondary containment. Collection and off-site disposal of sanitary wastewaters. Drainage and treatment systems for managing surface run-off designed to avoid adverse effects on groundwater quality. Compliance with the ESMP, and Project Emergency Preparedness and Response Plan	Low
		Carbonate aquifer	Moderate	Moderate	Moderate		Low
		Russkaya abstraction	Negligible	Negligible	Not Significant		Not Significant
		Sukko groundwater resource	High	Negligible	Not Significant		Not Significant

Continued…

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
	Accidental damage to existing utilities causing groundwater contamination	Superficial aquifer	Moderate	Low	Low	Pre-construction surveys and Good International Industry Practice will be used to reduce the risk of accidental damage to existing utilities that might cause contamination. Compliance with the ESMP, and Project Emergency Preparedness and Response Plan	Low
		Carbonate aquifer	Moderate	Low	Low		Low
	Water abstraction from Sukko well	Sukko groundwater resource	High	Negligible	Not Significant	Restrict abstraction to agreed volumes. No abstraction May to September.	Not Significant
Preparation of access road / upgrades to junctions of existing roads	Vegetation clearance and earthworks causing or increasing mobilisation of contamination in the soil causing deterioration in groundwater quality	Superficial aquifer	Moderate	Low	Low	In the event that previously unidentified contamination is observed during construction, works in the affected area will cease until the contaminated material is tested and appropriate mitigation measures designed or an appropriate disposal process identified. Reinstate soils and replant as soon as possible after construction and testing.	Not Significant
		Carbonate aquifer	Moderate	Low	Low		Not Significant
		Russkaya abstraction	Negligible	Negligible	Not Significant		Not Significant
		Kavkaz abstraction	Moderate	Low	Not Significant		Not Significant

Continued…

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Establishment of Temporary Construction Areas	Vegetation clearance and earthworks causing or increasing mobilisation of contamination in the soil causing deterioration in groundwater quality	Superficial aquifer	Moderate	Low	Low	In the event that previously unidentified contamination is observed during construction, works in the affected area will cease until the contaminated material is tested and appropriate mitigation measures designed or an appropriate disposal process identified. Reinstate soils and replant as soon as possible after construction and testing.	Not Significant
		Carbonate aquifer	Moderate	Low	Low		Not Significant
Microtunnel construction	Change in water levels due to dewatering of shafts	Superficial aquifer	Moderate	Negligible	Not Significant	Adopt groundwater control measures appropriate to ground conditions. Abstraction and discharge permits will be obtained, as required.	Low
		Carbonate aquifer	Moderate	Low	Moderate		Low
	Changes in water levels due to tunnelling	Carbonate aquifer	Moderate	Negligible	Not Significant	Appropriate tunnelling and slurry management practice to control groundwater ingress and minimise slurry loss from the tunnel into surrounding aquifers.	Low

Continued...

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
	Change in water quality due to slurry	Superficial aquifer	Moderate	Low	Low	Appropriate tunnelling and slurry management practice to control groundwater ingress and minimise slurry loss from the tunnel into surrounding aquifers. Avoid use of additives containing hazardous chemicals in slurry as far as is practicable. Compliance with the Project Emergency Preparedness and Response Plan and Russian Landfall CMP is required.	Low
		Carbonate aquifer	Moderate	Low	Low		Low
Pipeline pull-in through microtunnels	Change in groundwater quality due to ingress of seawater prior to grouting	Superficial aquifer	Moderate	Negligible	Not Significant	-	Not Significant
		Carbonate aquifer	Moderate	Low	Low		Low
	Change in groundwater quality due to grout	Superficial aquifer	Moderate	Low	Low	Appropriate grouting management practice to minimise grouting loss into aquifer beyond tunnel annulus. Limit the use of additives containing hazardous chemicals in grout.	Low
		Carbonate aquifer	Moderate	Low	Low		Low

Continued…

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
	Change in aquifer properties due to uncontrolled grout ingress	Superficial aquifer	Moderate	Low	Low	Appropriate grouting management practice to minimise grouting loss into aquifer beyond tunnel annulus.	Low
		Carbonate aquifer	Moderate	Low	Low		Low
Open trench pipe-laying activities – from microtunnel entry shafts to landfall facilities	Vegetation clearance and earthworks causing or increasing mobilisation of contamination in the soil causing deterioration in groundwater quality	Superficial aquifer	Moderate	Low	Low	In the event that previously unidentified contamination is observed during construction, works in the affected area will cease until the contaminated material is tested and appropriate mitigation measures designed or an appropriate disposal process identified. Reinstate soils and replant as soon as possible after construction and testing.	Low
		Carbonate aquifer	Moderate	Low	Low		Low

Continued…

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
	Change in groundwater levels if groundwater control required at Graphova Gap crossing	Superficial aquifer	Moderate	Low	Moderate	Adopt groundwater control measures appropriate to ground conditions. Backfill excavation with material of similar or greater permeability than original materials. Undertake works during dry weather if possible.	Low
		Carbonate aquifer	Moderate	Negligible	Not Significant		Low
	Change in groundwater levels if groundwater control required in trench (except Graphova Gap)	Superficial aquifer	Moderate	Low	Low	Adopt groundwater control measures appropriate to ground conditions. Backfill excavation with material of similar or greater permeability than original materials.	Low
		Carbonate aquifer	Moderate	Low	Low		Low
Construction of landfall facilities	Vegetation clearance and earthworks causing or increasing mobilisation of contamination in the soil causing deterioration in groundwater quality	Superficial aquifer	Moderate	Low	Low	In the event that previously unidentified contamination is observed during construction, works in the affected area will cease until the contaminated material is tested and appropriate mitigation measures designed or an appropriate disposal process identified. Reinstate soils and replant as soon as possible after construction and testing.	Not Significant
		Carbonate aquifer	Moderate	Low	Low		Not Significant

Continued...

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
	Change in groundwater levels if groundwater control required for foundation or other excavations	Superficial aquifer	Moderate	Low	Low	Adopt groundwater control measures appropriate to ground conditions.	Low
		Carbonate aquifer	Moderate	Negligible	Not Significant		Low
Pre-commissioning activities associated with pipeline testing	Leaks of stored seawater following pipeline cleaning	Superficial aquifer	Moderate	Low	Low	Compliance with the ESMP, and Project Emergency Preparedness and Response Plan	Low
		Carbonate aquifer	Moderate	Low	Low		Low
	Leaks of seawater during hydro-testing of pipeline influencing groundwater quality	Superficial aquifer	Moderate	Moderate	Moderate	Design, management and monitoring carried out in line with the appropriate method statements for hydro-testing. Halt hydro-testing immediately if leakage is detected and remediate as far as practicable any pollution of soil or water.	Low
		Carbonate aquifer	Moderate	Moderate	Moderate		Low

Continued...

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
	Leaks of fresh test water during hydro-testing of landfall facilities influencing groundwater quality	Superficial aquifer	Moderate	Low	Low	Design, management and monitoring carried out in line with the appropriate method statements for hydro-testing. Halt hydro-testing immediately if leakage is detected and remediate as far as practicable any pollution of soil and water.	Low
		Carbonate aquifer	Moderate	Low	Low		Low
	Disposal of fresh hydro-testing water from landfall facilities	Superficial aquifer	Moderate	Negligible	Not Significant	Design, management and monitoring carried out in line with the appropriate method statements for hydro-testing. Halt hydro-testing immediately if leakage is detected and remediate as far as practicable any pollution of soil and water. The necessary consents will be in place prior to discharge commencing. The quality of the water being discharged will be in accordance with the discharge consent.	Not Significant
		Carbonate aquifer	Moderate	Negligible	Not Significant		Not Significant

Complete.

Table 8.21 Assessment of Surface Water Potential Impacts: Construction and Pre-Commissioning Phase

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
General construction activities	Leaks and spills during use and storage or pollutants causing contamination of surface water (directly or indirectly via soil or groundwater)	Shingar River	Moderate	Moderate	Moderate	Spillage prevention, bunding and restrictions near artificial drains, and water bodies to minimise impact. Material will be stored away from sensitive soils and water bodies where possible, with secondary containment. Surface run-off treatment systems will be implemented at the landfall facilities to control the quality of the surface run-off entering watercourses. The drainage systems for the landfall facilities and the microtunnel construction area will include stormwater treatment systems. The necessary consents will be in place prior to discharge commencing. The quality of the water being discharged will be in accordance with the discharge consent. The treatment standards will be aligned with national water quality standards (Table 8.3). Collection and off-site disposal of sanitary wastewaters. Compliance with the ESMP, and Project Emergency Preparedness and Response Plan.	Low
		Tributary in Graphova Gap	Moderate	Moderate	Moderate		Low
		Existing surface water abstraction	Moderate	Moderate	Moderate		Low

Continued…

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
	Accidental damage to existing utilities causing surface water contamination	Shingar River	Moderate	Low	Low	Appropriate construction management practices will reduce the probability of this occurring. Compliance with the ESMP, and Project Emergency Preparedness and Response Plan.	Low
		Tributary in Graphova Gap	Moderate	Low	Low		Low
		Existing surface water abstraction	Moderate	Moderate	Moderate		Low
Preparation of access road / upgrades to junctions of existing roads	Vegetation clearance and earthworks causing increased vulnerability of soils to erosion affecting surface water quality via run-off	Shingar River	Moderate	Moderate	Moderate	Avoid unnecessary changes to natural drainage systems. Existing artificial drainage to be diverted maintaining gravity flows. Stockpiles to be covered as required. Siting of stockpiles away from watercourses or unstable slopes. Design and management of site drainage to reduce risk of soil erosion in exposed subsoil areas or in stockpiles. Drainage systems for surface run-off designed to avoid poor quality water directly entering watercourses.	Low
		Tributary in Graphova Gap	Moderate	Moderate	Moderate		Low
		Existing surface water abstraction	Moderate	Moderate	Moderate		Low

Continued...

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
	Vegetation clearance and earthworks causing increased run-off affecting flow regime	Shingar River	Moderate	Moderate	Moderate	In the event that previously unidentified contamination is observed during construction, works in the affected area will cease until the contaminated material is tested and appropriate mitigation measures designed or an appropriate disposal processes identified. Reinstate soils and replant as soon as possible after construction and testing.	Low
		Tributary in Graphova Gap	Moderate	Moderate	Moderate		Low
		Existing surface water abstraction	Moderate	Moderate	Moderate		Low
Establishment of Temporary Construction Areas	Vegetation clearance and earthworks causing increased vulnerability of soils to erosion affecting surface water quality via run-off	Shingar River	Moderate	Moderate	Moderate	Avoid unnecessary changes to natural drainage systems. Existing artificial drainage to be diverted maintaining gravity flows. Strip topsoil from working area and store in stockpiles. Stockpiles kept to agreed height, and free from disturbance. Stockpiles to be covered as required. Siting of stockpiles away from watercourses or unstable slopes. Design and management of site drainage to reduce risk of soil erosion in exposed subsoil areas or in stockpiles.	Low
		Tributary in Graphova Gap	Moderate	Moderate	Moderate		Low
		Shingar River	Moderate	Moderate	Moderate		Low

Continued...

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
	Vegetation clearance and earthworks causing increased run-off affecting flow regime	Tributary in Graphova Gap	Moderate	Moderate	Moderate	Drainage systems for surface run-off designed to avoid poor quality water directly entering watercourses. Surface run-off treatment systems will be implemented at the landfall facilities to control the quality of the surface run-off entering watercourses. The drainage systems for the landfall facilities and the microtunnel construction area will include stormwater treatment systems. The necessary consents will be in place prior to discharge commencing. The quality of the water being discharged will be in accordance with the discharge consent. The treatment standards will be aligned with national water quality standards (Table 8.3). In the event that previously unidentified contamination is observed during construction, works in the affected area will cease until the contaminated material is tested and appropriate mitigation measures designed or an appropriate disposal process identified. Reinstate soils and replant as soon as possible after construction and testing.	Low

Continued…

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Microtunnel construction	Changes in water quality due to slurry ingress during tunnelling	Shingar River	Moderate	Low	Low	Appropriate tunnelling and slurry management practice. Avoid use of additives containing hazardous chemicals in slurry as far as is practicable.	Low
	Leaks and spills of slurry			High*	High	Appropriate tunnelling and slurry management practice. Compliance with the Project Emergency Preparedness and Response Plan and Russian Landfall CMP is required.	Low
Pipeline pull-in through microtunnels	Changes in water quality due to grouting	Shingar River	Moderate	Low	Low	Appropriate grouting management practice to reduce risk of breakouts. Limit the use of additives containing hazardous chemicals in grout.	Low

Continued…

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Open trench pipe-laying activities – from microtunnel entry shafts to landfall facilities	Vegetation clearance and earthworks causing increased vulnerability of soils to erosion affecting surface water quality via run-off	Shingar River	Moderate	Moderate	Moderate	Avoid unnecessary changes to natural drainage systems. Existing artificial drainage to be diverted maintaining gravity flows.	Low
		Tributary in Graphova Gap	Moderate	Moderate	Moderate	Strip topsoil from working area and store in stockpiles. Stockpiles kept to agreed height, and free from disturbance. Stockpiles to be covered as required. Siting of stockpiles away from watercourses or unstable slopes.	Low
	Vegetation clearance and earthworks causing increased run-off affecting flow regime	Shingar River	Moderate	Moderate	Moderate	Design and management of site drainage to reduce risk of soil erosion in exposed subsoil areas or in stockpiles. Drainage systems for surface run-off designed to avoid poor quality water directly entering watercourses.	Low
		Tributary in Graphova Gap	Moderate	Moderate	Moderate	In the event that previously unidentified contamination is observed during construction, works in the affected area will cease until the contaminated material is tested and appropriate mitigation measures designed or an appropriate disposal process identified. Reinstate soils and replant as soon as possible after construction and testing.	Low

Continued…

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
	Change in flow regime during crossing works	Tributary in Graphova Gap	Moderate	Moderate	Moderate	Undertake crossing works during dry weather if possible. Divert any remaining flows around working area. Reinstate stream as close to original condition as possible. Use sediment control measures (e.g. silt curtains or straw bales) as required. Backfill excavation with material of similar or greater permeability than original materials to avoid changes to baseflow.	Low
	Disturbance of stream bed sediments during crossing works	Tributary in Graphova Gap	Moderate	Moderate	Moderate		Low
	Changes in water quality (turbidity, suspended solids) during crossing works	Tributary in Graphova Gap	Moderate	Moderate	Moderate		Low
Construction of landfall facilities	Vegetation clearance and earthworks causing increased vulnerability of soils to erosion affecting surface water quality via run-off	Tributary in Graphova Gap	Moderate	Moderate	Moderate	Avoid unnecessary changes to natural drainage systems. Existing artificial drainage to be diverted maintaining gravity flows. Strip topsoil from working area and store in stockpiles. Stockpiles kept to agreed height, and free from disturbance. Stockpiles to be covered as required. Siting of stockpiles away from watercourses or unstable slopes.	Low

Continued…

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
	Vegetation clearance and earthworks causing increased run-off affecting flow regime	Tributary in Graphova Gap	Moderate	Moderate	Moderate	Design and management of site drainage to reduce risk of soil erosion in exposed subsoil areas or in stockpiles. Drainage systems for surface run-off designed to avoid poor quality water directly entering watercourses. Surface run-off treatment systems will be implemented at the landfall facilities to control the quality of the surface run-off entering watercourses. The drainage systems for the landfall facilities will include stormwater treatment systems. The necessary consents will be in place prior to discharge commencing. The quality of the water being discharged will be in accordance with the discharge consent. The treatment standards will be aligned with national water quality standards (Table 8.3). In the event that previously unidentified contamination is observed during construction, works in the affected area will cease until the contaminated material is tested and appropriate mitigation measures designed or an appropriate disposal process identified.	Low

Continued…

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Pre-commissioning activities associated with pipeline testing	Leaks of stored seawater following pipeline cleaning	Shingar River	Moderate	Low	Low	Reinstate soils and replant as soon as possible after construction and testing. Compliance with the ESMP and Project Emergency Preparedness and Response Plan.	Low
	Leaks of seawater during hydro-testing of pipeline influencing surface water quality	Shingar River	Moderate	Low	Low	Design, management and monitoring carried out in line with the appropriate method statements for hydro-testing. Halt hydro-testing immediately if leakage is detected.	Low
		Tributary in Graphova Gap	Moderate	Moderate	Moderate		Low
	Leaks of fresh water during hydro-testing of landfall facilities influencing surface water quality	Tributary in Graphova Gap	Moderate	Low	Low	Design, management and monitoring carried out in line with the appropriate method statements for hydro-testing. Halt hydro-testing immediately if leakage is detected and remediate as far as practicable any pollution of soil/water.	Low

* Potential impact magnitude is high but likelihood of occurrence is very low.

Complete.

8.6.3 Assessment of Potential Impacts: Operational Phase

8.6.3.1 Assessment of Potential Impacts (Pre-mitigation)

The permanent RoW will be approximately 95 m wide (19 m either side of the centreline of the outermost pipelines) and 2.5 km long (0.1 km upstream and 2.4 km downstream of the landfall facilities) and will result in a permanent land take of approximately 23.75 ha. The permanent RoW will include an access track.

Operational activities associated with the Project are limited. Operation of the Project for the terrestrial part of the landfall section will involve routine inspections, maintenance activities and monitoring.

The Pipeline permanent RoW will be indicated by land and aerial markers. Warning signs to indicate the presence of the pipelines will also be erected at specific locations along the Pipeline route. Deep rooting trees or permanent crops will not be allowed to grow, however bushes and other shallow rooted vegetation will be allowed to grow naturally or will be planted. A track suitable for 4x4 vehicles only, will be present within the RoW for inspection purposes of the pipelines.

Maintenance activities will include the periodic clearing of certain vegetation from the permanent RoW. It is assumed that the vegetation clearance will be primarily through mechanical clearing. It is assumed that regular and widespread herbicide application will not be required for the required partial vegetation clearance as shallow vegetation will be allowed to grow. However, it is recognised that herbicide usage may be locally required on occasion.

The operation of vehicles and equipment to undertake these maintenance and inspection activities are seen as the key activities of relevance to soil, groundwater and surface water baseline conditions.

The impacts due to the presence of the Pipeline, tunnel, the Graphova Gap pipeline crossing and access roads, are presented under the Operational Phase assessment because these are considered to be impacts that arises as a result of operation and not as a result of construction activity.

Soils

There is the potential for soils around the landfall facilities, RoW and access roads to be contaminated through vehicle movements, spills and leaks. Typical contaminants include those associated with vehicle operations including hydrocarbons and heavy metals. There will be no discharges to soil of sanitary or process wastewater. The potential for contamination of soil at the landfall facility, RoW and access road is low magnitude and **Moderate** significance.

Soils within the permanent right of way (RoW) along the Pipeline route may be disturbed through the periodic clearance of vegetation and vehicle movements. Vegetation provides protection and stability to soils from erosive forces. Maintenance and permanent RoW clearance activities are not anticipated to require removal of all ground vegetation, and therefore soil disturbance will be limited. This impact is of low magnitude and **Moderate** significance.

The pipeline crossings at the Graphova Gap and the anode groundbed at the Landfall facilities are in areas with naturally unstable geomorphic features (**Chapter 7 Physical and Geophysical Environment**). Erosion during flood events can be a key natural mechanism triggering ground movements associated with these features. The presence of the Project infrastructure could influence stability but the effects are expected to be localised and can be managed through design controls implemented during the Construction Phase. The impact during the Operational Phase due to the on-going presence of the structures is of low **magnitude** and **Moderate** significance.

Groundwater

Groundwater quality may be affected by any accidental leaks or spills at the landfall facilities or during maintenance activities. The limited activity on site during the Operational Phase reduces the likelihood of spills occurring. Therefore, it is an impact of low magnitude and **Moderate** significance for the superficial and carbonate aquifer. Negligible impact is expected at the groundwater abstractions; this is **Not Significant.**

The buried pipes will pass under the Graphova Gap. The buried pipes may act as a barrier to groundwater flow in the superficial aquifer. Any impact on flows that did occur would be long term but spatially localised. However, given the design it is unlikely that the pipelines will create a complete barrier to groundwater flow. Therefore, it is an impact of low magnitude and **Low** significance for the superficial aquifer. The impact on the carbonate aquifer is to be negligible magnitude and **is Not Significant**. No impact is expected at any of the abstractions.

The microtunnels may act as a barrier to groundwater flow. Any impact on flows that did occur would be long term but spatially localised. However, given the size of the tunnels relative to the aquifer geometry it is unlikely that the pipelines will create a complete barrier to groundwater flow. Therefore it is an impact of low magnitude and **Low** significance for the carbonate aquifer. The impact on the superficial aquifer is of negligible magnitude and **Low** significance. No impact is expected at any of the abstractions.

The anodes in the subsurface as part of the cathodic protection systems will gradually degrade, releasing metal ions into the subsurface, which will be leached and infiltrate into groundwater. The anodes are proposed to be titanium with mixed metal oxides. The rate of anode degradation is anticipated to be very slow (decades). Natural attenuation including dilution within the groundwater will reduce concentrations in groundwater within a relatively short distance from the anode bed. The calcined petroleum coke backfill around the anodes is considered effectively inert; no significant leaching of contaminants from the backfill into groundwater is expected. Some sorption of metal ions onto the coke may occur. Considering that the anodes are below the water table the impacts on both aquifers are of negligible magnitude and are **Not Significant**. No impact is expected at any of the abstractions.

Surface Water

Surface water quality may be affected by any accidental leaks or spills. The limited activity on site during the Operational Phase reduces the likelihood of spills occurring. The impact on water quality in both watercourses within the Study Area and at the assumed surface water abstraction is likely to be limited and of low magnitude and **Moderate** significance.

Periodic clearance of vegetation may lead to an increase in soil erosion and run-off rates. This may influence water quality and the flow regime. However, maintenance and permanent RoW clearance activities will not require removal of all ground vegetation, and soil disturbance will be limited. This impact is limited and of low magnitude and **Moderate** significance.

It is unlikely that the presence of the tunnels would affect natural groundwater baseflow such that the flow regime in the Shingar River is influenced. Thus the impact magnitude is assessed as negligible magnitude and **is Not Significant**.

Where the pipelines cross the Graphova Gap, they may behave as an obstruction and cause groundwater levels to change, which may lead to a change in baseflow to surface waters, especially during the winter months. However, given the design, including permeable rock fill, it is unlikely that the pipeline trenches will create a complete barrier to groundwater flow. The impact for the watercourse is therefore low magnitude and **Low** significance. The impact on the surface water abstraction is negligible magnitude and is **Not Significant**.

As described in **Chapter 5 Project Description**, rock fill and a buried concrete slab will be used to help protect the Pipeline from scour and erosion during flood events. This will be designed not to erode significantly during typical flow events. However, during major flood events the backfill may be eroded. This would not naturally recover without maintenance works. The overall impact on the watercourse is therefore moderate magnitude and **Moderate** significance.

The presence of the rock fill will alter the nature of the local bed sediments over this stretch of the stream. Gradually, fine-grained sediment will infill the gaps between the rock fill and the stream bed will return to a more natural condition. The impact will be limited in spatial extent and will gradually recover through natural processes. The impact on the watercourse is therefore low magnitude and **Low** significance.

The access roads and landfall facilities will be static sites. Run-off from areas of hardstanding will be higher than from vegetated areas. Storm water run-off during wet weather events may capture minor volumes of contaminants (e.g. traces of oil and grease) and entrain sediments. However, the impacts of run-off on water quality will only occur during times of high flow (i.e. when water quality in the watercourses is naturally likely to be highly turbid and dilution factors will be high). The impact on the Shingar River is of negligible magnitude and **Not Significant**. The impact on surface waters in Graphova Gap and the surface water abstraction from surface run-off from the access road and landfall facilities is limited and of low magnitude and **Low** significance for the flow regime and of **Moderate** significance for water quality.

The anode groundbed in the landfall facilities is located in a natural run-off channel with evidence of natural erosion during rainfall events. Further downhill is a gully which is a tributary of the watercourse in Graphova Gap. During flood events, the backfill from the anode groundbed may be eroded by run-off. The calcined petroleum coke is inert and the groundbed is uphill from the main stream channel. However, the coke backfill may migrate further than rock-based sediment during flood events as it will be lighter. The impact on downstream water quality is limited and of low magnitude and **Low** significance.

8.6.3.2 Mitigation and Monitoring

Some of the effects of activities associated with the Operational Phase of the Project may impact on soil, groundwater and surface waters. The significance of these impacts has been assessed based on the sensitivity of each receptor and the expected magnitude of the potential impacts. The results of this assessment are presented in Table 8.22, Table 8.23 and Table 8.24.

Where significant impacts are identified, mitigation measures will be required to minimise the impacts or reduce the likelihood of an impact occurring. Appropriate mitigation measures are presented in this section.

The mitigation measures will be controlled through the ESMP for the Operational Phase. Monitoring will record how effective mitigation is and may result in changes to the mitigation measures.

Soils Mitigation

A number of the design controls described in **Chapter 5 Project Description** aim to reduce the risks to soils during the Operational Phase (Section 8.6.1.1).

Mitigation measures are recommended to further reduce the risk of leaks and spills occurring. Compliance with the Emergency Response and Crisis Management Plan and requirements in the Russian Landfall CMP is required. In the event of a leak or spill occurring, the speed of response to the incident is a key factor in determining the magnitude of the resultant impacts.

Appropriate storage and handling protocols will be required for fuels and other chemicals used on site. Refuelling will only be undertaken in designated areas. Activities near to watercourses and drains and exposed soil areas will be controlled. All bulk materials or wastes stored on site will be within appropriate storage facilities and procedures will be implemented for handling, storage, transport and transfer to minimise the potential for leaks or spills.

Further specific mitigation measures that will be implemented to protect the existing soil quality and structure include:

- Restriction of construction activities to the Pipeline RoW, the footprint of the permanent landfall facilities, and permanent access roads;
- Vehicle movements will be restricted to defined access tracks and hardstanding areas;
- Sediment and erosion controls (e.g. cut-off drains, swales, detention and retention basins, mesh fencing and sandbags etc.) will be implemented at all maintenance sites to limit the loss of soil from the site;
- Sediment and erosion controls, including appropriate drainage systems, will be routinely inspected and maintained to manage run-off and to limit the loss of soil from the site, in particular following vegetation clearance;
- Spillage prevention, bunding and restrictions near drains, sensitive soils and water bodies to avoid impacts. Material will be stored away from sensitive soils and water bodies where possible, with secondary containment and a full method statement to address construction risks and avoid impacts; and

- Ensure potential silted water is appropriately managed prior to entering into any watercourses, attenuation measures to minimise soil erosion and impacts on water quality through potential disturbance of sediments.

Soils Monitoring

- Monitoring of the active geomorphological features will be undertaken in accordance with Russian guidance in relation to 'Safety in emergency situations - Monitoring and predicting hazardous geological phenomena and processes - General requirements' (GOST R 22.1.06-99 and GOST R 22.1.08-99). The monitoring shall include route inspections of active geomorphological features; the frequency of monitoring shall be gradually reduced as stabilisation progresses but is expected to be at least every three years. Additional monitoring will be undertaken following natural events that might affect geomorphological stability such as seismic events or mudflows; and
- No ongoing monitoring of soil quality is required during the Operational Phase.

Groundwater Mitigation

In addition to the design controls (Section 8.6.1.1) and mitigation measures for soil outlined above (Section 8.6.2.2), the following mitigation measures are also recommended to be adopted to minimise the potential for adverse impacts:

- Sanitary wastewaters generated during Operational Phase will be safely stored in temporary facilities (mobile installations for wastewater treatment or septic tanks) and then regularly transported and disposed of in a nearby licensed facility for the disposal of wastewater;
- Choice of anode material. Materials that are non-hazardous are preferable. Position the anodes above the water table if possible;
- If there is the potential for the Pipeline to create a barrier to groundwater flow such that baseflows to Graphova Gap are significantly affected, then drainage will be designed and installed during construction to allow groundwater to by-pass the obstruction to groundwater flow; and
- Consultation with neighbouring abstractors as and when required.

Groundwater Monitoring

No ongoing groundwater monitoring is required during the Operational Phase.

Surface Water Mitigation

In addition to the design controls (Section 8.6.1.1) and mitigation measures for soil and groundwater outlined above (Section 8.6.2.2), many of which are relevant to potential surface water impacts, the following mitigation measures are also recommended to be adopted to minimise the potential for adverse impacts:

- The detailed design of the Graphova Gap pipeline and access road crossings will allow for maintaining natural flows. The access road crossing will be designed to avoid significant increase in flood risk downstream;

- Stormwater discharges from the landfall facilities will pass through a sand trap and filter, and an oil interceptor prior to discharge. The treatment standards will be aligned with required water quality standards prior to discharge of the stormwater into the environment;
- The anode groundbed will be microsited in relation to local terrain and the backfill and surfacing will be designed to reduce the potential for erosion by run-off;
- Throughout the lifespan of the Project, periodic inspection and cleaning of blockages within the site drainage will be carried out and detailed within a monitoring programme;
- Direct discharges from the landfall facilities drainage systems to watercourses will be avoided;
- Where possible, drainage of working areas will include routing of surface water to detention basins to settle out suspended solids before discharge to watercourses;
- Throughout the lifespan of the Project periodic inspection and cleaning of blockages within the site drainage will be carried out and detailed within a monitoring programme; and
- Inspection and reinstatement following major flood event.

Surface Water Monitoring

Surface water quality monitoring is required during the Operational Phase. Monitoring shall be undertaken periodically within the watercourse in the Graphova Gap to confirm the stormwater drainage systems at the landfall facility are operating as designed. This will include collection of upstream and downstream water samples. The monitoring scope and frequency will be in accordance with the agreed discharge consent for the stormwater drainage system. The water samples shall be analysed for basic chemistry, such as pH, electrical conductivity, dissolved oxygen and suspended solids, as well as to assess potential pollutant concentrations (including petroleum hydrocarbons).

8.6.3.3 Residual Impacts: Operational Phase

Table 8.22, Table 8.23 and Table 8.24 present a summary of the potential residual impacts to soil, groundwater and surface water respectively arising from the Project following application of the mitigation measures described in Section 8.6.2.2.

The assessment of the significance of residual impacts assumes full application and effectiveness of the mitigation measures.

Soils

The significance of the residual impacts on soils is **Low**.

Groundwater

The significance of the residual impacts on groundwater is **Not Significant** to **Low**.

Surface Water

The significance of the residual impacts on surface waters is **Not Significant** to **Low**.

Table 8.22 Assessment of Soil Potential Impacts: Operational Phase

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
General maintenance activities	Leaks and spills during use and storage or pollutants causing contamination of soil	Agricultural soils	Moderate	Low	Moderate	Spillage prevention, bunding and restrictions near watercourses, artificial drains, sensitive soils (moderate and high sensitivity) and water bodies to minimise impact. Material will be stored away from sensitive soils and water bodies where possible, with secondary containment. Compliance with the ESMP and Project Emergency Preparedness and Response Plan.	Low
		Phaeozem soils	High	Low	Moderate		Low
		Fluvisols	High	Low	Moderate		Low
	Vegetation clearance along RoW causing increased vulnerability of soils to erosion and compaction	Agricultural soils	Moderate	Low	Moderate	Restrict vegetation clearance to removal of trees and shrubs. Geotechnical slope stabilisation will be undertaken where required during Construction Phase which will also reduce future impacts during Operational Phase. Restrict vehicle movements to agreed access routes.	Low
		Phaeozem soils	High	Low	Moderate		Low
		Fluvisols	High	Low	Moderate		Low
		Unstable geomorphic features	High	Low	Moderate		Low

Continued…

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Presence of pipeline crossing in Graphova Gap	Slope instability	Unstable geomorphic features	High	Low	Moderate	Grade slopes during pipeline crossing construction to avoid creation of unstable slopes on stream banks and valley sides. Geotechnical slope stabilisation will be undertaken where required during Construction Phase which will also reduce future impacts during Operational Phase.	Low
Presence of landfall facilities including anode groundbed	Slope instability	Unstable geomorphic features	High	Low	Moderate	Micrositing of anode groundbed and array within existing topography during detailed design. Grade slopes during construction to avoid creation of unstable slopes. Geotechnical slope stabilisation will be undertaken where required during Construction Phase which will also reduce future impacts during Operational Phase.	Low

Complete.

Table 8.23 Assessment of Groundwater Potential Impacts: Operational Phase

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
General maintenance activities	Leaks and spills during use and storage or pollutants causing contamination of groundwater (directly or indirectly via soil or surface water)	Superficial Aquifer	Moderate	Low	Moderate	Spillage prevention, bunding and restrictions near watercourses, artificial drains, sensitive soils (moderate and high sensitivity) and water bodies to minimise impact. Material will be stored away from sensitive soils and water bodies where possible, with secondary containment Collection and off-site disposal of sanitary wastewaters. Drainage and treatment systems for managing surface run-off designed to avoid adverse effects on groundwater quality. Compliance with the ESMP and Project Emergency Preparedness and Response Plan. Consultation with neighbouring abstractors.	Low
		Carbonate Aquifer	Moderate	Low	Moderate		Low
		Russkaya abstraction	Negligible	Negligible	Not Significant		Not Significant
		Kavgaz abstraction	Moderate	Negligible	Not Significant		Not Significant
		Sukko groundwater resource	High	Negligible	Not Significant		Not Significant

Continued…

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Presence of microtunnels beneath Shingar River	Tunnels act as hydraulic barrier to groundwater flow causing potential change in water levels	Superficial Aquifer	Moderate	Negligible	Low	Appropriate grouting management practice during Construction Phase to minimise grouting loss into aquifer from tunnel annulus.	Low
		Carbonate Aquifer	Moderate	Low	Low		Low
Presence of pipeline crossing in Graphova Gap	Pipelines act as hydraulic barrier to groundwater flow causing potential change in water levels	Superficial Aquifer	Moderate	Low	Low	Backfill excavation during Construction Phase with material of similar or greater permeability than original materials to avoid changes to baseflow.	Low
		Carbonate Aquifer	Moderate	Negligible	Not Significant		Not Significant
Presence of landfall facilities including anode groundbed	Consumption of anode materials for cathodic protection influencing groundwater quality	Superficial Aquifer	Moderate	Negligible	Not Significant	Choice of anode materials. Locate anodes above the water table if possible.	Not Significant
		Carbonate Aquifer	Moderate	Negligible	Not Significant		Not Significant

Complete.

Table 8.24 Assessment of Surface Water Potential Impacts: Operational Phase

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
General maintenance activities	Leaks and spills during use and storage or pollutants causing contamination of surface water (directly or indirectly via soil or groundwater)	Shingar River	Moderate	Low	Moderate	Spillage prevention, bunding and restrictions near artificial drains, sensitive soils (moderate and high sensitivity) and water bodies to minimise impact. Material will be stored away from sensitive soils and water bodies where possible, with secondary containment. Collection and off-site disposal of sanitary wastewaters. Drainage management systems designed to manage surface run-off and avoid poor quality water entering watercourses directly. Drainage management systems at landfall facilities to include sand trap and filter, and oil interceptor prior to discharge. Water discharge standards at landfall facility to be aligned with national water quality criteria (Table 8.4).	Low

Continued…

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
General maintenance activities	Leaks and spills during use and storage or pollutants causing contamination of surface water (directly or indirectly via soil or groundwater)	Tributary in Graphova Gap	Moderate	Low	Moderate	Compliance with the ESMP and Project Emergency Preparedness and Response Plan. Consultation with neighbouring abstractors.	Low
		Surface water abstraction	Moderate	Low	Moderate		Low
	Vegetation clearance along RoW causing increased vulnerability of soils to erosion affecting water quality via run-off	Shingar River	Moderate	Low	Moderate	Restrict vegetation clearance to removal of trees and shrubs. Grade slopes during reinstatement works following construction to avoid unstable slopes. The natural terrain should be re-established where possible. Restrict vehicle movements to agreed access routes.	Low

Continued…

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
General maintenance activities	Vegetation clearance along RoW causing increased vulnerability of soils to erosion affecting water quality via run-off	Tributary in Graphova Gap	Moderate	Low	Moderate	Restrict vegetation clearance to removal of trees and shrubs. Grade slopes during reinstatement works following construction to avoid unstable slopes. The natural terrain should be re-established where possible. Restrict vehicle movements to agreed access routes.	Low
		Surface water abstraction	Moderate	Low	Moderate		Not Significant
	Vegetation clearance along RoW causing increased run-off affecting flow regime	Shingar River	Moderate	Low	Moderate		Low
		Tributary in Graphova Gap	Moderate	Low	Moderate		Low
		Surface water abstraction	Moderate	Low	Moderate		Not Significant

Continued…

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Presence of microtunnels beneath Shingar River	Tunnels act as hydraulic barrier to groundwater flow causing potential change in baseflow changing stream flow regime during low flow conditions	Shingar River	Moderate	Negligible	Not Significant	Appropriate grouting management practice during Construction Phase to minimise grouting loss into aquifer from tunnel annulus.	Not Significant

Continued…

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Presence of pipeline crossing in Graphova Gap	Pipelines act as hydraulic barrier to groundwater flow causing potential change in baseflow changing stream flow regime during low flow conditions	Tributary in Graphova Gap	Moderate	Low	Low	Design and construction of rock backfill above Pipeline. Backfill excavation with material of similar or greater permeability than original materials to avoid changes to baseflow. Grade slopes within floodplain during pipeline crossing construction to minimise obstructions during flood events. The natural terrain should be re-established where possible. Inspection and reinstatement following major flood event.	Low
		Surface water abstraction	Moderate	Negligible	Not Significant		Not Significant
	Erosion of pipeline trench during flood events	Tributary in Graphova Gap	Moderate	Moderate	Moderate		Low
		Surface water abstraction	Moderate	Negligible	Not Significant		Not Significant

Continued…

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Presence of pipeline crossing in Graphova Gap	Change to stream bed sediments	Tributary in Graphova Gap	Moderate	Low	Low	Design and construction of rock backfill above Pipeline. Backfill excavation with material of similar or greater permeability than original materials to avoid changes to baseflow. Grade slopes within floodplain during pipeline crossing construction to minimise obstructions during flood events. The natural terrain should be re-established where possible. Inspection and reinstatement following major flood event.	Low
		Surface water abstraction	Moderate	Negligible	Not Significant		Not Significant

Continued…

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Presence of landfall facilities and access road in catchment	Increased run-off from hardstanding areas affecting flow regime	Shingar River	Moderate	Negligible	Not Significant	and filter, and oil interceptor, prior to discharge. Water discharge standards at landfall facility to be aligned with national water quality criteria (Table 8.3).	Low
		Tributary in Graphova Gap	Moderate	Low	Low		Low
		Surface water abstraction	Moderate	Low	Low		Low
	Run-off changing water quality	Shingar River	Moderate	Negligible	Not Significant		Low
		Tributary in Graphova Gap	Moderate	Low	Moderate		Low
		Surface water abstraction	Moderate	Low	Moderate		Low
	Erosion of anode groundbed backfill influencing run-off quality	Tributary in Graphova Gap	Moderate	Low	Low	Design groundbed backfill and surfacing to reduce risk of erosion. Micrositing of anode groundbed and array within existing topography.	Low

Complete.

8.6.4 Assessment of Potential Impacts: Decommissioning Phase

8.6.4.1 Introduction

The planned Project lifetime is 50 years, within which there may be changes to statutory decommissioning requirements, as well as advances in technology and knowledge. The eventual decommissioning requirements will be taken into account in the design stage by ensuring that a range of possible options will be available.

Decommissioning of the South Stream Offshore Pipeline will be carried out according to prevailing international and national legislation, regulations and good practice regarding environmental and other potential impacts.

At this stage in the Project the full extent of the decommissioning requirements is not known. If the trenched pipeline is removed, the impacts during decommissioning are expected to be broadly similar to those during construction. If the trenched pipeline is left in place, the potential impacts are likely to be reduced. It is assumed that it is probable that the pipelines within the microtunnels shall be decommissioned but will remain in situ.

Potential impacts to abstractions have not been assessed as it is unknown what, if any, abstractions may be present in the Study Area at the time of decommissioning.

8.6.4.2 Assessment of Potential Impacts (Pre-mitigation)

Soils

Potential impacts to soil during decommissioning will relate to the storage and use of fuels, chemical and waste, land clearance and earthworks, and the interactions between decommissioning workers and the soil.

Leaks and spills are a potential impact of medium extent and moderate magnitude to the agricultural soils, phaeozem soils and fluvisols, resulting in **Moderate** significance impact for agricultural soils and **High** significance impact for the phaeozem and fluvisol soils. The potential impact on other soils in the Study Area is low magnitude given the minor extent of these soils within the landfall section, giving a **Low** significance impact.

For the landfall facilities, the impacts associated with land clearance and earthworks are of moderate magnitude impacts for agricultural soils and phaeozem soils as the areas are medium in extent and less than 10 ha and the impacts are potentially reversible, resulting in **Moderate** significance for agricultural soils and **High** significance for phaeozem soils.

If the trenched pipeline has to be removed during decommissioning, then there will be impacts associated with land clearance and earthworks along the trenching corridor. The impact magnitude for agricultural soils is high as the area is large and more than 10 ha, giving a **High** significance, and the impact magnitude for phaeozem soils is moderate given the medium extent, giving a **High** significance for phaeozem soils. The impact magnitudes for fluvisols during the removal of the pipeline crossing at Graphova Gap are moderate given the works are medium in extent and the soils are expected to gradually recover after reinstatement due to natural processes, giving a **High** significance.

Ground instability of geomorphologically unstable features are of moderate magnitude given the effects are likely to be minor in extent but of medium term, giving a **High** significance impact.

Construction Workers

The potential for contamination to be present in the soils will be reviewed prior to decommissioning. Contamination may be present locally due to current or future land use or illegal dumping.

Accidental leaks and spills during the decommissioning works may also cause soil contamination.

Contaminated soil may affect construction workers through being inadvertently ingested or inhaled or through dermal contact. For conservatism the potential impact on human health before mitigation is of high magnitude and **High** significance given humans are a high sensitivity receptor.

Groundwater

Potential impacts to the groundwater are likely to arise primarily in the Decommissioning Phase through potential contamination and disturbance of the flow regime during any excavations.

The majority of leaks and spills are likely to be relatively small in volume. Groundwater quality may be locally affected but is expected to gradually recover through natural attenuation and the impact will be medium term. The potential impact on groundwater quality associated with accidental leaks and spills is moderate magnitude and **Moderate** significance.

If the trenched pipeline is removed or any excavations are required during decommissioning of the landfall facilities, there is the potential for the excavations to intersect the water table, particularly at the Graphova Gap. The impact upon groundwater flows within the superficial aquifer is low magnitude and **Low** significance as the impacts will be temporary and recovery is expected to be rapid. Given the expected excavation depths, the potential impact to the carbonate aquifer is anticipated to be negligible magnitude and **Not Significant**.

The soil strip and removal of vegetation during land clearance and earthworks will have a low magnitude impact of **Low** significance.

Surface Water

Potential impacts to the surface watercourses are likely to arise primarily in the Decommissioning Phase through potential contamination and disturbance associated with construction site discharges, run-off and changes to local landforms.

The majority of leaks and spills are likely to be relatively small in volume. Depending on the size and nature of the spillage, this could cause water quality or sediment quality impacts along multiple reaches and it is therefore a potential impact of moderate magnitude and **Moderate** significance.

The impacts associated with land clearance and earthworks are of moderate magnitude and **Moderate** significance prior to mitigation.

If the trenched pipeline is removed, then the impact on the watercourse will be of moderate magnitude and **Moderate** significance.

8.6.4.3 Mitigation and Monitoring

Potential impacts to soil, groundwater and surface water have been identified. The significance of these impacts has been assessed based on the sensitivity of each receptor and the expected magnitude of the potential impacts. The results of this assessment are presented in Table 8.25, Table 8.26 and Table 8.27.

As the potential impacts on soil and water during the Decommissioning Phase will be similar to those during the Construction Phase, the mitigation measures outlined in Section 8.6.2.2will be relevant.

A detailed scope for appropriate monitoring will be developed at the time of decommissioning, taking into account prevailing environmental conditions, good international practice and available technology.

8.6.4.4 Residual Impacts: Decommissioning Phase

Table 8.25, Table 8.26 and Table 8.27 present a summary of the potential residual impacts to terrestrial soil, groundwater and surface water arising during the Decommissioning Phase following application of the identified mitigation measures.

Soils

The impacts assessed and the mitigation measures put in place reduce the residual impacts on soils to **Low** significance.

Groundwater

The impacts assessed and the mitigation measures put in place reduce the residual impacts on groundwater to **Not Significant** to **Low** significance.

Surface Water

The impacts assessed and the mitigation measures put in place reduce the residual impacts on surface water to **Low** significance.

Table 8.25 Assessment of Soil Potential Impacts: Decommissioning Phase

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
General decommissioning activities	Leaks and spills during use and storage or pollutants causing contamination of soil	Agricultural soils	Moderate	Moderate	Moderate	Spillage prevention, bunding and restrictions near watercourses, artificial drains, sensitive soils (moderate and high sensitivity) and water bodies to minimise impact. Material will be stored away from sensitive soils and water bodies where possible, with secondary containment. Compliance with the ESMP and Project Emergency Preparedness and Response Plan.	Low
		Phaeozem soils	High	Moderate	High		Low
		Fluvisols	High	Moderate	High		Low
		Other soils	Low	Low	Low		Low
	Contact with contaminated soil posing a risk to human health	Construction workers	High	High	High	In the event that previously unidentified contamination is observed during decommissioning, works in the affected area will cease until the contaminated material is tested and appropriate disposal processes identified. Use of appropriate personal protection equipment.	Low

Continued…

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Establishment of Temporary Construction Areas	Vegetation clearance causing increased vulnerability of soils to erosion and compaction	Agricultural soils	Moderate	Moderate	Moderate	Strip topsoil from working area and store in stockpiles. Stockpiles kept to agreed height, and free from disturbance. Stockpiles to be covered as required. Siting of stockpiles away from watercourses or unstable slopes. Design and management of site drainage to reduce risk of soil erosion in exposed subsoil areas or in stockpiles. Reinstate soils and replant as soon as possible after decommissioning.	Low
		Phaeozem soils	High	Moderate	High		Low
		Unstable geomorphic features	High	Moderate	High		Low
	Changes to soil properties through earthworks including stockpiling	Agricultural soils	Moderate	Moderate	Moderate	Strip topsoil from working area and store in stockpiles. Spoil handling protocols to avoid mixing different soil types. Topsoil to be stored separately to subsoil. Management of stored soils to prevent contamination and change of soil properties.	Low
		Phaeozem soils	High	Moderate	High		Low

Continued…

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Establishment of Temporary Construction Areas	Earthworks influencing ground stability	Unstable geomorphic features	High	Moderate	High	Appropriate construction management practices will reduce the probability of occurrence. Grading of slopes. Use of geotechnical engineering measures to aid slope stability. Design, management and monitoring carried out in line with the appropriate Construction Method Statements. Siting of stockpiles away from watercourses or unstable slopes.	Low
Open trench pipe removal activities – from microtunnel entry shafts to landfall facilities	Vegetation clearance causing increased vulnerability of soils to erosion and compaction	Agricultural soils	Moderate	High	High	Strip topsoil from working area and store in stockpiles. Stockpiles kept to agreed height, and free from disturbance. Stockpiles to be covered as required. Siting of stockpiles away from watercourses or unstable slopes. Design and management of site drainage to reduce risk of soil erosion in exposed subsoil areas or in stockpiles Reinstate soils and replant as soon as possible after trench is backfilled.	Low
		Phaeozem soils	High	Moderate	High		Low
		Fluvisols	High	Moderate	High		Low
		Unstable geomorphic features	High	Moderate	High		Low

Continued…

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Open trench pipe removal activities – from microtunnel entry shafts to landfall facilities	Changes to soil properties through earthworks including excavation of trench and stockpiling	Agricultural soils	Moderate	Moderate	Moderate	Strip topsoil from working area and store in stockpiles. Spoil handling protocols to avoid mixing different soil types. Topsoil to be stored separately to subsoil. Management of stored soils to prevent contamination and change of soil properties.	Low
		Phaeozem soils	High	Moderate	High		Low
		Fluvisols	High	Moderate	High		Low
	Earthworks influencing ground stability	Unstable geomorphic features	High	Moderate	High	Appropriate construction management practices will reduce the probability of occurrence. Grading of slopes. Use of geotechnical engineering measures to aid slope stability. Design, management and monitoring carried out in line with the appropriate Construction Method Statements. Siting of stockpiles away from watercourses or unstable slopes.	Low

Continued…

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Decommissioning of landfall facilities	Vegetation clearance causing increased vulnerability of soils to erosion and compaction	Agricultural soils	Moderate	Moderate	Moderate	Strip topsoil from working area and store in stockpiles. Stockpiles kept to agreed height, and free from disturbance. Stockpiles to be covered as required. Siting of stockpiles away from watercourses or unstable slopes. Design and management of site drainage to reduce risk of soil erosion in exposed subsoil areas or in stockpiles. Reinstate soils and replant as soon as possible after decommissioning.	Low
		Unstable geomorphic features	High	Moderate	High		Low
	Changes to soil properties through earthworks	Agricultural soils	Moderate	Moderate	Moderate	Strip topsoil from working area and store in stockpiles. Spoil handling protocols to avoid mixing different soil types. Topsoil to be stored separately to subsoil. Management of stored soils to prevent contamination and change of soil properties.	Low

Continued…

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Decommissioning of landfall facilities	Earthworks influencing ground stability	Unstable geomorphic features	High	Moderate	Moderate	Appropriate construction management practices will reduce the probability of occurrence. Grading of slopes. Use of geotechnical engineering measures to aid slope stability. Design, management and monitoring carried out in line with the appropriate Construction Method Statements. Siting of stockpiles away from watercourses or unstable slopes.	Low

Complete.

Table 8.26 Assessment of Groundwater Potential Impacts: Decommissioning Phase

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
General decommissioning activities	Leaks and spills during use and storage or pollutants causing contamination of groundwater (directly or indirectly via soil or surface water)	Superficial aquifer	Moderate	Moderate	Moderate	Spillage prevention, bunding and restrictions near watercourses, artificial drains, sensitive soils (moderate and high) and water bodies to minimise impact. Material will be stored away from sensitive soils and water bodies where possible, with secondary containment. Collection and off-site disposal of domestic wastewaters. Drainage and treatment systems for managing surface run-off designed to avoid adverse effects on groundwater quality. Compliance with the ESMP and Project Emergency Preparedness and Response Plan.	Low
		Carbonate aquifer	Moderate	Moderate	Moderate		Low

Continued…

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Establishment of Temporary Construction Areas	Vegetation clearance and earthworks causing or increasing mobilisation of contamination in the soil causing deterioration in groundwater quality	Superficial aquifer	Moderate	Low	Low	In the event that previously unidentified contamination is observed during decommissioning, works in the affected area will cease until the contaminated material is tested and appropriate disposal processes identified.	Low
		Carbonate aquifer	Moderate	Low	Low		Low
Open trench pipe removal activities – from microtunnel entry shafts to landfall	Vegetation clearance and earthworks causing or increasing mobilisation of contamination in the soil causing deterioration in groundwater quality	Superficial aquifer	Moderate	Low	Low	In the event that previously unidentified contamination is observed during decommissioning, works in the affected area will cease until the contaminated material is tested and appropriate disposal processes identified.	Low
		Carbonate aquifer	Moderate	Low	Low		Low

Continued...

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Open trench pipe removal activities – from microtunnel entry shafts to landfall	Change in groundwater levels if groundwater control required at Graphova Gap crossing	Superficial aquifer	Moderate	Low	Low	Adopt groundwater control measures appropriate to ground conditions. Backfill excavation with material of similar or greater permeability than original materials. Undertake works during dry weather if possible.	Low
		Carbonate aquifer	Moderate	Low	Low		Low
	Change in groundwater levels if groundwater control required in trench (except Graphova Gap)	Superficial aquifer	Moderate	Low	Low	Adopt groundwater control measures appropriate to ground conditions. Backfill excavation with material of similar or greater permeability than original materials.	Low
		Carbonate aquifer	Moderate	Negligible	Not Significant		Not Significant
Decommissioning of landfall facilities	Change in groundwater levels if groundwater control required for excavations	Superficial aquifer	Moderate	Low	Low	Adopt groundwater control measures appropriate to ground conditions. Backfill excavations with material of similar permeability to original materials.	Low
		Carbonate aquifer	Moderate	Negligible	Not Significant		Not Significant

Complete.

Table 8.27 Assessment of Surface Water Potential Impacts: Decommissioning Phase

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
General decommissioning activities	Leaks and spills during use and storage or pollutants causing contamination of surface water (directly or indirectly via soil or groundwater)	Shingar River	Moderate	Moderate	Moderate	Spillage prevention, bunding and restrictions near watercourses, artificial drains, sensitive soils (moderate and high) and water bodies to minimise impact. Material will be stored away from sensitive soils and water bodies where possible, with secondary containment. Collection and off-site disposal of domestic wastewaters. Stormwater discharges from the landfall facilities will pass through a sand trap and filter, and an oil interceptor prior to discharge. The treatment standards will be aligned with required water quality standards prior to discharge of the stormwater into the environment. Compliance with the ESMP and Project Emergency Preparedness and Response Plan.	Low
		Tributary in Graphova Gap	Moderate	Moderate	Moderate		Low

Continued...

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Establishment of Temporary Construction Areas	Vegetation clearance and earthworks causing increased vulnerability of soils to erosion affecting surface water quality via run-off	Shingar River	Moderate	Moderate	Moderate	Avoid unnecessary changes to natural drainage systems. Existing artificial drainage to be diverted maintaining gravity flows. Strip topsoil from working area and store in stockpiles. Stockpiles kept to agreed height, and free from disturbance. Stockpiles to be covered as required. Siting of stockpiles away from watercourses or unstable slopes. Design and management of site drainage to reduce risk of soil erosion in exposed subsoil areas or in stockpiles. Drainage systems for surface run-off designed to avoid poor quality water entering watercourses.	Low
		Tributary in Graphova Gap	Moderate	Moderate	Moderate		Low
	Vegetation clearance and earthworks causing increased run-off affecting flow regime	Shingar River	Moderate	Moderate	Moderate		Low
		Tributary in Graphova Gap	Moderate	Moderate	Moderate		Low

Continued…

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Establishment of Temporary Construction Areas	Vegetation clearance and earthworks causing increased run-off affecting flow regime	Tributary in Graphova Gap	Moderate	Moderate	Moderate	Stormwater discharges from the landfall facilities will pass through a sand trap and filter, and an oil interceptor prior to discharge. The treatment standards will be aligned with required water quality standards prior to discharge of the stormwater into the environment. In the event that previously unidentified contamination is observed during decommissioning, works in the affected area will cease until the contaminated material is tested and appropriate disposal processes identified. Reinstate soils and replant as soon as possible after decommissioning.	Low

Continued…

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Open trench pipe removal activities – from microtunnel entry shafts to landfall facilities	Vegetation clearance and earthworks causing increased vulnerability of soils to erosion affecting surface water quality via run-off	Shingar River	Moderate	Moderate	Moderate	Avoid unnecessary changes to natural drainage systems. Existing artificial drainage to be diverted maintaining gravity flows. Strip topsoil from working area and store in stockpiles. Stockpiles kept to agreed height, and free from disturbance. Stockpiles to be covered as required. Siting of stockpiles away from watercourses or unstable slopes. Design and management of site drainage to reduce risk of soil erosion in exposed subsoil areas or in stockpiles. Drainage/ treatment systems for surface run-off designed to avoid poor quality water directly entering watercourses.	Low
		Tributary in Graphova Gap	Moderate	Moderate	Moderate		Low
	Vegetation clearance and earthworks causing increased run-off affecting flow regime	Shingar River	Moderate	Moderate	Moderate		Low
		Tributary in Graphova Gap	Moderate	Moderate	Moderate		Low

Continued…

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Open trench pipe removal activities – from microtunnel entry shafts to landfall facilities	Vegetation clearance and earthworks causing increased run-off affecting flow regime	Tributary in Graphova Gap	Moderate	Moderate	Moderate	In the event that previously unidentified contamination is observed during decommissioning, works in the affected area will cease until the contaminated material is tested and appropriate disposal processes identified. Reinstate soils and replant as soon as possible after decommissioning.	Low
	Change in flow regime during crossing works	Tributary in Graphova Gap	Moderate	Moderate	Moderate	Undertake crossing works during dry weather if possible.	Low
	Disturbance of stream bed sediments during crossing works	Tributary in Graphova Gap	Moderate	Moderate	Moderate	Divert any remaining flows around working area. Reinstate stream as close to original condition as possible. Use sediment control measures (e.g. silt curtains or straw bales) as required.	Low
	Changes in water quality (turbidity, suspended solids) during crossing works	Tributary in Graphova Gap	Moderate	Moderate	Moderate	Backfill excavation with material of similar or greater permeability than original materials to avoid changes to baseflow.	Low

Continued...

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Decommissioning of landfall facilities	Earthworks causing increased vulnerability of soils to erosion affecting surface water quality via run-off	Tributary in Graphova Gap	Moderate	Moderate	Moderate	Avoid unnecessary changes to natural drainage systems. Existing artificial drainage to be diverted maintaining gravity flows. Strip topsoil from working area and store in stockpiles. Stockpiles kept to agreed height, and free from disturbance. Stockpiles to be covered as required. Siting of stockpiles away from watercourses or unstable slopes.	Low

Continued…

Site/Activity	Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Decommissioning of landfall facilities	Earthworks causing increased run-off affecting flow regime	Tributary in Graphova Gap	Moderate	Moderate	Moderate	Design and management of site drainage to reduce risk of soil erosion in exposed subsoil areas or in stockpiles. Drainage management systems designed to manage surface run-off and avoid poor quality water entering watercourses directly. Drainage management systems at landfall facilities to include appropriately certified water treatment systems to treat stormwater prior to discharge. Water treatment standards to be aligned with national water quality criteria (Table 8.3). In the event that previously unidentified contamination is observed during decommissioning, works in the affected area will cease until the contaminated material is tested and appropriate disposal processes identified. Reinstate soils and replant as soon as possible after decommissioning.	Low

Complete.

8.6.5 Unplanned Events

The potential impacts associated with unplanned events are discussed in **Chapter 19 Unplanned Events**.

Procedures to minimise the risk and impact of accidental spills will be developed within the Spill Prevention and Response Plan **(Chapter 22 Environmental and Social Management**). Spill kits shall be kept in accessible locations at all times during the Construction and Pre-Commissioning, Operation and Decommissioning Phases, and employees will be trained in their use and disposal. Considering the small size of any potential spillages and mitigation employed the impacts on soils, groundwater and surface water are expected to be **Low**.

8.6.6 Cumulative Impacts Assessment

All cumulative impacts identified are summarised in **Chapter 20 Cumulative Impact Assessment**.

8.7 Conclusions

8.7.1 Soils – Construction and Pre-Commissioning Phase

The soil receptors in the Study Area include agricultural soils, fluvisols, phaeozem soils and unstable geomorphic features. Construction workers are also a high sensitivity receptor for soils. The impacts pre-mitigation are **Low** to **High** significance. The Project Area impacts are primarily associated with potential contamination of the soils through use and storage of materials, increased susceptibility to erosion, changes in soil properties and unstable ground. Through mitigation the residual significance of the impacts are reduced to **Low**.

8.7.2 Soils – Operational Phase

The Project Area impacts pre-mitigation are **Moderate** significance. The impacts are primarily associated with potential for leaks and spills, vegetation management along the permanent RoW, and interaction of Project infrastructure with natural geomorphological processes. Through mitigation the residual significance of the impacts are reduced to **Not Significant** to **Low**.

8.7.3 Groundwater – Construction and Pre-Commissioning Phase

The groundwater receptors in the Study Area include superficial and carbonate aquifers and existing abstractions. The impacts pre-mitigation are **Not Significant** to **Moderate** significance. The impacts in the Study Area are primarily associated with potential contamination of the groundwater through use and storage of materials, groundwater control, the mobilisation of existing contamination and hydro-testing. Through mitigation the residual significance of the impacts are reduced to **Not Significant** to **Low**.

8.7.4 Groundwater –Operational Phase

The Study Area impacts pre-mitigation are **Moderate** to **Low** significance. The impacts are primarily associated with potential contamination and the potential influence of the pipeline structure on the groundwater flow regime. Through mitigation the residual significance of the impacts are reduced to **Not Significant** to **Low**.

8.7.5 Surface Water – Construction and Pre-Commissioning Phase

The Study Area surface water receptors include the Shingar River and the tributary of the Sukko River in the Graphova Gap and existing surface water abstractions. The Study Area impacts pre-mitigation are of **Moderate** significance. The impacts are primarily associated with the contamination of the surface water through use and storage of materials, construction of access roads, surface water run-off across disturbed soils and river crossing by the Pipeline. Through mitigation the residual significance of the impacts are reduced to **Not Significant** to **Low.**

8.7.6 Surface Water –Operational Phase

The Study Area impacts significance pre-mitigation are **Low** to **Moderate**. The impacts are primarily associated with impact on the surface watercourses through potential contamination, surface water run-off at landfall facilities and access road, and river crossings by the Pipeline and access road. Through mitigation the residual significance of the impacts are reduced to **Not Significant** to **Low**.

8.7.7 Decommissioning Phases

If the activities involve the removal of the trenched pipeline and access road then the impacts and pre-mitigation impact significances are likely to be similar to those reported during the Construction Phase. The exception being the impacts associated with microtunnelling and hydro-testing.

Through mitigation the residual significance of impacts on soil, groundwater and surface water can be reduced to **Not Significant** to **Low**. If the Pipeline is left in place then the impacts will be greatly reduced compared with the impacts if the Pipeline is removed. If the landfall facilities are removed then the impacts during the decommissioning works will be greater than if the facilities are left in place, but the long-term impacts on the water environment will be reduced if the facilities are removed.

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Ref. 8.13	GN 2.1.7.2041-06. Maximum permissible concentrations (MPCs) of chemical substances in the soil.
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Ref. 8.17	GN 2.1.5.1315-03. Maximum permissible concentrations (MPCs) of chemicals substances contained in water of Water Bodies for Economic-Potable and Social-Domestic Water Use, including the Supplements and Amendments No 1 to GN2.1.5.1315-03.
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Ref. 8.19	Order of the Federal Fisheries Agency No. 20 dated 18 January 2010, on approving the standards for Water Quality in Fishing Water Bodies, including Standards for maximum permissible concentrations of Harmful Substances in the Water of Fishing Water Bodies.
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Ref. 8.21	Article 65 of the Water Code of the Russian Federation
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Chapter 9: Air Quality

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9 Air Quality

9.1 Introduction

This chapter describes the atmospheric emissions associated with the Project and assesses their potential to affect existing and future air quality conditions.

Air quality is an important consideration in the ESIA process given its ability to affect human health and the integrity of the environment. High concentrations of pollutants can give rise to the following issues:

- **Adverse Human Health Effects.** Given the potential for air pollution to cause respiratory and cardiovascular illness among the more sensitive members of the population, air quality standards have been set both nationally and internationally. These standards form the basis against which Project emissions have been assessed;
- **Deterioration of Habitat Sites and Surrounding Land.** Nitrogen and sulphur deposition can alter the acidity of the soil, which in turn may inhibit the growth of particular types of flora. This is particularly important for projects in close proximity to critical habitats[1] or to nationally or internationally protected areas[2]; and
- **Nuisance and Annoyance amongst Neighbouring Communities.** High dust emissions can lead to an increase in baseline deposition rates on property surfaces and agricultural crops, as well as, potentially affecting flora through the inhibition of plant growth.

In addition, it is widely acknowledged, scientifically, that the emission of greenhouse gases such as carbon dioxide (CO_2) and methane (CH_4) cause global warming, which in turn may affect weather and climate. Therefore, it is considered important to minimise greenhouse gas (GHG) emissions from the Project as far as is practicable[3].

The aim of this air quality assessment is to determine the impacts to ambient air quality and the likelihood of any of the aforementioned issues occurring. Predictive modelling tools are used to quantify the air quality to the extent possible, and determine any predicted exceedences of Project standards. Where necessary, mitigation measures are specified to ensure applicable air quality standards are met.

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[1] As defined in International Finance Corporation Performance Standard 6.

[2] **Chapter 11 Terrestrial Ecology** and **Chapter 12 Marine Ecology** describe the existence of critical habitat in the Project Area of Influence, and also describe the Utrish State Nature Reserve that is located approximately 3 km south of the nearest Project Activities.

[3] South Stream Transport has no influence over the energy strategies of European countries or their GHG emissions; however, it is able to manage its own GHG emissions resulting from the construction and operation of the Pipeline. The discussion about GHG emissions in this chapter is therefore limited to the Project's GHG emissions.

The key activities and emission sources during Construction and Pre-Commissioning Phases are considered to be:

- **Area and point sources** – nitrogen purging, dust generation and emissions from equipment (including diesel generators) used on the Project during site preparation, earth moving, pipe laying (both onshore and offshore) and other construction activities;
- **Mobile sources** – onshore and offshore emissions associated with deliveries, material movement and worker traffic during construction; and
- **Fugitive sources** – releases of fugitive dust from excavation activities and the movement of vehicles across unpaved roads.

An overview of the traffic associated with the Project is presented in Appendix 9.1 Traffic and Transport Study.

During the Operational Phase, activities will be limited to the operation of landfall facilities, periodic use of equipment to clean and inspect the pipelines, using pipeline inspection gauges (PIGs), and the intermittent use of maintenance and repair vehicles and vessels. Pigging will result in the release of a small volume of volatile organic compounds (VOCs) on an occasional basis (approximately once every five years).

This chapter provides a description of the air quality limits, the assessment methodology used, baseline conditions within the Study Area, the mitigation measures required to prevent, reduce or offset any significant adverse impacts, and the anticipated residual impacts after these measures have been employed. The likely potential for cumulative impacts when considering the Project along with other planned developments in the surrounding area is discussed in **Chapter 20 Cumulative Impact Assessment** and the cumulative impacts associated with the Russkaya Compressor Station are discussed in Appendix 20.1 Environmental Impacts of Associated Facilities: Russkaya Compressor Station.

9.2 Scoping

This chapter focusses on the key aspects and activities which may result in impacts on air quality. Non-key aspects and activities have been scoped out, with further justification provided below.

Air quality effects can be wide ranging and to varying levels of severity. Therefore, some air quality aspects have been scoped out of this assessment as they are considered to be below any measurable or noticeable level of change, although they are briefly mentioned where appropriate as confirmation that they have been considered and scoped out.

The assessment has focussed on the key pollutants of concern in the Study Area (Section 9.3) and the main emissions from the Project Activities. The main source of airborne pollutants from the Project is expected to occur from the combustion of diesel and marine fuels and associated engine exhaust emissions. In addition, construction and earth moving activities associated with the generation of dust are also anticipated. Other airborne pollutants are considered to be emitted in such small or immeasurable quantities that they have been scoped out of this assessment. The main pollutants of concern are discussed below in more detail:

- **Nitrogen dioxide (N_2O):** Oxides of nitrogen (NO_X) are formed as a by-product of the combustion of fossil fuels (such as natural gas) by the oxidation of nitrogen contained in the air and in the fuel. NO_X is primarily emitted as nitrogen oxide (NO), but also includes a small proportion emitted as nitrogen dioxide (NO_2); once emitted the former can be oxidised in the atmosphere to produce further NO_2. It is NO_2 that is associated with adverse health impacts and at high concentrations it can affect lung function and airway responsiveness, and exacerbates asthma and mortality. The rate of conversion of NO_X to NO_2 in the atmosphere is discussed later in this report;
- **Sulphur dioxide (SO_2):** SO_2 is a colourless gas that is readily soluble in water. It is formed through the combustion of sulphur containing fossil fuels and is a major air pollutant in many parts of the world. Excessive exposure to SO_2 (above the limit values) may cause discomfort in the eyes, lungs and throat and the United States Environmental Protection Agency (USEPA) have linked exposure to mortality;
- **Carbon monoxide (CO):** CO is formed by the incomplete combustion of carbon containing fuels such as natural gas. Exposure to high concentrations causes carboxyhaemoglobin[4], which substantially reduces the capacity of the blood to carry oxygen;
- **Volatile Organic Compounds (VOCs):** VOCs are a group of organic compounds that evaporate relatively easily into the air. They form a by-product of combustion and are also naturally present in fossil fuels. Benzene is a widely regulated VOC, which is a recognised carcinogen in humans. Non-methane VOCs (NMVOCs) exclude methane, methane has been considered separately in this assessment due to its global warming potential;
- **Particulate Matter (PM):** Air quality limits exist for total suspended particulate matter, which is all suspended particulate matter suspended in the air, and the finer PM_{10} and $PM_{2.5}$ size fractions, which can penetrate deeper into the lungs. PM_{10} and $PM_{2.5}$ are defined as particulate matter with an equivalent aerodynamic diameter of less than 10 and 2.5 microns (µm), respectively. Exposure to increased concentrations of PM_{10} and $PM_{2.5}$ is consistently associated with respiratory and cardiovascular illness and mortality;
- **Dust:** Dust is generally regarded as particulate matter less than 75 µm and can include suspended and deposited particulate matter. The effects to humans of construction activities from dust are two-fold; as a potential nuisance, and as having the potential to cause human health effects. Complaints against construction works are often associated with the former, relating to deposition of dust on windows, cars, and the outside of buildings, with the latter being from a finer fraction of the dust. In extremely large quantities, dust can also smother vegetation reducing photosynthesis and growth rates. Large dust particulates (greater than 30 µm), which makeup the greatest proportion of dust emitted from construction works, will largely deposit close to any such works; and
- **Greenhouse Gases (GHG):** Emissions of GHG have also been considered within this assessment due to their potential importance with regards to global warming, in particular

[4] A stable complex of carbon monoxide and haemoglobin that forms in red blood cells upon contact with carbon monoxide (CO).

emissions of CO_2 and methane. However, these gases do not have air quality limit values against which to assess Project emissions.

An estimated emissions inventory is provided in this assessment in Section 9.6.6 in tonnes per year of pollutant (additional details on GHG emissions and methodology are provided in Appendix 9.5: Atmospheric Emissions from South Stream Russia Construction and Pre-Commissioning Phase). This is provided for emissions reporting purposes and should not be confused with assessment of impact magnitude and significance.

The air quality standards relevant to the Project are set out in Section 9.6.1.1. The Project Standards are based on Russian Federation national limits (Ref. 9.1) and standards referred to in the International Finance Corporation (IFC) Environmental, Health and Safety General Guidelines (Ref. 9.2), which are in turn, based on the World Health Organisation (WHO) Air Quality Guidelines (Ref. 9.3).

9.3 Spatial and Temporal Boundaries

For the Construction and Pre-Commissioning Phase and the Operational Phase of the Project, the Project Area (as defined in **Chapter 1 Introduction**) is sub-divided into the following sections where certain activities which give rise to airborne pollutants could occur:

- **Offshore Section** – All marine based activities located at water depths of greater than 30 m. It extends from the border of the nearshore section to the border of the Russian and Turkish EEZs in the Black Sea;
- **Nearshore Section** – Marine based activities which commence at the exit point of the microtunnels, located approximately 400 m from the coast at a water depth of approximately 23 m and extends approximately 425 m out to a water depth of 30 m; and
- **Landfall Section** – any activity that occurs on the land including the Pipeline permanent Right-of-Way (RoW), landfall facilities and access roads.

Although the ports have not been confirmed, for the purposes of this ESIA Report, activities within the existing port at Novorossiysk have been considered and assessed on the basis that this is one of the ports most likely to be used.

In general, airborne pollutants once emitted can travel for long distances and cross national and international boundaries, although the atmospheric emissions generated by the Project Activities are expected to disperse relatively quickly and to have a limited geographical extent. Considering this and for the purposes of this assessment the air quality Study Area has been further defined as:

- **Offshore Study Area** – An area of 2 km around the Pipeline route (Offshore) in water depths greater than 30 m; and
- **Nearshore and Landfall Study Areas** – Preliminary modelling demonstrated that the maximum impacts of the Project would occur within a 2 km buffer, and this distance is considered adequate for the Study Area. A more detailed 200 m buffer area either side of the Pipeline RoW (landfall) and access roads was also considered part of the Study Area.

There are several residential areas and sensitive habitats within the Study Areas. These include a Kindergarten and a large school within the nearest town of Varvarovka, as well as other nursery and primary schools within other local communities. There are high schools in Gai Kodzor and Supsekh. There are also local outpatient facilities within the local towns, including Varvarovka; the nearest hospital is in Anapa. The sensitive habitats are described in **Chapter 11 Terrestrial Ecology** and **Chapter 12 Marine Ecology**.

Certain offshore receptors such as workers on the Project vessels would not be subject to air quality limit values discussed within this chapter (instead they would be subject to occupational exposure limit values which are not covered within this air quality assessment). An exclusion zone of 2 km will be enforced around the RoW (offshore) and therefore offshore human receptors and, as such, the Offshore Study Area are not considered in this assessment.

Full details of activities associated within the Study Area are presented within the impact section for each corresponding Project phase.

Port facilities and haulage routes are discussed within the assessment despite being outside of this defined Study Area. Unless specifically mentioned in the assessment, all other topic specific Study Areas (e.g. terrestrial ecology) are considered outside the scope of the air quality assessment. The Study Area is illustrated in Figure 9.1.

Air quality surveys were conducted in 2012 and 2014 (see Section 9.4.4 for details). The locations of the surveys were selcetd to inform the underlining baseline conditons of the area. The air quality **Survey Area** is thus the spatail extent of these surveys and is presented in Figure 9.2.

Secondary data was also collected from a variety of sources (see Section 9.4.2) to inform the baseline. Data collected from secondary sources forms the basline of the **Wider Study Area** which emcompasses the Study Areas and the Survey Area, mentioned above.

9.4 Baseline Data Collection

9.4.1 Methodology and Data

This section discusses details of air quality surveys carried out across the Survey Area as well as data sourced from secondary parties. This is used to inform the baseline conditions.

9.4.2 Secondary Data

Secondary data has been provided by the "Krasnodar Regional Centre for Hydrometeorology and Environmental Monitoring" for 2012 (Ref. 9.4) to help establish the baseline conditions at the Wider Study Area.

Background pollutant concentrations have been provided by the Krasnodar Regional Centre for Hydrometeorology and Environmental Monitoring for the three towns of Anapa, Varvarovka and Gostagaevskaya. Country emissions data is available from the European Monitoring and Evaluation Programme (EMEP) Centre on Emission Inventories and Projections (CEIP) for pollutants, and the United Nations Climate Change Secretariat (Ref. 9.5) for GHGs.

9.4.3 Data Gaps

To determine baseline concentrations, it is important that a range of sources are used to provide a good representation of air quality in the Wider Study Area. The Krasnodar Regional Centre for Hydrometeorology and Environmental Monitoring data is based on measurements taken in central Anapa, and as such is likely to be representative of areas with higher baseline pollutant concentrations than those experienced in more rural environments within the Wider Study Area. Therefore, it was deemed necessary to obtain primary data to supplement the available secondary data for the Study Area.

9.4.4 Primary Data and Baseline Surveys

A two-month survey of air quality was undertaken within the Survey Area between August and October 2012. The purpose of this survey was to confirm that the available secondary data is representative of the Study Area or, if not, to provide new data on which to base the impact assessment. A further diffusion tube monitoring survey commenced in February 2014, focussed on the area affected by early works activities. The first month of results from the monitoring are also included in this chapter, and provide some indication of the seasonal variation in background pollutant concentrations during the winter months. The survey is ongoing and further results will be incorporated into the project dataset and, if appropriate, used as the Environmental and Social Management Plans (ESMPs) evolve.

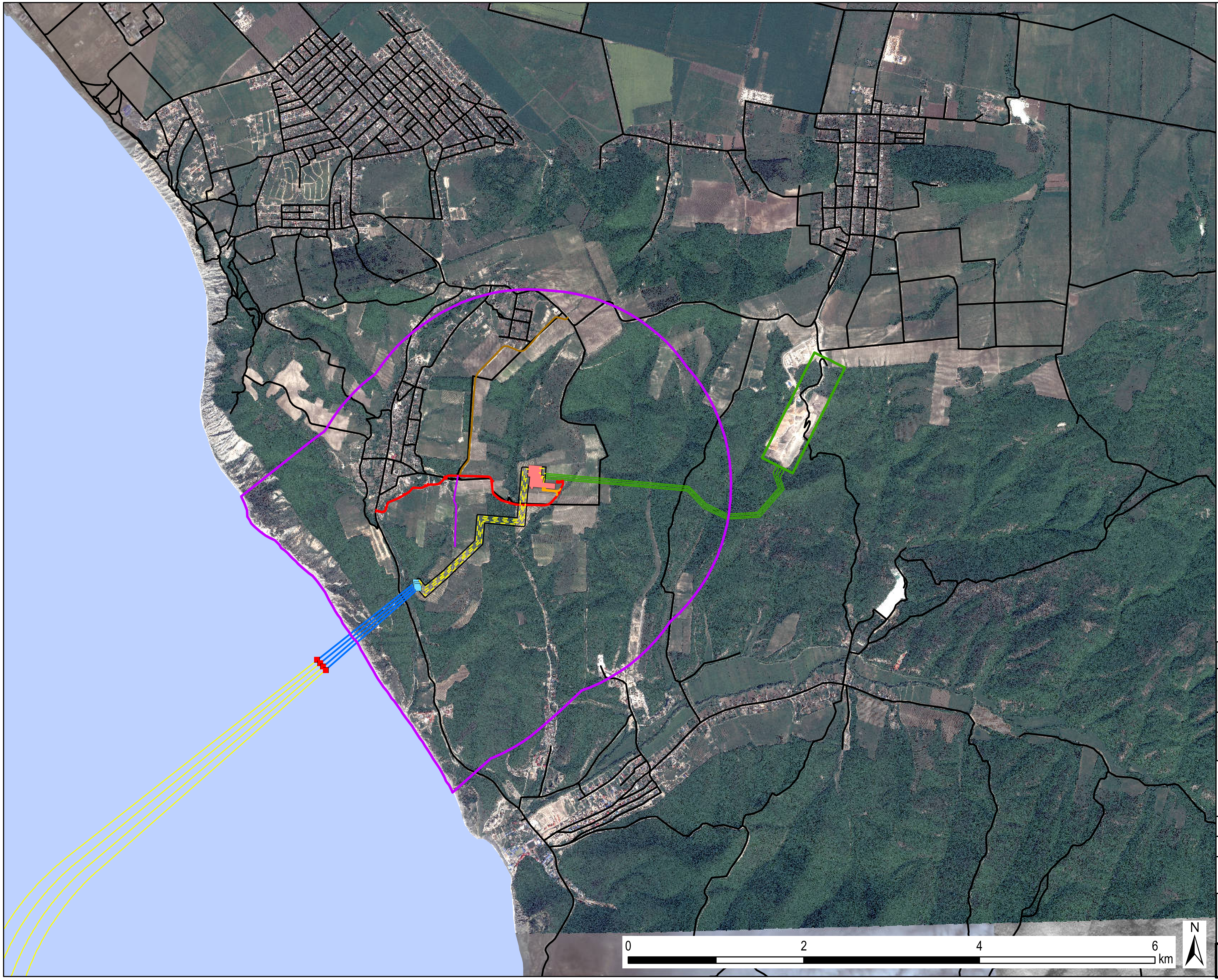
The air quality survey was undertaken using a network of diffusion tubes (passive sampling devices containing a steel mesh impregnated with a sorbent material or sorbent chamber) onto which specific gases are absorbed or adsorbed. Diffusion tubes have limitations to the data quality which are discussed in Section 9.4.5.

Monitoring was undertaken at nine sampling locations for two successive one-month periods between 15 August and 19 October 2012, as shown in Figure 9.2 and described in Table 9.1. This is considered a snap shot of conditions and results are likely to be less representative than annual datasets. The monitoring locations were selected to include a variety of sites along the construction corridor, some nearby residential dwellings and educational facilities that are likely to be more affected by the Project, and the suburbs of other less affected settlements.

The survey was undertaken for selected pollutants detailed in the Section 9.2, which are of known human health risk commonly associated with fuel combustion; namely SO_2, NO_2, and benzene. For PM_{10} and total particulate matter (airborne particulate matter of all size fractions), which cannot be sampled using passive methods such as diffusion tubes, it was considered sufficient to rely on secondary data rather than install automatic monitoring stations.

The 2014 monitoring survey commenced on 18 February and the monitoring locations are shown on Figure 9.2 and described in Table 9.12. The survey was undertaken for a number of pollutants commonly associated with road traffic emissions and fuel combustion; namely SO_2 and NO_x. Due to the low results obtained from the 2012 survey, the measurements for benzene were not repeated.

The locations of the diffusion tube monitoring are presented in Table 9.2.



LEGEND

- Study Area
- Other Roads

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Landfall facilities
- Proposed microtunnels
- Proposed offshore pipelines
- Right-of-Way
- Microtunnel entry shaft
- Microtunnel exit pit
- Permanent access road to be constructed by SSTTBV
- Temporary access road constructed by SSTTBV
- Varvarovka bypass road (used by Project during construction only)

United Gas Supply System

- United Gas Supply System pipelines
- Russkaya compressor station
- Permanent access road to be constructed by Gazprom Invest

Projection: Lambert Conformal Conic

Purpose of Issue
For Information

Client
South Stream Offshore Pipeline / Stream ENERGISING EUROPE

Project Title
SOUTH STREAM OFFSHORE PIPELINE

Drawing Title
STUDY AREA FOR THE ASSESSMENT OF THE ATMOSPHERIC EMISSIONS

Drawn	Checked	Approved	Date
AH	RW	MW	04/03/2014

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Drawing Number: Figure 9.1 | Rev

Plot Date: 04 Mar 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA\Chapter 9 Air Quality\Figure 9.1 Study area for the assessment of the Atmospheric Emissions.mxd

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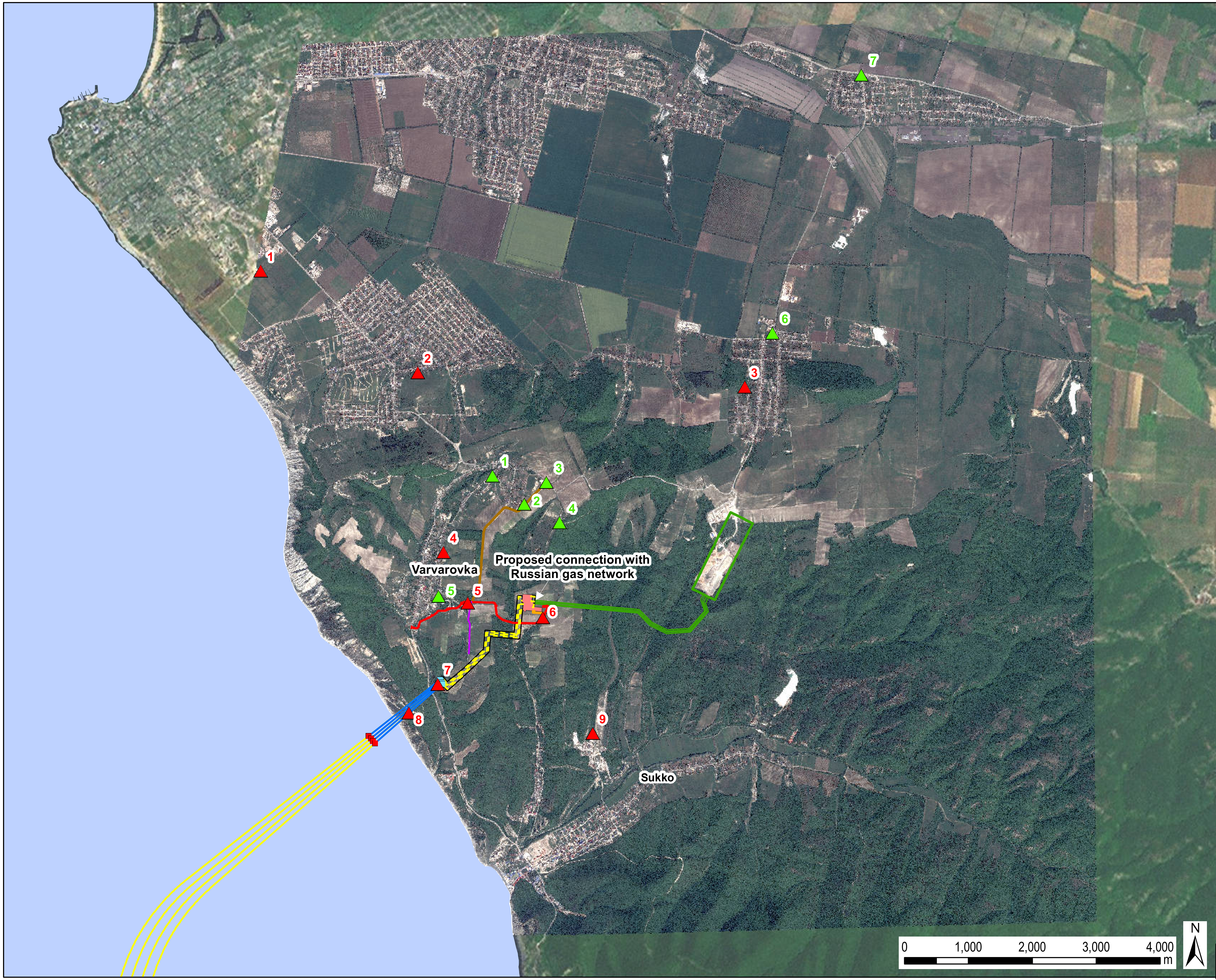


LEGEND

- Diffusion tube monitoring locations 2014
- Diffusion tube monitoring locations 2012

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Landfall facilities
- Proposed microtunnels
- Proposed offshore pipelines
- Right-of-Way
- Microtunnel entry shaft
- Microtunnel exit pit
- Permanent access road to be constructed by SSTTBV
- Temporary access road constructed by SSTTBV
- Varvarovka bypass road (used by Project during construction only)

United Gas Supply System

- United Gas Supply System pipelines
- Russkaya compressor station
- Permanent access road to be constructed by Gazprom Invest

Projection: Lambert Conformal Conic

Purpose of Issue
For Information

Client
South Stream
Offshore Pipeline
ENERGISING EUROPE

Project Title
SOUTH STREAM OFFSHORE PIPELINE

Drawing Title
DIFFUSION TUBE SAMPLING LOCATIONS

Drawn	Checked	Approved	Date
AH	RW	MW	04/03/2014

URS Internal Project No.	Scale @ A3
46369082	1:55,000

URS Infrastructure & Environment UK Limited
Scott House
Alençon Link, Basingstoke
Hampshire, RG21 7PP
Telephone (01256) 310200
Fax (01256) 310201
www.ursglobal.com

Drawing Number
Figure 9.2

Rev

Plot Date: 04 Mar 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 9 Air Quality\Figure 9-2 Diffusion tube sampling locations.mxd

Table 9.1 Description of Diffusion Tube Monitoring Locations – 2012 Survey

Sampling Location	Description
1	The eastern part of Anapa, located approximately 7 km northwest of the Pipeline (Receptor number 8, Table 9.15).
2	The eastern part of Supsekh located east of Anapa, approximately 3.5 km northwest of the Pipeline (near Receptor number 7, Table 9.15).
3	A nearby town (Gai Kodzor), approximately 4.5 km northeast of the landfall facilities (near Receptor number 10, Table 9.15).
4	The eastern part of Varvarovka, approximately 1.5 km northwest of the landfall facilities (Receptor number 3, Table 9.15).
5	Situated 1.2 km west of the landfall facilities and 800 m northwest of the Pipeline.
6	Adjacent to the proposed landfall facilities.
7	The location of the microtunnel entry points.
8	A location on the coastline, beneath which the Pipeline will be tunnelled.
9	Approximately 2 km southeast of the landfall facilities.

Table 9.2 Description of Diffusion Tube Monitoring Locations – 2014 Survey

Sampling Location	Description
1	Background location within northern Varvarovka.
2	Closest residential properties to the route of the Varvarovka Bypass Road
3	The closest residential property to northern access point of the Varvarovka Bypass Road
4	Background location to the east of the Varvarovka Bypass Road
5	Southern Varvarovka, west of the proposed location of the Landfall Facilities, close to monitoring location 5 in the 2012 survey.
6	In the town of Gai Kodzor, close to the road through the town.
7	In the town of Rassvet, close to the junction of the M25 main road.

9.4.5 Data Assumptions and Limitations

The secondary data reported by the Krasnodar Regional Centre for Hydrometeorology and Environmental Monitoring are derived from short term monitoring undertaken in central Anapa, which is outside of the Study Area, but within the Wider Study Area, and not wholly representative of long term conditions at the worst affected receptors adjacent to the RoW.

The diffusion tube monitoring locations provide a good representation of the annual average concentrations for each pollutant within the Study Area. The survey period will not have captured the seasonal variation in concentrations related to meteorological conditions. They are, however, easily deployed and are useful in providing indicative concentrations at a variety of locations within the Project Area. The samples were analysed using a UK Accreditation Service (UKAS) certified laboratory based in the UK.

It is not considered that the above is a substantial limitation given the findings of the assessment. This is discussed in more detail in Section 9.6.

9.4.6 Model verification and validation

The assessment is not able to verify modelled predictions against measured baseline concentrations due to the lack of emission sources in the existing environment; this can only be achieved once emission sources are present. Instead the assessment relies upon validation. The model producer CERC has produced a number of validation papers for the dispersion model used in this assessment, ADMS, which shows the approximate level of accuracy. An overview of the model and these validation papers is presented in Appendix 9.2: Overview of ADMS and Model Validation.

9.5 Baseline Characteristics

9.5.1 Meteorological and Climatic Conditions

The Krasnodar Regional Centre for Hydrometeorology and Environmental Monitoring has provided a climatic summary for the period from 1977 to 2009 (Ref. 9.4), based on the nearest meteorological station to the Project, which is located in Anapa, 5 km north of the proposed Pipeline route (World Meteorological Organisation Station ID 37001).

Table 9.3 provides a summary of the average monthly air temperature onshore. The annual average temperature is 12.1 Celsius (°C), with the coldest months shown as December to March and the warmest months June to September. The maximum average monthly temperature occurs in July and is 23.1°C. The minimum average monthly temperature occurs in January, and is 1.8°C.

Table 9.3 Average Monthly Air Temperature, °C

Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Annual av.
1.8	2.4	5.4	11.0	15.2	20.1	23.1	22.7	18.2	12.8	7.7	4.2	12.1

Although not shown in Table 9.3, the estimated average maximum daily air temperature occurs in July and is 29.0°C. The estimated average minimum daily air temperature occurs in January and is -2.2°C.

Table 9.4 provides a summary of the wind data based on the climatic record. The predominant wind direction is north-easterly (i.e. blowing from the northeast) occurring for 25% of the year, followed by southerly winds for 21% of the year, easterly winds for 17% of the year and northerly winds for 11% of the year. The wind speeds are generally highest during southerlies, with an average speed of 6.7 metres per second (m/s) and a maximum recorded wind speed of 34 m/s during the 32 year record. The maximum recorded wind speed during this period was 40 m/s, which was recorded during a south-westerly wind.

Table 9.4 Wind Speed and Direction Data

Average wind speed by directions (m/s)								
N	*NE*	*E*	*SE*	*S*	*SW*	*W*	*NW*	
3.6	4.4	3.7	4.8	6.7	5.7	4.7	4.3	
Maximum wind speed by directions (m/s)								
25	29	33	29	34	40	35	27	
Repeatability of wind directions and calms %								
N	*NE*	*E*	*SE*	*S*	*SW*	*W*	*SW*	*Calm*
11	25	17	5	21	9	8	4	1

Table 9.5 presents the average monthly and annual precipitation amounts at Anapa meteorological station. The annual average rainfall is shown to be 539 millimetres (mm), with the slightly higher quantities occurring during the winter months of November to February. The daily maximum rainfall event during the climate record is 85.9 mm. The deepest snowfall on record is 33 cm, though snowfall is generally sparse in comparison with the rest of the region and Russian Federation.

Table 9.5 Monthly and Annual Rainfall Amounts (mm)

Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Annual av.
50	43	41	40	37	39	34	39	45	41	59	71	539

Table 9.6 presents the maximum number of recorded days with fog by month. It shows that May has the maximum number of fog days with nine fog events. August has the least number of fog days, with an average of one day with fog.

Table 9.6 Maximum Number of Days with Fog, by month

Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
3	5	6	5	9	4	2	1	4	4	3	4

The climatic data is not considered further in this assessment given that it is not expected to be affected by the Project.

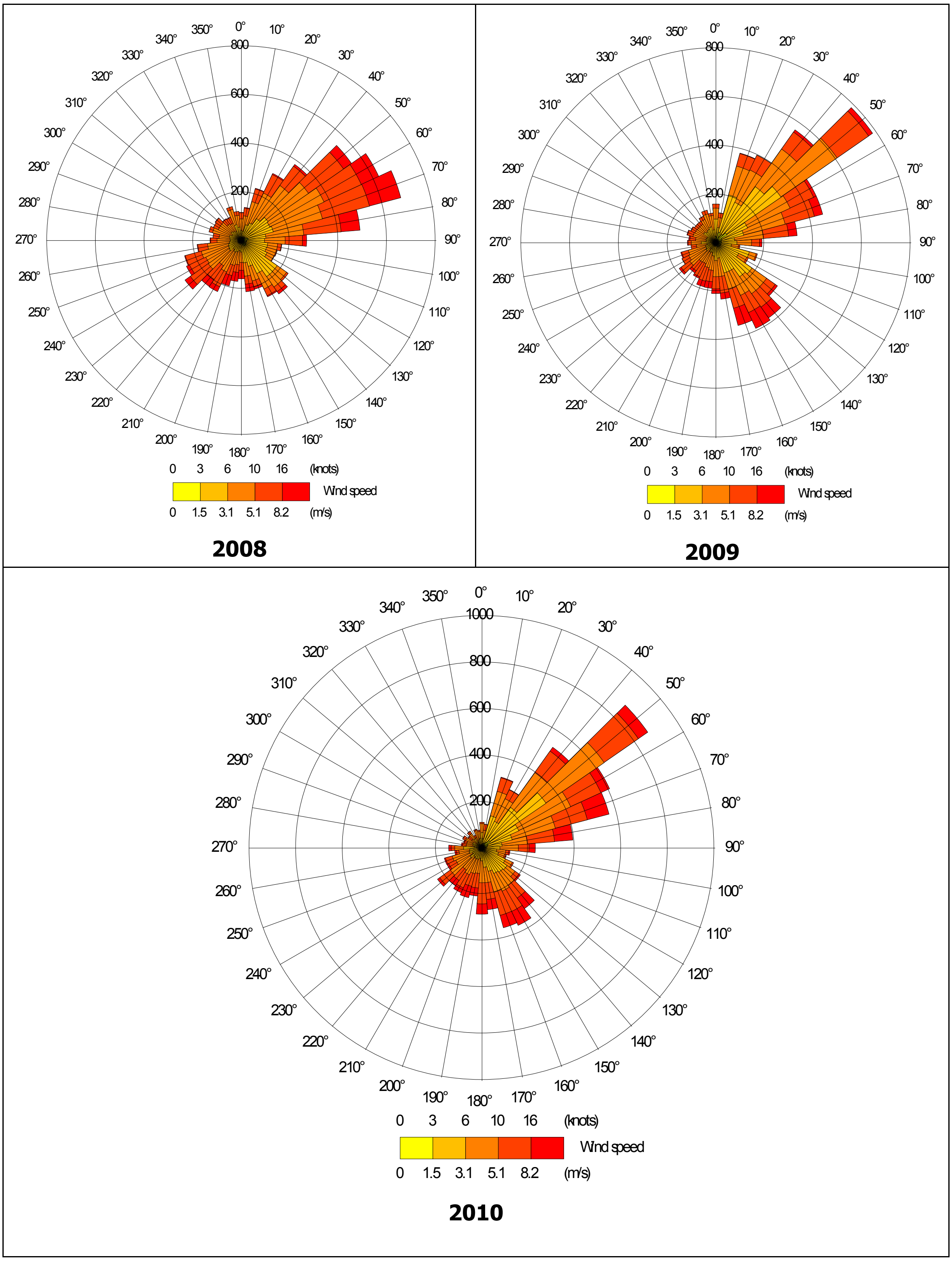
Local meteorological conditions can, however, affect the plume dispersion of emissions downwind of the site, with plumes being largely transported in the direction of the wind. Atmospheric conditions influence both plume spread and the rapidity it reaches ground level.

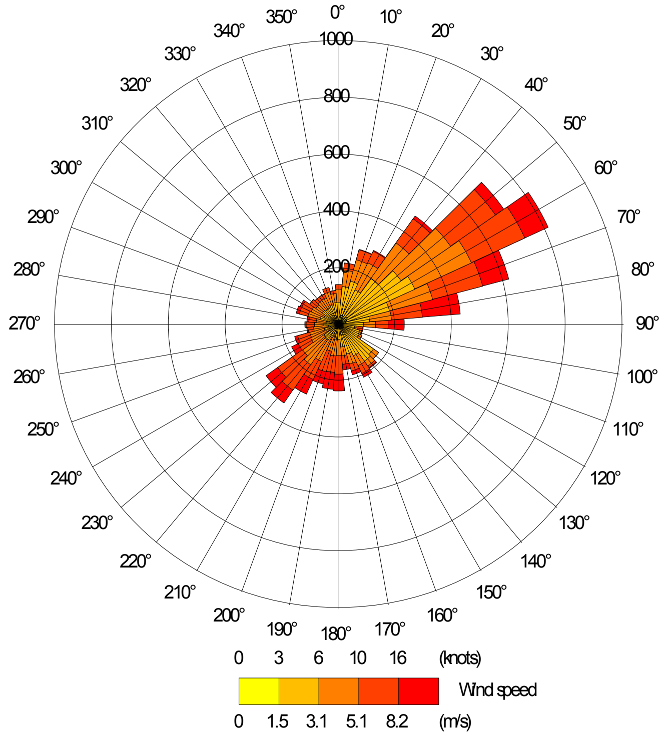
The atmospheric dispersion model used for the assessment (discussed in Section 9.6.2) requires measurements of wind speed and direction, ambient temperature, humidity, cloud cover or solar radiation and estimates of the urban and rural mixing heights. Ground level concentrations are computed for each hour of meteorological data for specified averaging periods and receptor points. It is typically recommended to use meteorological data from a monitoring station as close to the assessed site as possible, since this is likely to be exposed to similar weather conditions.

Hourly sequential meteorological data from Anapa meteorological station, for the years 2008 to 2012 inclusive, has been utilised for the assessment. The use of data from a five year period is likely to have captured much of the variation in meteorological conditions that would be experienced within the Landfall and Nearshore Study Area. This is not necessarily representative of meteorological conditions offshore, but impacts to offshore receptors are not considered within this assessment.

Figure 9.3 shows the typical wind speed and direction experienced at Anapa Meteorological Station for each of the five years within the dataset, with the predominant wind direction being north-easterly. It is therefore reasonable based on this data to expect that air emissions from the Project Area will generally be dispersed to the southwest (to sea) over the longer term.

Figure 9.3 Wind Roses, Anapa Meteorological Station (2008 to 2012)

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Wind speed
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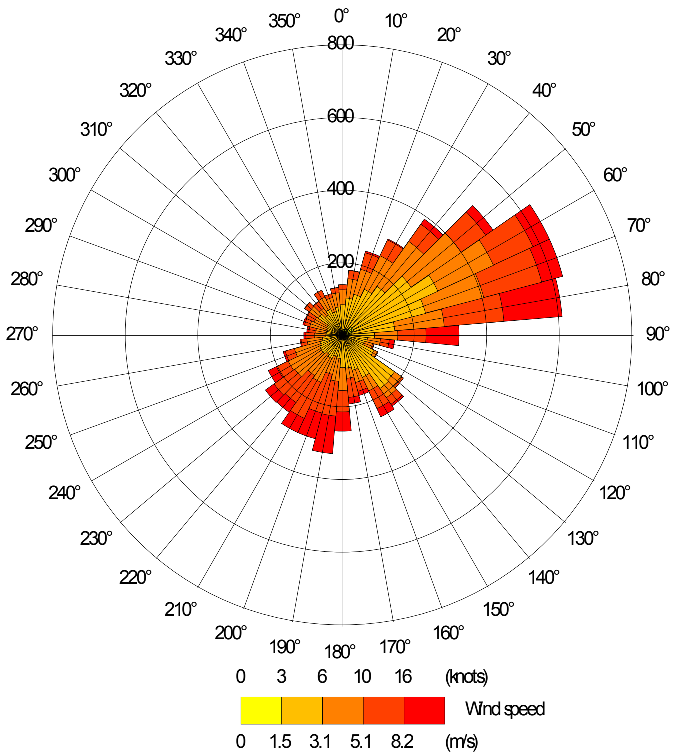
2011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Wind speed
0 1.5 3.1 5.1 8.2 (m/s)

2012

9.5.2 Baseline Air Quality

9.5.2.1 Krasnodar Regional Centre for Hydrometeorology and Environmental Monitoring Data

In order to assess the Project's potential to impact local air quality, it is necessary to first determine the baseline ambient air quality.

Background air pollutant concentrations in the Wider Study Area have been provided by the Krasnodar Regional Centre for Hydrometeorology and Environmental Monitoring for the three towns of Anapa, Varvarovka and Gostagaevskaya. These are illustrated in Figure 9.2. It is understood that the values are derived from monthly spot sampling at a site in central Anapa, and extrapolated to provide values for other areas. As the monitoring is short-term, it is considered that these values are representative of short term concentrations (less than a 24 hour averaging period) rather than long term annual average concentrations.

The concentrations for 2012 (the most recent data) are summarised in Table 9.7. Concentrations are presented in µg/m^3 unless otherwise stated. Any exceedences of the Project Standards (Table 9.7) are highlighted in bold font.

Table 9.7 2012 Pollutant Concentrations Supplied by the Krasnodar Regional Centre for Hydrometeorology and Environmental Monitoring (µg/m^3)

Pollutant	Anapa	Varvarovka	Gostagaevskaya	Russian Limits*	Project Standard (Averaging Period)
SO_2	10	11	10	50 (APC) 500 (MPC)	125 (24 hr) 500 (10 min)
NO_2	**66**	**56**	**56**	40 (APC) 200 (MPC)	40 (ann. Mean) 200 (max 1 hr)
Total Particulate matter	**221**	140	**170**	150 (APC) 500 (MPC)	n/a
CO (mg/m^3)	2.0	1.8	2.0	3 (APC) 5 (MPC)	n/a
NO	39	21	21	60 (APC) 400 (MPC)	n/a

* APC – Equivalent to Annual Mean. MPC – Maximum 20 minute mean (Maximum Permissible Concentrations)

The reported concentrations of SO_2, CO and NO are below the long term and short term Russian Limits and adopted Project Standards. If the reported NO_2 concentrations are assumed to be representative of the annual mean then the Russian Limit and Project Standard would be exceeded at all three locations, but the short term criteria are not exceeded. Concentrations of total particulate matter reported for Anapa and Gostagaevskaya are in excess of the long term Russian limit value but below the maximum peak MPC value.

The monitoring station in Anapa is located in an urban area, whereas the land in the vicinity of the Project Area is more rural in character. The area around the monitoring station is likely to experience higher concentrations of pollutants than those experienced in close proximity to the Project, particularly in the case of substances associated with emissions from road traffic and other sources such as NO_2. Total particulate matter concentrations could also be linked to road traffic levels, both due to exhaust emissions and through the re-suspension of road dust. In rural areas, overall concentrations of airborne total particulate matter are likely to be much lower, despite farming activities, e.g. the movement of machinery on un-surfaced ground representing occasional sources of emissions.

9.5.2.2 Diffusion Tube Monitoring Results

Table 9.8 presents the findings of the diffusion tube monitoring. Concentrations are presented in micrograms per cubic metre (μg/m^3).

Table 9.8 Diffusion Tube Results (μg/m^3)

Diffusion Tube Sample Location	Pollutant	Month 1 - 15/08/2012 to 18/09/2012	Month 2 - 18/09/2012 to 19/10/2012	2 month average	Annual average Russian Federation Limit	Annual average IFC Guideline
Tube 1 Eastern Anapa	SO_2	8.0	9.8	8.9	50	n/a
	NO_2	12.7	12.0	12.4	40	40
	O-zone (O_3)	22.7	74.6	48.7	n/a[†]	n/a
	Benzene	3.6	0.6	2.1	100	n/a
Tube 2 Eastern Supsekh	SO_2	11.2	18.1	14.7	50	n/a
	NO_2	9.9	9.2	9.6	40	40
	O_3	43.9	137.6	90.8	n/a[†]	n/a
	Benzene	1.3	0.8	1.1	100	n/a
Tube 3 Gai Kodzor	SO_2	10.3	12.8	11.6	50	n/a
	NO_2	6.1	6.9	6.5	40	40

Continued...

Diffusion Tube Sample Location	Pollutant	Month 1 - 15/08/2012 to 18/09/2012	Month 2 - 18/09/2012 to 19/10/2012	2 month average	Annual average Russian Federation Limit	Annual average IFC Guideline
Tube 3 Gai Kodzor	O_3	26.2	83.2	54.7	n/a†	n/a
	Benzene	0.7	0.3	0.5	100	n/a
Tube 4 Eastern Varvarovka	SO_2	9.8	11.8	10.8	50	n/a
	NO_2	7.0	6.4	6.7	40	40
	O_3	32.6	122.8	77.7	n/a†	n/a
	Benzene	0.5	0.5	0.5	100	n/a
Tube 5 650 m S of landfall facilities, 300 m E of pipeline route	SO_2	8.0	8.3	8.2	50	n/a
	NO_2	6.2	5.2	5.7	40	40
	O_3	26.9	59.8	43.4	n/a†	n/a
	Benzene	1.6	<0.27*	<0.9	100	n/a
Tube 6 Landfall facilities site	SO_2	8.0	7.8	7.9	50	n/a
	NO_2	5.6	6.3	6.0	40	40
	O_3	29.1	90.2	59.7	n/a†	n/a
	Benzene	1.6	1.8	1.7	100	n/a
Tube 7 Microtunnel entry point	SO_2	8.9	11.8	10.4	50	n/a
	NO_2	8.8	9.2	9.0	40	40
	O_3	26.2	55.2	40.7	n/a†	n/a
	Benzene	0.5	0.4	0.5	100	n/a
Tube 8 Coastline	SO_2	6.7	12.3	9.5	50	n/a
	NO_2	4.9	6.6	5.8	40	40
	O_3	25.5	73.8	49.7	n/a†	n/a

Continued...

Diffusion Tube Sample Location	Pollutant	Month 1 - 15/08/2012 to 18/09/2012	Month 2 - 18/09/2012 to 19/10/2012	2 month average	Annual average Russian Federation Limit	Annual average IFC Guideline
Tube 8 Coastline	Benzene	0.5	2.4	1.5	100	n/a
Tube 9 2 km SE of landfall facilities	SO_2	7.2	6.4	6.8	50	n/a
	NO_2	5.1	6.0	5.6	40	40
	O_3	15.6	73.1	44.4	n/a†	n/a
	Benzene	1.7	0.5	1.1	100	n/a

* Below the analytical limit of detection
† Monthly average ozone concentrations are less than the 160 µg/m^3 8-hour daily maximum limit at all diffusion tube stations. This limit is not directly comparable to the measured data and therefore it cannot be concluded whether or not this limit is met or exceeded, although it is likely.

Complete.

The following conclusions can be drawn from the diffusion tube monitoring undertaken within the Survey Area:

1. Measured concentrations are below the national and IFC guideline annual limits for the parameters monitored;
2. Monthly average SO_2 concentrations are between 14% and 30% of the Russian Federation annual APC, and broadly similar to the concentrations measured by the Krasnodar Regional Centre;
3. NO_2 concentrations are between 14% and 31% of the Russian Federation annual APC and mean annual IFC limit, and considerably less than the concentration values derived from monitoring within central Anapa (in Table 9.8); and
4. Benzene concentrations are below the Russian Federation annual APC.

The diffusion tube data are limited in temporal extent (it presents only two months of data and shows variability between months for some pollutants and/or monitoring locations); however, it still does provide an indication of long term average concentrations within the Survey Area located away from major urban settlements and associated emissions such as road traffic and industry.

Table 9.9 presents the findings of the first month of diffusion tube monitoring from the 2014 survey. Concentrations are presented in µg/m^3. The monitoring equipment placed at location 1 was missing at the end of the one month period, so there is currently no data available for this site.

Table 9.9 Diffusion Tube Results – 2014 Survey (μg/m³)

Diffusion Tube Sample Location	Pollutant	Month 1 – 18/01/2014 to 21/02/2014	Annual average Russian Federation Limit	Annual average IFC Guideline
Tube 1 Northern Varvarovka	SO_2	-	50	n/a
	NO_2	-	40	40
	NO	-	n/a	n/a
Tube 2 Adjacent to Bypass Road	SO_2	1.1	50	n/a
	NO_2	10.9	40	40
	NO	6.8	n/a	n/a
Tube 3 Near to N access point of Varvarovka Access Road	SO_2	1.5	50	n/a
	NO_2	13.5	40	40
	NO	8.1	n/a	n/a
Tube 4 East of Varvarovka Access Road	SO_2	1.6	50	n/a
	NO_2	6.6	40	40
	NO	8.4	n/a	n/a
Tube 5 W of landfall facilities	SO_2	2.5	50	n/a
	NO_2	12.5	40	40
	NO	8.6	n/a	n/a
Tube 6 Gai Kodzor	SO_2	2.7	50	n/a
	NO_2	20.6	40	40
	NO	18.4	n/a	n/a
Tube 7 Rassvet	SO_2	1.8	50	n/a
	NO_2	22.1	40	40
	NO	22.3	n/a	n/a

The following conclusions can be drawn from the first month of results from the 2014 diffusion tube monitoring undertaken within the Survey Area:

1. Measured concentrations remain below the national and IFC guideline annual limits for the parameters monitored in the winter months, when concentrations are likely to be higher than in summer;
2. SO_2 concentrations are lower than those measured in the 2012 survey, despite the likely increase in domestic fuel use during the winter period;
3. NO_2 concentrations measured at locations 2, 3 and 5 are slightly higher than other measurements from Varvarovka in the 2012 survey. This indicates that background NO_2 concentrations may increase by a small amount in the winter months. The concentrations remain below 35% of the annual mean project standard. The measurement at location 4 is however consistent with background measurements from 2012;
4. NO_2 concentrations at locations 6 and 7 are influenced by nearby sources of road traffic emissions. Measured concentrations remain well below the project standards.
5. NO_2 concentrations remain considerably less than the concentration values derived from monitoring within central Anapa (in Table 9.9);

The diffusion tube data are currently limited in temporal extent (although only one month of data it is considered to be representative of the winter when higher concentrations are likely to be observed). The early results of the 2014 survey confirm that the 2012 monitoring does provide a reasonable indication of concentrations within the Survey Area located away from major urban settlements and associated emissions such as road traffic and industry.

9.5.3 Baseline Summary

The baseline section has considered the existing climatic and air quality conditions.

The climate data has been sourced from Anapa meteorological station and shows that the climate is typical of a coastal location within the Krasnodar region.

Air quality baseline conditions have been derived using a combination of data provided by the Krasnodar Regional Centre for Hydrometeorology and Environmental Monitoring for the three towns of Anapa, Varvarovka and Gostagaevskaya, and a two month diffusion tube survey at nine sampling locations within the Project RoW and immediate surrounds.

Concentrations reported by the Krasnodar Regional Centre for Hydrometeorology and Environmental Monitoring exceed the air quality limits for annual average NO_2 and particulate matter concentrations. These values, however, are derived from short term monitoring undertaken in central Anapa, which is outside of the Study Area and not necessarily representative of conditions at the worst affected receptors adjacent to the RoW.

The diffusion tube monitoring data indicates that the annual mean project standards for the parameters monitored are not exceeded, with NO_2 concentrations between 14% and 31% of the annual mean project standard. This is considerably less than the concentration reported by the Krasnodar Regional Centre for Hydrometeorology and Environmental Monitoring, and concentrations of this magnitude indicate that the short-term standards are also unlikely to be regularly exceeded in the baseline, given the lack of existing major sources of emissions in the vicinity of the construction site. The large difference between the NO_2 diffusion tube data and Krasnodar Regional Centre data also indicates that particulate matter concentrations in the Study Area would also be considerably less than those found in central urban locations.

The diffusion tube data are limited in temporal extent, but the monitoring data taken from both summer and winter months can still be considered to be indicative of long term concentrations within the construction corridor and at the nearest rural dwellings.

9.6 Impact Assessment

9.6.1 Impact Assessment Methodology

This section discusses the approach to determining the potential impacts associated with the Project on the baseline conditions described in Section 9.5.

The potential impacts upon the air quality are derived through the activities of the Project. These are described in detail in **Chapter 5 Project Description** of this ESIA Report and Table 9.10 outlines the key activities that are likely to give rise to air emissions and where this is likely to occur.

Table 9.10 Key Activities likely to result in Atmospheric Emissions

Phase	Activity	Impact	Project Section		
			Offshore	Nearshore	Landfall
Construction	Pipe-lay vessel and support vessel movements	Release of combustion gases into the atmosphere	✓	✓	
	Construction plant and generator operation	Release of combustion gases into the atmosphere			✓
	Road and rail movements	Release of combustion gases into the atmosphere			✓
	Earth moving activities	Dust generation			✓

Continued...

Phase	Activity	Impact	Project Section		
			Offshore	Nearshore	Landfall
Pre-Commissioning	Operation of extraction pump, flooding pump, compressor, and associated diesel fired equipment	Release of combustion and natural gases into the atmosphere	✓	✓	✓
Operation	Mobilisation of vessels for checking the Pipeline or repairs	Release of combustion gases into the atmosphere	✓		
	Gas flow through the Pipeline	Release of natural gas to the atmosphere through flanges			✓
	Pigging activities and emergency shut-down / alterations to Pipeline operation	Release of natural gas to the atmosphere through venting			✓

Complete.

9.6.1.1 Air Quality Standards

Table 9.11 presents the applicable Project Standards and relevant ambient air quality standards for the Project, based on the Russian Federation national limits (Ref. 9.1), Bulgarian National Limits and the IFC Environmental, Health and Safety General Guidelines (Ref. 9.2), which are in turn based on the WHO Air Quality Guidelines (Ref. 9.3). Note that Project Standards have been adopted across both Russia and Bulgaria. This assessment focuses on the assessment of Russian National limit values for the purposes of assessing air quality impacts and is supplemented with IFC standards where applicable.

Concentrations are presented in micrograms pollutant per cubic metre of air (µg/m^3), except CO which is reported in milligrams CO per cubic metre of air (mg/m^3)[5].

[5] There is a factor of 1000 difference between µg/m3 and mg/m3. For example, the MPC for NO2 is 200 µg/m3, which is the equivalent of 0.2 mg/m3.

Table 9.11 Relevant Air Quality Standards (µg/m^3)

Pollutant	Averaging Period	Russian Federation Limits	IFC / World Bank / WHO Guidelines	Bulgarian Limit	Adopted Project Standard
Sulphur dioxide (SO_2)	10 minutes	n/a	500	500	**500**
	24 hour	n/a	125*	125**	**125**
	Maximum (20 minute) permissible concentration (MPC)	500	n/a	n/a	**500**
	Average (annual) permissible concentration (APC)	50	n/a	n/a	**50**
Nitrogen dioxide (NO_2)	1 hour / MPC	200	200	200~	**200**
	Annual / APC	40	40	40	**40**
Total particulate matter (PM)	MPC	500	n/a	n/a	**500**
	APC	150	n/a	n/a	**150**
Particulate matter (PM_{10})	24 hour	n/a	50±	50	**50**
	Annual	n/a	50 ±±	40	**40**
Particulate matter ($PM_{2.5}$)	24 hour	n/a	50 ^		**50**
	Annual	n/a	25 ^^	25 (20 from 2020)	**25**
Carbon monoxide (CO) (mg/m^3)	MPC	5	n/a	n/a	**5**
	APC	3	n/a	n/a	**3**
Benzene	MPC	300	n/a	300	**300**
	APC	100	n/a	5	**5**
Ozone (O_3)	8 hour daily maximum	n/a	160 #	120	**120**

Continued...

Pollutant	Averaging Period	Russian Federation Limits	IFC / World Bank / WHO Guidelines	Bulgarian Limit	Adopted Project Standard
Nitric oxide (NO)	MPC	400	n/a	400	**400**
	APC	60	n/a	60	**60**

* Based on Interim Target 1. The guidance also includes a guideline limit of 20 µg/m^3 and an interim target 2 of 50 µg/m^3
** Not to be exceeded more than 3 times in a calendar year
~ Not to be exceeded more than 18 times in a calendar year
± Based on the 99th percentile. Contains an Interim Target 1 of 150 µg/m^3, Interim Target 2 of 100 µg/m^3, and Interim Target 3 of 75 µg/m^3
±± Based on Interim Target 2. The guidance also includes a guideline limit of 20 µg/m^3, Interim Target 1 of 70 µg/m^3, and Interim Target 3 of 30 µg/m^3
^ Based on Interim Target 2. The guidance also includes a guidance limit of 25 µg/m^3, Interim Target 1 of 75 µg/m^3, and Interim Target 3 of 37.5 µg/m^3
^^ Based on Interim Target 2. The guidance also includes a guidance limit of 10 µg/m^3, Interim Target 1 of 35 µg/m^3, and Interim Target 3 of 15 µg/m^3
# Interim Target 1. The guideline limit is 100 µg/m^3

Complete.

Russian Federation limits (Ref. 9.1) require pollutants to be no more than a factor of 0.8 (80%) of the Maximum Permissible Concentration (MPC) in Sanitary Protection Zones (SPZs), which is a buffer zone between the Project and nearby residential areas. It is established for industrial facilities that emit pollutants into the atmosphere or have other environmental impacts. The SPZ is illustrated in Figure 9.4, along with the nearby sensitive receptors.

National limits are also provided for hydrogen disulphide, benzo(a)pyrene, and formaldehyde in the Russian Federation. These pollutants are not expected to be emitted in large quantities by activities associated with the Project and there are no known large emission sources of these substances in the vicinity of the Pipeline route. For these reasons, these pollutants have not been assessed further.

There are no known regulatory or guidance limits available in the Russian Federation regulations or IFC guidelines for assessing the effect of dust deposition for either habitats or people. Guidance levels vary country to country. For example, a guideline level of 200 milligrams per square metre per day (mg/m^2/day) is typically used within the UK to indicate the potential for dust nuisance by the UK Environment Agency, while in South Africa 600 mg/m^2/day is the action level for residential areas, below which the risk of nuisance is considered low.

There are no known limits for assessing impacts on atmospheric concentrations of pollutants at protected habitats in the IFC/World Bank guidance or Russian Federation regulations. Utrish State Nature Reserve is the closest designated site to the Project, located approximately 3.2 km southeast of the microtunnel entry points (the closest point of the Pipeline). **Chapter 11 Terrestrial Ecology** has also identified critical vegetation in the Study Area that has not been designated as a state reserve.

In the absence of criteria for the protection of flora and fauna, and to allow an assessment of potential impacts on air emissions on protected and non-protected vegetation, the critical levels set out in European Union Directive 2008/EC/50 for the protection of ecosystems have been applied to this assessment for locations outside of urban settlements. These limits are presented in Table 9.12 in µg/m^3.

Table 9.12 Relevant Critical Levels for the Protection of Vegetation (µg/m^3)

Pollutant	Averaging Period	Russian Limits	EU Limit Value	IFC Guidelines
Sulphur dioxide (SO_2)	Calendar year and winter (1 October to 31 March)	-	20	-
Oxides of nitrogen (NO_X)	Calendar year	-	30	-

9.6.1.2 Impact Assessment Criteria

Chapter 3 Impact Assessment Methodology presents full details of the assessment of impact significance and this chapter outlines how these assessment criteria apply specially for air quality. While a number of national and international air quality standards may apply to the Project, there is relatively little guidance on the assessment of air quality impact significance. Some guidance on this issue is provided by the IFC, which recommends that any new project should contribute at most 25% of any applicable ambient air quality limit to allow for future developments (Ref. 9.2). In this case, however, much of the potential impacts on air quality would occur during construction and would hence not degrade the airshed over the long-term.

The criteria used in describing receptor sensitivity and impact magnitude in this ESIA have taken into account IFC guidance (Ref. 9.2) as well as technical guidance from the international community, as detailed in **Chapter 3 Impact Assessment Methodology**. The Russian Federation provides ambient limits (see Table 9.11) but there is no known guidance on attributing significance to modelled increases in pollutant concentrations. Subsequently, the criteria used in describing receptor sensitivity and magnitude of impacts for this ESIA Report have taken technical guidance from the international community into account, in particular the guidelines provided by the air quality regulators and professional bodies from the UK (Ref. 9.6 and Ref. 9.7).

The significance of a predicted air quality impact in this ESIA Report has been determined taking into account air quality limits (receptor sensitivity), and the predicted magnitude of impact associated with the Project (magnitude of change). These two considerations are discussed in further detail below.

9.6.1.3 Receptor Sensitivity

In general, air quality limits for the protection of human health (shown in Table 9.11) are set at a level that research indicates is "safe" for the general public. In theory, air quality concentrations sustained above the prescribed limits have the potential to lead to adverse health effects. Similarly, air quality levels for the protection of sensitive ecosystems and habitats (i.e. those habitats which are likely to demonstrate a significant ecological response to the air quality parameter under consideration) are set at a level which should not lead to a deterioration of such ecosystems. A receptor is therefore considered particularly sensitive where concentrations are approaching or already exceed the critical levels, as any increase is likely to have a perceptible effect on the habitat under consideration.

It is also acknowledged that the characteristics of receptors may affect their sensitivity to changes in air quality concentrations. For example, in general, the elderly and very young are more likely to be adversely affected by changes in air quality than middle aged adults. Therefore, some locations (e.g. hospitals, nursing homes, schools) are considered to represent locations of higher sensitivity. In addition some habitats may be highly sensitive to changes of a particular pollutant but be more resilient to increased levels of others.

Table 9.13 presents a description of receptor sensitivity, using the categories High, Moderate, Low, and Negligible. These descriptors have been developed specifically for the Project, although they are in part based on the aforementioned guidance methodology. Receptor sensitivity for ecosystems/habitats uses definitions provided with **Chapter 11 Terrestrial Ecology**, though re-assigned for specific sensitivity to air quality.

The human health criteria do not apply to Project workers who would be covered by health and safety standards, places of work which are not relevant to the ambient air quality limits, or locations where people are not expected to be present for sufficient time for these limits to be judged to be applicable.

Table 9.13 Receptor Sensitivity Criteria

Sensitivity	Description		
	Sensitivity for Human Health		*Sensitivity for Protection of Ecosystems/Habitats*
High	A zone or agglomeration* designated as exceeding an air quality limit value; or Undesignated areas where concentrations are 85% or more of an air quality limit value.	And it is within an area where members of the public are regularly present; Or any hospital, school, nursing homes or similar facilities considered to be vulnerable to changes in ambient air quality concentrations.	Within an ecosystem/habitat type which is recognised to be of importance at an international level or is a critical habitat as defined by the IFC, and where the habitat has the potential to be affected by baseline concentrations close to or above the air quality critical levels.

Continued…

Sensitivity	Description		
	Sensitivity for Human Health		*Sensitivity for Protection of Ecosystems/Habitats*
Moderate	Areas not designated as exceeding the limit values and where baseline concentrations are between 50%-85% of an air quality limit.	And it is within an area where members of the public are regularly present; Or at any hospital, school, nursing homes or similar facilities considered to be vulnerable to changes in ambient air quality concentrations.	Within an ecosystem/habitat type recognised to be of importance at a national scale and where the habitat has the potential to be affected by baseline concentrations close to or above the air quality critical levels.
Low	Areas not designated as exceeding the limit values and where baseline concentrations are between 15%-50% of an air quality limit.	And is within an area where members of the public are regularly present.	Within an ecosystem/habitat type occurring outside of any designation, but which represent a typical example of the feature under consideration within the context of the ecological resource present within the country and is not likely to be affected by air quality levels.
Negligible	Areas not designated as exceeding the limit values and where baseline concentrations are less than 15% of an air quality limit.	Or is within an area where members of the public are not regularly present.	Within an ecosystem/habitat type which is either appreciably degraded/disturbed by human activity, have low diversity of common and widespread species or have high proportions of invasive/non-native species and would not likely to be affected by air quality levels.

* As defined in EU Directive 2008/50/EC (Ref. 9.8)

Complete.

It is possible for a receptor to have a different level of sensitivity to different pollutants and averaging periods. For example, concentrations may exceed the short-term limit for nitrogen dioxide, yet easily comply with the limits set for other pollutants, meaning that a receptor in this location would have a high sensitivity to NO_2 but a low or negligible sensitivity with regards to other pollutants. Where relevant, this has been discussed in the assessment.

9.6.1.4 Impact Magnitude

Table 9.14 presents a description of the magnitude of change, using the classifications High, Moderate, Low and Negligible.

The impact magnitude criteria are based on aforementioned guidance, using a change that is more than 25% of a limit (the IFC industry benchmark) as the definition for a high impact magnitude event. The banding for impact magnitude is based on professional judgement, taking into account the aforementioned guidance provided by the air quality regulators and professional bodies referred to in Section 0.

The frequency and reversibility of impacts are not assigned in the impact magnitude but are instead addressed in context, where appropriate, throughout the assessment. The air quality limits are based on specific averaging periods which by default define frequency.

Table 9.14 Magnitude Criteria

Magnitude	Description
High	A change of more than 25% of the limit value where the total predicted concentration (taking into account the baseline conditions and impact attributed to the Project) exceeds the limit value, OR a change of greater than 50% of the limit value where the total predicted concentration complies with the limit value.
Moderate	A change of 15% to 25% of the limit value where the total predicted concentration exceeds the limit value, OR a change of 25-50% of the limit value where the total predicted concentration complies with the limit value.
Low	A change of 5% to 15% of the limit value where the total predicted concentration exceeds the limit value, OR a change of 10-25% of the limit value where the total predicted concentration complies with the limit value.
Negligible	A change of less than 5% of the limit value where the total predicted concentration exceeds the limit value, OR a change of less than 10% of the limit value where the total predicted concentration complies with the limit value.

How the application of the magnitude of impact and receptor sensitivity criteria combine in a sensitivity matrix to generate impact significance categories (High, Moderate, Low, Not Significant or Benefit), is discussed in detail in **Chapter 3 Impact Assessment Methodology**, though the significance criteria and description is presented in Table 9.15 and Table 9.16 for ease of reading.

Table 9.15 Significance Criteria

		Receptor Sensitivity (vulnerability and value)			
		Negligible	*Low*	*Moderate*	*High*
Impact Magnitude (extent, frequency, reversibility, duration)	*Negligible*	Not significant	Not significant	Not significant	Not significant/ Low†
	Low	Not significant	Low	Low/Moderate*	Moderate
	Moderate	Not significant	Low/Moderate	Moderate	High
	High	Low	Moderate	High	High

† Allows technical discipline author to decide if impact significance is Not Significant or Low
* Allows technical discipline author to decide if impact significance is Low or Moderate

Table 9.16 Significance of Predicted Impacts

Adverse Impacts	**High**	**Significant.** Impacts with a "High" significance are likely to disrupt the function and value of the resource/receptor, and may have broader systemic consequences (e.g. ecosystem or social well-being). These impacts are a priority for mitigation in order to avoid or reduce the significance of the impact.
	Moderate	**Significant.** Impacts with a "Moderate" significance are likely to be noticeable and result in lasting changes to baseline conditions, which may cause hardship to or degradation of the resource/receptor, although the overall function and value of the resource/receptor is not disrupted. These impacts are a priority for mitigation in order to avoid or reduce the significance of the impact.
	Low	**Detectable but not significant.** Impacts with a "Low" significance are expected to be noticeable changes to baseline conditions, beyond natural variation, but are not expected to cause hardship, degradation, or impair the function and value of the resource/receptor. However, these impacts warrant the attention of decision-makers, and should be avoided or mitigated where practicable.
	Not Significant	**Not Significant.** Any impacts are expected to be indistinguishable from the baseline or within the natural level of variation. These impacts do not require mitigation and are not a concern of the decision-making process.

9.6.1.5 Sensitive Receptors

As stated in Section 9.2, the atmospheric emissions from the Project are anticipated to disperse very quickly after the point of release and as such only have the potential to affect receptors within close proximity to the Project Activities. As such only the closest receptors have been identified for inclusion within the modelling assessment. These receptors could also potentially be affected by the construction and operation of the Russkaya CS, and this is considered further in Appendix 20.1.

Human Health Receptors

Identified human health receptors within the Wider Study Area are described Table 9.17 and are illustrated in Figure 9.4. Figure 9.4 also shows the location of the SPZ at which concentrations should not exceed 0.8 (80%) of the MPCs.

Table 9.17 Description of Nearby Air Quality Sensitive Receptors

Receptor Number	Description
1	A group of residential dwellings, a nursery and school situated in the southern extremity of the nearby town Varvarovka, approximately 800 m north of the microtunnel entry points.
2	A group of dwellings on the coast, which include the Shingari holiday complex and the Don holiday complex, approximately 1.3 km south of the microtunnel entry points.
3	A residential area in Varvarovka, approximately 1.5 km northwest of the landfall facilities.
4	A residential dwelling situated in the northeastern part of Varvarovka, approximately 1.5 km north of the landfall facilities.
5	The southern boundary of a proposed residential development currently under construction, approximately 500 m northwest of the microtunnel entry points and 1.5 km southwest of the landfall facilities. An extension of the town of Varvarovka.
6	A group of residential dwellings situated approximately 1.5 km south of the landfall facilities.
7	The southern part of Supsekh located southeast of Anapa, approximately 3.5 km northwest of the nearest point of the pipelines.
8	The south eastern part of Anapa, approximately 7 km northwest of the nearest point of the pipelines.
9	The eastern part of Supsekh located southeast of Anapa, approximately 4 km north of the nearest point of the pipelines.
10	The southern edge of a nearby town, (called Gai Kodzor) approximately 4.5 km northeast of the landfall facilities.
11	Two log cabins that have recently been built on cleared land, not currently in use but likely to be in the near future. Approximately 1.1 km south of the landfall facilities.
12	The settlement of Sukko, approximately 3 km south of the microtunnel entry points.

Locations where members of the public may be present for a short period of time, such as footpaths and countryside, are considered relevant to the assessment of short-term concentrations (e.g. limits where the averaging period is 24 hours or less) and have been assessed using a regular spaced grid of receptors to calculate the maximum short-term model (known as a Cartesian Grid of receptor points).

Ecological Receptors

In addition to residential receptors there are also several nationally and internationally protected habitat sites that may be considered sensitive to air emissions attributed to the Project. The closest designated habitat site is the Utrish state national reserve, which is located approximately 3.2 km southeast of the microtunnelling location (and also extends into the nearshore water), as shown in Figure 9.4. There is also habitat through which the landfall section will be constructed, as described in **Chapter 11 Terrestrial Ecology**, and other sensitive land uses such as vineyards in the area.

In contrast to land based receptors, the potential for air quality impacts upon offshore marine environments was considered to be outside the required scope of this air quality assessment. No limits exist for the assessment of air quality impacts on seawater or marine ecology. Consequently, offshore was not considered to have any potential receptors.

9.6.1.6 Study Area Sensitivity

This section identifies and evaluates the sensitivity of receptors within the Study Area. The Project is located within a relatively isolated, vegetated area, with very few human receptors.

Study Area sensitivity criteria presented in Table 9.18 combines the Study Area's baseline concentrations with the sensitivity criteria, presented in Table 9.13 based on pollutant and averaging period. It is possible for a receptor to have a different level of sensitivity to different pollutants and averaging periods. For example, concentrations may exceed the short-term limit for NO_2 yet are easily aligned with the limits set for other pollutants, meaning that a receptor in this location could have a high sensitivity to NO_2 but a low sensitivity to other pollutants.

As discussed earlier in this chapter, the Study Area does not consider offshore emissions sources and receptors. It is considered that air quality conditions offshore would be similar or lower than background air quality conditions on land, due to limited proximity of human activity and the free atmosphere over large water bodies. Offshore sensitivity is not considered further in this assessment.

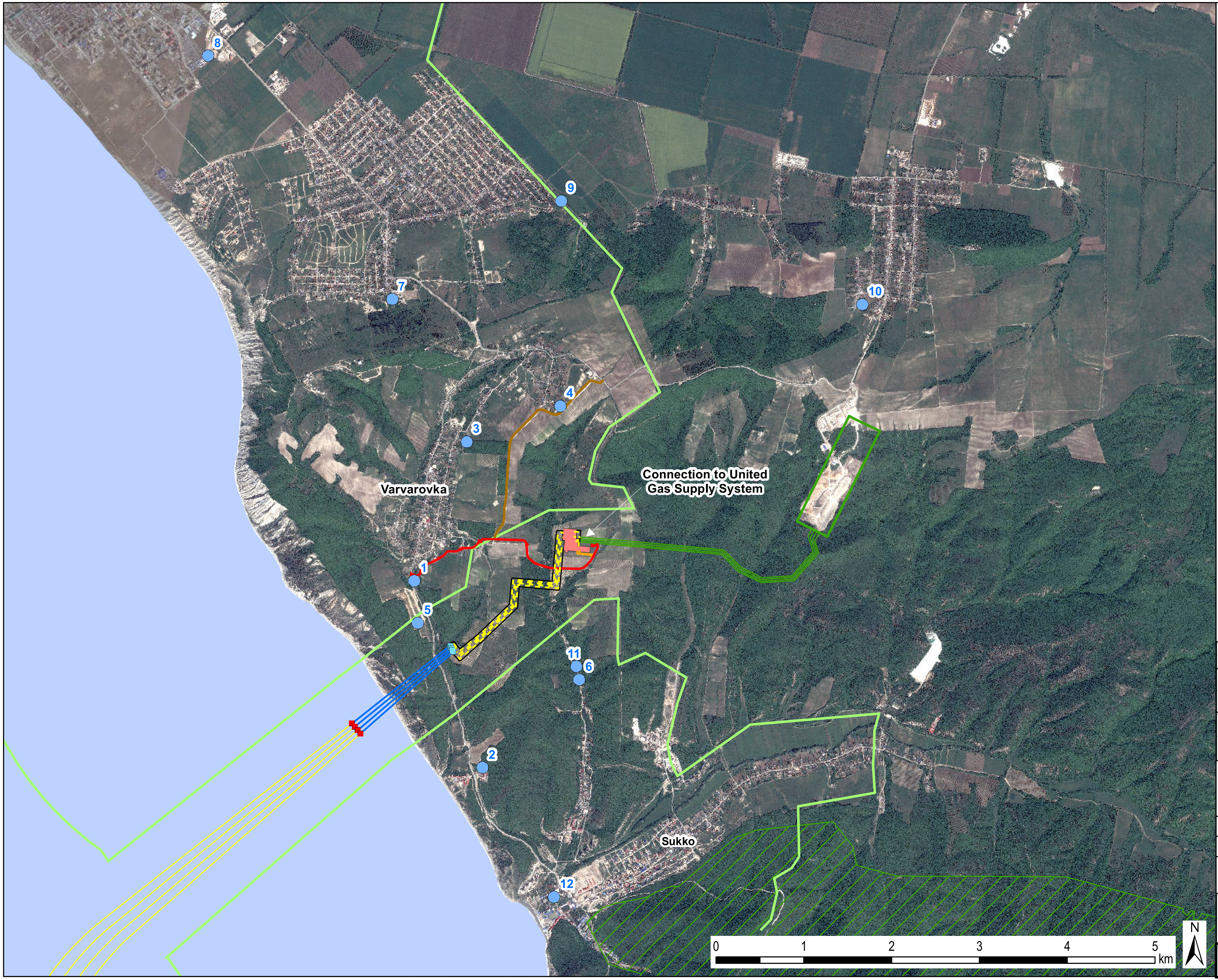
Table 9.18 summarises the perceived sensitivity of the Study Area, based on the monitoring data presented in Table 9.8 and Table 9.9, and the descriptors presented in Table 9.13. The sensitivity of each of the discrete sensitive receptors listed in Table 9.18 for the pollutants assessed, can be found in Appendix 9.4: Dispersion Modelling Results Tables Commissioning Phase.

The receptor sensitivity is low for SO_2, NO and NO_2. Although rural concentrations are likely to be well below those reported in urban centres, a moderate sensitivity has been assumed for CO. A high sensitivity is assumed for total particulate matter, PM_{10} and $PM_{2.5}$, at all locations in the Study Area. Finally, it is assumed that receptors are of negligible sensitivity to benzene due to anticipated low baseline concentrations resulting from the absence of local emission sources.

Table 9.18 Summary of Study Area Sensitivity

	Negligible	Low	Moderate	High
SO_2	-	Mean Annual Concentrations for Ecological Receptors Short-term concentrations for Human Health		
NO_2	Mean Annual and Short-term Concentrations for Human Health and Ecological Receptors in Suburbs of settlements and rural areas (based on diffusion tube monitoring)	-	-	-
Total particulate matter	-		-	Mean Annual Concentrations for Human Health Short-term concentrations for Human Health
CO	-	-	Short-term concentrations for Human Health	-
Benzene	Mean Annual and Short-term Concentrations for Human Health	-	-	-

The closest and potentially worst affected sensitive receptor is Receptor 5, which is also on the boundary of the SPZ. Table 9.19 summarises the baseline concentrations that have been assumed for this Receptor. These concentrations are also likely to be representative of background values elsewhere within the Study Area.



LEGEND

- Air quality sensitive receptors
- The boundary of the third area of sanitary protection zone (monitored zone)
- Boundary of the state nature reserve "Utrish"

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Landfall facilities
- Proposed microtunnels
- Proposed offshore pipelines
- Right-of-Way
- Microtunnel entry shaft
- Microtunnel exit pit
- Permanent access road to be constructed by SSTTBV
- Varvarovka bypass road (used by Project during construction only)

United Gas Supply System

- United Gas Supply System pipelines
- Russkaya compressor station
- Permanent access road to be constructed by Gazprom Invest

Projection: Lambert Conformal Conic

Purpose of Issue: For Information

Client: South Stream Offshore Pipeline — Stream ENERGISING EUROPE

Project Title: SOUTH STREAM OFFSHORE PIPELINE

Drawing Title: LOCATION OF AIR QUALITY SENSITIVE RECEPTORS

Drawn	Checked	Approved	Date
AH	RW	MW	04/03/2014

URS Internal Project No.	Scale @ A3
46369082	1:40,000

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Drawing Number: Figure 9.4

Rev

Plot Date: 04 Mar 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 9 Air Quality\Figure 9.4 Location of Air Quality Sensitive Receptors.mxd

Table 9.19 Baseline Conditions at Receptor 5 / SPZ Boundary

	Concentration ($\mu g/m^3$)	Source
SO_2	10	Diffusion tube 7, located at the microtunnel entry points
NO_2	9	Diffusion tube 7. This is similar to the other diffusion tube findings
Total particulate matter*	140	Krasnodar Regional Centre for Hydrometeorology and Environmental Monitoring value for Varvarovka
PM_{10}*	140	It is also assumed, conservatively, that all particulate matter is PM_{10}. In reality a noticeable portion of total particulate matter is particles greater than 10 microns.
$PM_{2.5}$*	140	It is also assumed, unrealistically, that all particulate matter is $PM_{2.5}$. In reality a relatively small portion of total particulate matter is expected to be 2.5 microns or less.
CO	1,800	Krasnodar Regional Centre for Hydrometeorology and Environmental Monitoring value for Varvarovka
Benzene	0.5	Diffusion tube 7

* In the absence of other measured data, the total particulate matter concentration has been taken from the Krasnodar Regional Centre for Hydrometeorology and Environmental Monitoring value for Varvarovka.

9.6.2 Modelling Undertaken

This section provides an overview of the modelling undertaken using atmospheric dispersion modelling software to establish impact magnitude from activities.

Where necessary, the atmospheric dispersion model ADMS 5 has been used to model or screen the predicted impact of atmospheric emissions associated with the Project. ADMS 5 is an internationally recognised dispersion model, which is regularly used in the UK, USA, Europe, Middle East, and Asia.

ADMS 5 is an advanced Gaussian plume dispersion model specifically designed to model a wide range of emission sources. The model uses hourly sequential meteorological data to enable a realistic assessment of dispersion from point sources to be conducted for weather conditions that are directly applicable to the site. See Appendix 9.2 for an overview of ADMS 5 and comparisons to other internationally recognised or well-known models.

Unlike some of the other pollutants mentioned in this assessment, emissions of NO_X vary dependant on a wide number of combustion variables and are also subject to chemical reactions in the atmosphere. Due to this, it is necessary to state how NO_X transformation has been considered in this assessment. In practice, typically 5% to 10% of NO_X emitted from the engine exhausts of site plant and vessels is expected to be in the form of NO_2 at the point of discharge (i.e. stack exit), the remainder being NO. NO is a less harmful pollutant than NO_2 but it is of interest as a precursor to NO_2. The conversion of NO to NO_2 takes place in the atmosphere under the influence of several factors, primarily the availability of ozone (O_3). However, the chemistry of this conversion is complex and subject to many influences, and therefore, it is not possible to accurately predict the rate of conversion of NO to NO_2. As such, a conservative conversion factor has been applied in order to calculate NO_2 concentrations at ground level. For the purpose of this assessment, a 35% conversion factor for NO_X to NO_2 has been used for this study for short-term[6] averages of 24 hours or less (including the MPC), and 100% to calculate annual average NO_2. This assumption is considered conservative and is expected to lead to a higher estimation of ground-level NO_2 concentration than would occur in practice (Ref. 9.7 and Ref. 9.9).

The estimated exhaust emissions from the site plant and vessels have been calculated using the European Environment Agency (EEA) Air Pollutant Emission Inventory Guidebook 2009 (Ref. 9.10).

9.6.2.1 Traffic Modelling

The UK Design Manual for Roads and Bridges (DMRB) screening tool (Ref. 9.6) has been used to screen the impact of additional Project related road traffic movements on NO_2 and PM_{10} concentrations adjacent to affected routes, in the absence of local guidance on the assessment of road traffic emissions. Although the screening tool no longer contains the most recent version of the UK vehicle emissions factor database, it can be considered to be representative of emissions from older Euro I type vehicles, and as such, its use within this assessment can be considered to be robust. The screening tool was originally developed to indicate whether more complex and sophisticated modelling of air quality is required and a number of features of the DMRB procedures are designed to overestimate road traffic emissions. Therefore, it can be assumed with some confidence that any change in road traffic flows will not result in any air quality problems if none are predicted using the DMRB methodology.

9.6.2.2 Vessel Modelling

Vessels are not static sources which makes it difficult to model their impact on a particular terrestrial receptor. In order to consider the impact on annual mean pollutant concentrations at receptors, vessels were therefore modelled as line sources. The maximum impact on short-term concentrations, however, would be seen during times when vessels are at their closest point to shore, so the modelling of short-term concentrations has been undertaken by representing the vessel fleet as a series of point sources in this location, so that the impact on short-term concentrations throughout the full range of meteorological conditions can be evaluated. Full details on Vessels usage and the expected number of days of operation are outlined in **Chapter 5 Project Description.**

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[6] Short-term standards include the 10 minute, 20 minute (MPC), 1 hour, 8 hour and 24 hour averaging periods, which are used to assess short-term exposure. Long-term standards include the annual average and APCs.

In order to consider the impact on mean annual concentrations onshore, the vessels' emissions were modelled using a number of line sources to represent each section of water: a 470 m line source for nearshore vessels in depths of 23 to 30 m near to the micro tunnel entrance and 47 km for offshore vessels operating in depths of 30 to 600 m. The offshore vessels in depths over 600 m are more than 15 km from the shore and have not been modelled. Figure 9.6 illustrates the indicative locations of these line sources in the ADMS 5 model.

The line sources used in the assessment of the contribution to annual mean pollutant concentrations have been allocated a release height of 20 m and an emission temperature of 200°C, using emission rates presented in Table 9.20. The assessment of impacts on annual mean concentrations has taken into account the expected utilisation and time on task of the shipping types to be employed through the calculation of an emission rate factored over one calendar year, but the use of a complete year of meteorological data for a construction fleet moving at a speed of up to 3 km per day ensures a robust assessment of impacts.

The emission factors were derived using the known vessel types, Table 3-2 of the EMEP / EEA emission factors, Chapter 1.A.3.d of the 2009 EMEP / EEA Emission Factors, (Ref. 9.10), and the expected number of days of operation outlined in **Chapter 5 Project Description**. The output from the modelling of the shipping emission sources described in Table 9.20 has been combined with the annual mean output from the construction plant model described in Section 9.6.2.3, in order to enable an overall assessment of the impact of activities on long term pollutant concentrations to be made.

Table 9.20 Modelled Annual Mean Emission Rates for Construction Vessels (g/km/s)

Water Depth	NO_X	CO	NMVOC	SO_2*	PM
23-30 m	0.02	0.002	0.0004	0.0007	0.08
30-600 m	6.19×10^{-4}	5.84×10^{-5}	1.18×10^{-5}	2.21×10^{-5}	2.13×10^{-6}

* Calculated based on 1.5% sulphur content in the fuel which is typical for Marine Diesel Oil (MDO) purchased in Russia

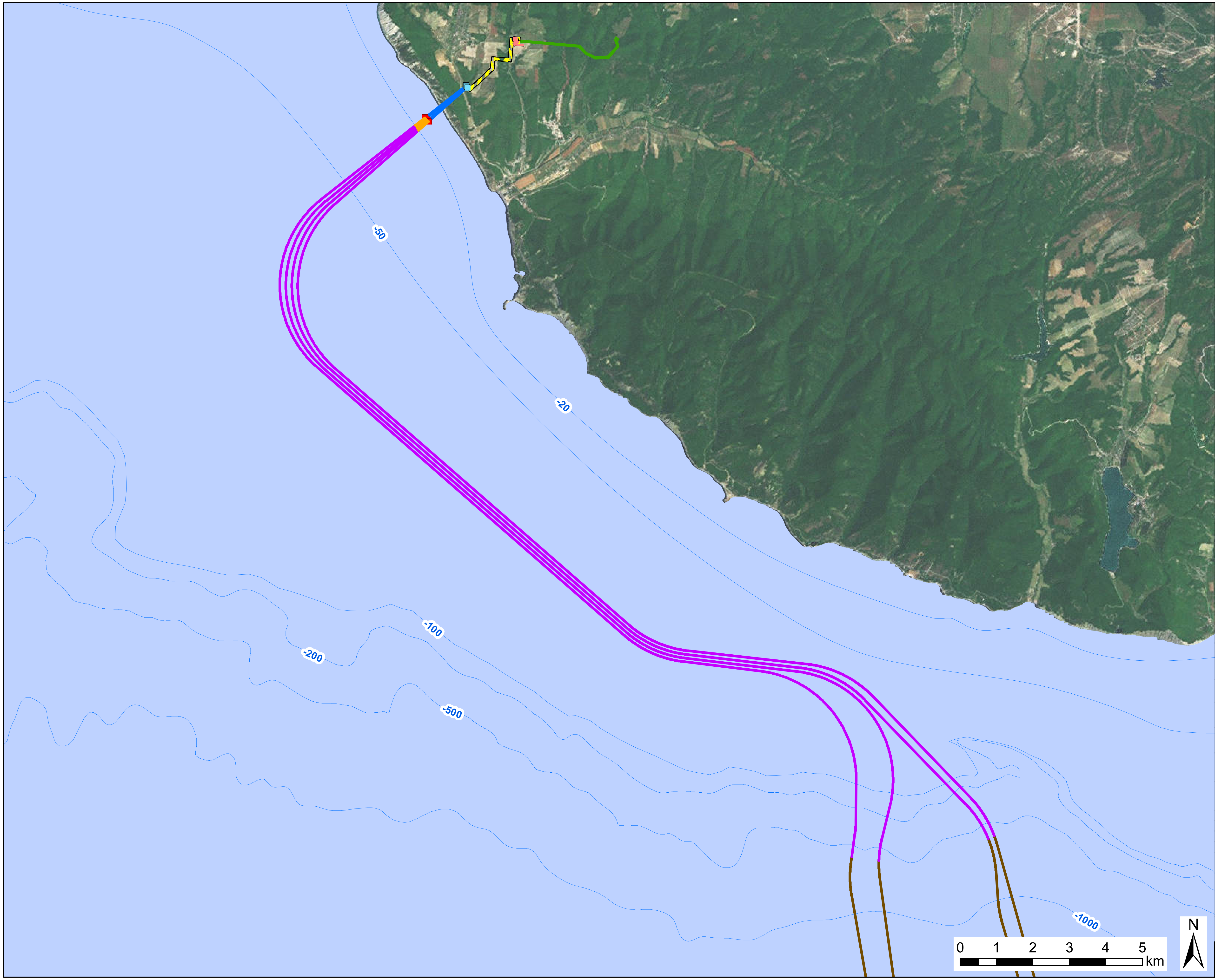
With respect to emissions from shipping which could cause short term impacts on sensitive receptors near to the shore line, it is considered that that the shallow water pipe lay operations to be undertaken in close proximity to the micro tunnel exits would have the greatest potential to affect local air quality. A scenario has been modelled which represents peak emissions during this part of the construction programme, consisting of a point source representing the pipe-laying vessel and the two anchor handling vessels at the microtunnel exit point, plus a further point source 300 m further from the shore representing a Multi Service Vessel (MSV).

The point source emissions used in the assessment of the contribution to short-term pollutant concentrations have been allocated a release height of 20 m and an emission temperature of 200°C, and have used the emission rates presented in Table 9.20. The assessment of impacts on short term concentrations has taken into account the expected utilisation as a percentage of engine load of the shipping types to be employed through the calculation of an emission rate factored over one hour, and the use of a complete year of meteorological data for a situation which is likely to exist for less than 7 days per pipeline ensures a robust assessment of impacts.

The shipping emission sources described in Table 9.21 have been incorporated into the construction plant model described in Section 9.6.2.3, in order to enable an overall assessment of the impact of activities on short term pollutant concentrations to be made.

Table 9.21 Modelled Short Term Emission Rates for Construction Vessels (grams per second (g/s))

Vessels	NO_X	CO	NMVOC	SO_2	PM
Pipe-laying vessel and Anchor Handling Vessels	94.7	8.9	3.4	36.2	1.8
MSV	22.4	2.1	0.8	8.6	0.4



LEGEND

ADMS Line Source

- 23-30 mbsl
- 30-600 mbsl
- >600 mbsl

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Landfall facilities
- Proposed microtunnels
- Proposed offshore pipelines
- Right-of-way
- Microtunnel entry shaft
- Microtunnel exit pit

United Gas Supply System

- United Gas Supply System pipelines
- Isobaths

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue

For Information

Client

South Offshore Pipeline — Stream ENERGISING EUROPE

Project Title

SOUTH STREAM OFFSHORE PIPELINE

Drawing Title

ADMS SOURCES

Drawn	Checked	Approved	Date
AH	NT	NT	04 Mar 2014

URS Internal Project No.	Scale @ A3
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Drawing Number: Figure 9.5

Rev

Plot Date: 04 Mar 2014
File Name: I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 9 Air Quality\Figure 9.5 ADMS Sources.mxd

9.6.2.3 Modelled Diesel (Construction) Plant

During the Construction Phase of the Project it was considered necessary to model the emissions from some of the diesel powered plant within the Study Area. A scenario was selected which represents a peak period where a number of construction activities are taking place simultaneously, and this was modelled in combination with the shipping emissions described in Section 9.6.2.2. This scenario included the plant associated with the Microtunnelling, Landfall Facilities, Trench Excavation and Pipeline Installation activities. The construction of the Varvarovka bypass road, site preparation and reinstatement phases are forecast to take place outside of this period of peak activity, and have not therefore been included within the modelling and the impacts on local air quality would be lower.

Table 9.22 presents the numbers of construction used in the modelling of the construction phase.

Table 9.22 Indicative Number of Plant /Equipment Expected for Peak Construction Phase

	Micro-tunnelling	Landfall facilities	Trench Excavation	Pipeline installation
Bulldozer	-	2	1	1
Grader	-	1	1	1
Excavator	4	2	4	4
Tipper	-	2	2	2
Shovel	-	1	2	2
Sideboom	-	-	-	6
Generator (250 kW)	2	4	2	4
Generator (904 kW)	2	-	-	-
Generator (648 kW)	2	-	-	-
Crane	3	2	-	-
Welders	-	-	-	10
Bending machine	-	-	-	1
Bore Pile Drilling Rig	1	-	-	-

As with vessels, mobile construction plant are not static sources which makes it difficult to model their impact on a particular receptors. In order to consider the impact on pollutant concentrations from diesel plant on a robust basis, each plant type has been modelled as a combined point source situated in a worst case location with regard to proximity to sensitive receptors. The emission source has been assumed to discharge at a fixed height of 3 m above ground level with a nominal discharge velocity of 5 m/s.

In addition to the mobile plant, the diesel generators have also been included as individual point sources within the ADMS 5 model. Each 250 kW generator (as listed in Table 9.19) was modelled with an individual stack with a; discharge height of 5 m, diameter of 0.2 m, volume flux of 1.22 cubic metres per second (m^3/s) and temperature of 350°C. The generators for the microtunnelling plant are larger and the volumetric flow rates for these items have been scaled pro-rata. The emissions associated with landfall and nearshore construction plant have been calculated based on Non Road Mobile Machinery Stage IIIA emission rates and assuming a sulphur content in the fuel of 0.002% (Ref. 9.8).

Table 9.23 to Table 9.27 inclusive present the emissions rates used to calculate long-term (abbreviated to 'LT' in the tables) and short-term ('ST') pollutant concentrations. Long-term (annual mean) emissions take into account the utilisation rate of the construction plant and assume a working period of 10 hours per day (with no night time use), with the exception of the microtunnelling which is a 24 hour operation. The assessment of short-term impacts assumes an emission rate based on 100% continuous running, which is a conservative approach.

Table 9.23 Modelled Emission Rates for Microtunnelling Construction Plant Exhaust Emissions

Emission Rate (g/s)	NO_X*	CO	PM	NMVOC	SO_2
LT Per Generator	3.62	0.75	0.28	0.33	$8.4x10^{-4}$
LT Per Redundant Generator	0.259	0.05	0.02	0.02	$6.0x10^{-5}$
LT Per Peripheral Generator	0.19	0.19	0.11	0.28	$1.9x10^{-4}$
LT Microtunnelling Cranes	0.29	0.29	0.02	0.04	$2.8x10^{-4}$
LT Excavators	0.20	0.28	0.02	0.03	$1.9x10^{-4}$
LT Bore Pile Drilling Rig	0.23	0.23	0.01	0.03	$2.2x10^{-4}$
ST Per Generator	3.62	0.75	0.28	0.33	$8.4x10^{-4}$
ST Per Redundant Generator	2.59	0.54	0.20	0.23	$6.0x10^{-4}$
ST Per Peripheral Generator	0.19	0.19	0.11	0.28	$1.9x10^{-4}$

Continued...

Emission Rate (g/s)	NO_X*	CO	PM	NMVOC	SO_2
ST Microtunnelling Cranes	0.73	0.73	0.04	0.01	$7.0x10^{-4}$
ST Excavators	0.40	0.57	0.03	0.06	$3.8x10^{-4}$
ST Bore Pile Drilling Rig	0.47	0.47	0.03	0.07	$4.5x10^{-4}$

* NOx mass (expressed as NO2)

Complete.

Table 9.24 Modelled Emission Rates for Landfall Facilities Construction Plant Exhaust Emissions

Emission Rate (g/s)	NO_X*	CO	PM	NMVOC	SO_2
LT Per Generator	0.06	0.06	0.003	0.007	$4.8x10^{-5}$
LT Bulldozers	0.15	0.22	0.01	0.02	$1.5x10^{-4}$
LT Grader	0.02	0.03	0.02	0.003	$1.8x10^{-5}$
LT Excavators	0.06	0.06	0.003	0.009	$5.8x10^{-5}$
LT Tippers	0.04	0.04	0.003	0.006	$2.9x10^{-5}$
LT Shovel	0.23	0.23	0.01	0.03	$2.2x10^{-4}$
LT Crane	3.62	0.75	0.28	0.33	$8.4x10^{-4}$
ST Per Generator	0.24	0.24	0.01	0.03	$2.3x10^{-4}$
ST Bulldozers	0.49	0.69	0.04	0.07	$4.6x10^{-4}$
ST Grader	0.09	0.13	0.01	0.01	$8.4x10^{-5}$
ST Excavators	0.19	0.19	0.01	0.03	$1.8x10^{-4}$
ST Tippers	0.17	0.21	0.02	0.03	$1.4x10^{-4}$
ST Shovel	0.08	0.10	0.01	0.01	$7.0x10^{-5}$
ST Crane	0.49	0.49	0.03	0.07	$4.7x10^{-4}$

* NOx mass (expressed as NO_2)

Table 9.25 Modelled Emission Rates for Trench Excavation Construction Plant

Emission Rate (g/s)	NO_X*	CO	PM	NMVOC	SO_2
LT Per Generator	0.001	0.001	$5.6x10^{-4}$	0.001	$9.4x10^{-6}$
LT Bulldozers	0.15	0.22	0.01	0.02	$1.4x10^{-5}$
LT Grader	0.004	0.005	0.001	0.001	$3.4x10^{-6}$
LT Excavators	0.02	0.02	0.001	0.003	$2.3x10^{-5}$
LT Tippers	0.007	0.008	0.003	0.006	$5.7x10^{-6}$
LT Shovel	0.01	0.01	0.001	0.002	$8.4x10^{-6}$
ST Per Generator	0.24	0.24	0.01	0.03	$2.3x10^{-4}$
ST Bulldozers	0.24	0.35	0.02	0.03	$2.3x10^{-4}$
ST Grader	0.09	0.13	0.01	0.01	$8.4x10^{-5}$
ST Excavators	0.39	0.39	0.002	0.006	$3.7x10^{-4}$
ST Tippers	0.17	0.21	0.02	0.03	$1.4x10^{-4}$
ST Shovel	0.17	0.21	0.02	0.03	$1.4x10^{-4}$

* NOx mass (expressed as NO_2)

Table 9.26 Modelled Emission Rates for Pipe Installation Construction Plant

Emission Rate (g/s)	NO_X*	CO	PM	NMVOC	SO_2
LT Per Generator	0.015	0.015	$8.5x10^{-4}$	$2.1x10^{-4}$	$1.4x10^{-5}$
LT Bulldozer	0.02	0.03	0.002	0.003	$2.1x10^{-5}$
LT Grader	0.008	0.01	0.001	0.001	$7.6x10^{-6}$
LT Excavators	0.02	0.02	0.001	0.003	$1.7x10^{-5}$
LT Tippers	0.005	0.006	0.001	0.001	$4.2x10^{-6}$
LT Shovel	0.005	0.006	0.001	0.001	$4.2x10^{-6}$
LT Sidebooms	0.08	0.08	0.005	0.01	$7.7x10^{-5}$

Continued...

Emission Rate (g/s)	NO_X*	CO	PM	NMVOC	SO_2
LT Welders	0.02	0.02	0.002	0.004	$1.1x10^{-5}$
LT Bending Machine	0.008	0.008	0.001	0.001	$5.6x10^{-5}$
ST Per Generator	0.24	0.24	0.01	0.03	$2.3x10^{-4}$
ST Bulldozers	0.24	0.35	0.02	0.03	$2.3x10^{-4}$
ST Grader	0.09	0.13	0.01	0.01	$8.4x10^{-5}$
ST Excavators	0.19	0.19	0.01	0.03	$1.8x10^{-4}$
ST Tippers	0.08	0.1	0.01	0.01	$7.0x10^{-5}$
ST Shovel	0.08	0.1	0.01	0.01	$7.0x10^{-5}$
ST Sidebooms	1.34	1.34	0.08	0.19	0.001
ST Welders	0.36	0.31	0.03	0.06	$1.9x10^{-4}$
ST Bending Machine	0.13	0.13	0.01	0.02	$1.2x10^{-4}$

* NOx mass (expressed as NO_2)

Complete.

The diesel compressors used during the Pre-Commissioning Phase for cleaning, gauging and drying of each pipeline will be placed between the temporary PIG launcher / receiver located at a temporary construction area to the south of the landfall facilities. The compressor spread will require 80, 440 kW, combined compressor and booster units which will operate for up to 24 days per pipeline. Over this period, the compressors would operate 24 hours per day. The layout was modelled as four rows of 20 units, with a spacing of 5 m between each unit in the row and 10 m between each line of units. Emissions from multiple flues within a small area will in effect act as a single plume, and some recognition has been made of this within the model by combining the 80 individual stacks into 14 point sources. The ADMS software has evaluated the characteristics of the individual point sources and the spacing between them in order to determine the combined source parameters within the model.

Each 440 kW generator was modelled with a stack with a discharge height of 3 m, diameter of 0.25 m, volume flux of 2.14 m^3/s and temperature of 400°C. The emissions rates used to calculate long-and short-term pollutant concentrations are presented in Table 9.27 (Ref 9.12).

Table 9.27 Modelled Emission Rates for Pre Commissioning Compressor Booster Units

Emission Rate (g/s)	NO_X*	CO	PM	NMVOC	SO_2
Per Unit	0.49	0.43	0.03	0.16	4.1×10^{-4}

* NOx mass (expressed as NO_2)

9.6.2.4 Other Emission Sources

The assessment methodology used to assess other emission sources associated with other activities and phases of the Project, such as road traffic, rail, dust generation and fugitive venting, is sufficiently similar to the above or have been screened out of the assessment. Where necessary, this is detailed within the impacts section.

9.6.3 Assessment of Potential Impacts: Construction and Pre-Commissioning

9.6.3.1 Introduction

The Construction and Pre-Commissioning Phase has the largest potential to impact on the sensitive receptors identified in Section 9.6.1.3. This is mainly due to the increase in vessel movements, plant and traffic emissions.

This section identifies and evaluates the significance of the various predicted impacts that are likely to arise in association with the Construction and Pre-Commissioning Phase of the Project.

Industry-standard mitigation measures are assumed to be incorporated in the pre-mitigation assessment (such as incorporating a small stack on the diesel generators for example, which are mentioned previously).

9.6.3.2 Assessment of Potential Impacts (pre-mitigation)

This section identifies and evaluates the magnitude of the various predicted pre mitigation impacts that are likely to arise in association with the Construction and Pre-Commissioning Phase. Industry-standard mitigation measures are assumed to be incorporated in the pre-mitigation assessment. Additional mitigation measures required to minimise potential impacts are discussed in later sections.

Construction Plant and Vessel Impacts Diesel Exhaust Emissions

Impacts associated with the Construction Phase emissions from diesel plant and vessels have been combined into a single modelling scenario including modelled sources from:

- Construction plant and diesel generators in the landfall facilities;
- Construction plant and diesel generators used during the nearshore area (micro tunnelling); and

- Vessels related to nearshore activity.

Table 9.28 presents the results of the modelled Construction worst case scenario at the overall worst affected human health receptors, which are Receptor 2, located approximately 2.5 km east of the microtunnel exit points and Receptor 5, located approximately 500 m northwest of the microtunnel entry points and 1.5 km southwest of the landfall facilities at the southern boundary of a proposed residential development currently under construction. Receptor 5 is also situated on the boundary of the SPZ. The highest results predicted for these two receptors are presented in the Table 9.26. The predicted impacts are also the highest obtained from the modelling of five one year hourly sequential datasets, and as such likely to represent the highest impacts that could be experienced within the range of meteorological conditions at the Project Area.

The contour plots, or isopleths, showing the predicted impact on short-term and annual average pollutant concentrations are presented in Appendix 9.3: Contour Plots. Tables presenting the modelled impacts at all the selected discrete receptor locations are included in Appendix 9.4.

Table 9.28 Modelled Impacts associated with the Construction Diesel Plant and Vessels

Pollutant	Averaging period	Predicted impact on pollutant concentrations at worst affected sensitive receptor			Total predicted concentration, incl. baseline		
		$\mu g/m^3$	% of national limit	% of PS*	$\mu g/m^3$	% of national limit	% of PS*
NO_2	1 hour Maximum	99	n/a	50%	108	n/a	54%
	MPC	149	75%	75%	158	79%	79%
	APC	6.7	17%	17%	15.7	39%	39%
CO	MPC	223	4%	4%	2023	40%	40%
	APC	3	0.1%	0.1%	1803	60%	0.1%
SO_2	Maximum 10 minute	195	n/a	39%	205	n/a	41%
	Maximum 24 hour	16.4	n/a	13%	26.4	n/a	21%
	MPC	162	32%	32%	172	21%	21%
	APC	0.2	0.3%	0.3%	10.2	20%	20%

Continued...

Pollutant	Averaging period	Predicted impact on pollutant concentrations at worst affected sensitive receptor			Total predicted concentration, incl. baseline		
		µg/m³	% of national limit	% of PS*	µg/m³	% of national limit	% of PS*
Total PM	MPC	27.4	5%	5%	177	35%	35%
	APC	0.5	1%	1%	141	94%	94%
PM_{10} (assuming all PM is PM_{10})	Maximum 24 hour	6.5	n/a	13%	147	n/a	294%
	Annual average	0.5	n/a	1%	141	n/a	352%
$PM_{2.5}$ (assuming all PM is $PM_{2.5}$)	Maximum 24 hour	6.5	n/a	13%	147	n/a	294%
	Annual average	0.5	n/a	2%	141	n/a	564%
Benzene (assuming all VOCs are benzene)	MPC	38.4	13%	13%	38.9	13%	13%
	APC	0.7	14%	14%	1.2	24%	24%

* PS = Project Standard

Complete.

For CO, the predicted magnitude is less 5% of the project standard for both the short term and long term averaging periods, which is categorised as a negligible magnitude of change. According to the criteria presented in Table 9.13, such impacts can be regarded as **Not Significant**.

The maximum predicted impact on annual mean NO_2 concentrations is less than 25% of the Russian national standard and would not result in an exceedence of the APC limit. An impact of this magnitude in combination with a receptor of negligible sensitivity can be regarded to have a **Not Significant** impact. The predicted change in maximum 1 hour (IFC guideline) and 20 minute (Russian MPC) concentrations is more than 50% of the short term standard of 200 µg/m³ and as such is categorised as a high magnitude impact. As this impact would occur in an area containing receptors of negligible sensitivity (residential properties outside of urban centres) (Table 9.16), it can be regarded as of **Low** significance. Notably, the predicted maximum 20 minute concentration is just within 80% of the MPC, which should be achieved at locations with relevant exposure within the SPZ. Furthermore, the modelled impact is primarily due to a modelled scenario whereby worst case shipping emissions lasting no more than 6 days at the closest point to shore, have been combined with the most adverse 1 hour period of meteorological conditions over 5 complete years. As such, the impact reported is highly unlikely to occur in practice.

The predicted impacts on annual mean SO_2 concentrations amount to less than 10% of the applicable limits (where the total predicted concentration complies with the limit value) and is therefore of negligible magnitude, which when combined with the low sensitivity of the receptor, is **Not Significant**. The predicted change in maximum 20 minute (Russian MPC), 10 minute and 24 hour (IFC guideline) SO_2 concentrations is of a low magnitude, being between 10% and 25% of the criteria where the total predicted concentration complies with the limit value. For receptors of low sensitivity (Table 9.16), impacts of this magnitude result in an impact significance of **Low**.

The predicted change in annual mean and maximum 20 minute concentrations of total particulate matter are less than 10% of the Russian Federation limit values, and no exceedence of the criteria would occur. This would be a negligible magnitude impact, which results in a **Not Significant impact**.

The predicted change in annual mean concentrations of PM_{10} and $PM_{2.5}$, even when conservatively assuming that the entire particulate emission would be PM_{10} and $PM_{2.5}$ is of a negligible magnitude. Based on the assumption that PM_{10} and $PM_{2.5}$ concentrations exceed the national limits currently, this change can be regarded as **Not Significant**.

The predicted change in 24-hour PM_{10} and $PM_{2.5}$ concentrations is 13% of the IFC guideline, which is within the low magnitude of change category when the highly conservative assumption that baseline concentrations are in excess of the guideline across the Study Area is made. A low magnitude change at locations that are of high sensitivity due to baseline concentrations in excess of the project standard would give an impact of **Moderate** significance. However, for the reasons given in the baseline section, the assumptions made about existing PM_{10} and $PM_{2.5}$ concentrations are very likely to have considerably overestimated concentrations of these pollutants in a rural location such as the Study Area. In reality the baseline concentrations are highly likely to be well within the project standards, thereby giving a receptor of negligible or low sensitivity, which would result in a **Not Significant** or **Low** impact. Further monitoring will be undertaken in order to confirm that PM_{10} and $PM_{2.5}$ concentrations are well within the project standards as expected.

In terms of the EU limits for protecting vegetation and ecosystems, the highest modelled mean annual NO_X and SO_2 concentrations at the boundary of the Utrish nature reserve are 0.38 $\mu g/m^3$ in respect of NO_X and 0.07 $\mu g/m^3$ in respect of SO_2. This would be a negligible magnitude impact which results in a **Not Significant impact**.

Emissions from Vessel Incineration Plant

Some of the vessels to be employed in the Pipeline construction and pre-commissioning activities would use on-board incinerators to dispose wastes generated on board. The types and composition of the wastes are discussed in detail in **Chapter 18 Waste Management**, and would comprise:

- General Garbage (International Convention for the Prevention of Pollution from Ships (MARPOL) Annex V);

- Food (MARPOL Annex V); and
- Sludge/slops (MARPOL Annex I).

The total volumes of wastes to be burned are small. For nearshore vessels, the quantity of Annex I wastes that would be incinerated would be less than 75 kg per vessel per day. The quantity of Annex V materials would range from 22 kg per day (suction dredgers) to 210 kg per day (shallow water pipe-lay vessel). The average incinerator operating time would be from 0.5 hours per day (dredgers) to around 2 hours per day (shallow water pipe-lay vessel). The larger intermediate depth and deep water pipe-lay vessels would incinerate slightly higher quantities of Annex V general wastes (up to 600 kg per vessel per day), and the incinerators would operate for longer periods (up to around 7 hours per day).

The incineration plant to be used will be the International Maritime Organisation (IMO) and MARPOL compliant units provided as standard on Project vessels. The IMO specification (Ref. 9.11) for shipboard incineration plant sets out the operational controls, emissions standards, testing and certification requirements to be employed in the operation of such units.

Given the low volumes of wastes to be incinerated within IMO approved incineration plant on nearshore vessels, and the relative distance between offshore vessels and human sensitive receptors, it has therefore not been deemed necessary to model incinerator emissions, and the magnitude of impact is considered to be negligible.

Based on the predicted negligible magnitude the worst level of impact significance that would be expected is **Low**.

Construction Landfall Dust Generation Impacts

The movement of soils and rubble and vehicle traffic on unsealed roads during construction activities is anticipated to lead to the generation of fugitive airborne dusts. The occurrence and significance of dust generated by earth moving operations is difficult to estimate, and depends upon meteorological and ground conditions at the time and location of earth working, plus the nature of the operations being undertaken.

Any such dust generation also has the potential to lead to environmental and socio-economic impacts, if not properly mitigated. The potential impacts to humans of construction dust are two-fold: as a potential impact on amenity, and as having the potential to cause human health effects. Typically, a large majority of complaints against construction works are associated with the former, relating to deposition of dust on crops, windows, cars, and the outside of buildings. In terms of health, the smaller the dust particles, the more likely they are to be inhaled, leading to respiratory problems. Airborne particulate matter with a diameter of less than 10 µm represents the particle size fraction of greatest concern to human health.

Large dust particles (greater than 30 microns in diameter), which make up the greatest proportion of dust emitted from construction works, will largely deposit within 200 m of the working area. Intermediate-sized particles (10–30 microns) are likely to travel up to 200–500 m, although at large minerals working sites, for example, they have been recorded at distances of up to 1 km (Ref. 9.12). Particle deposition rates decrease rapidly on moving away from the construction source, due to gravitational settlement.

Similarly, airborne particulate concentrations also decrease on moving away from construction sources, due to dispersion and deposition. It is unlikely that PM_{10} would travel more than 1 km from any construction works (Ref. 9.13) providing they are properly managed. Table 9.15 shows that there are only two residential receptors within 1 km of the construction spread: Receptor 5, a proposed residential development currently under construction, approximately 500 m northwest of the microtunnel entry points and 1.5 km south-west of the landfall facilities; and Receptor 1, a group of residential dwellings situated in the southern extremity of the nearby town Varvarovka, approximately 800 m north of the microtunnel entry points.

During the construction of the Varvarovka bypass access road, construction will take place close to receptors on the eastern edge of Varvarovka. Such operations would be relatively short term in nature as the construction plant would advance along the route of the road as construction progresses. Whilst there are sensitive receptors within 50 m of the road construction site, the implementation of good site practice and the stringent use of dust mitigation measures throughout all elements of the works would be capable of controlling emissions, to the extent that the effect of any impact will not be significant. In use, the access road would be sealed, meaning that significant dust arisings from passing traffic would be unlikely, provided the road surface is kept clean.

Further to the main construction area, a spoil transfer area may be created and used to the east of the Varvarovka bypass access road. The minimum distance between the transfer area and residential properties is around 250 m, meaning that deposition of larger size fractions of dust are unlikely to be significant at these locations provided that standard measures to control dust arisings are maintained. PM_{10} can travel this distance; but given the mainly coarse and damp nature of the spoil material to be handled, it is not expected that a significant increase in PM_{10} concentrations would occur, provided that measures to control the resuspension of road dusts are maintained within the spoil area and along the unsealed access road during operations in dry or windy conditions.

The Gazprom access road from the south would pass within 50 m of receptors on the southern edge of Varvarovka; however, traffic on this route is expected to be low (less than 50 vehicles per day of which more than half would be cars and light vehicles). Standard dust control measures for haul roads would need to be implemented on this route, but if they are correctly applied it is unlikely that a significant impact on baseline dust deposition rates or PM_{10} concentrations would occur from this source.

In addition to distance between the source and receptor, wind speed and direction is another important factor in determining the significance of dust effects. Figure 9.4 reveals that the predominant wind direction is expected to be from the northeast to the southwest. More detailed analysis shows that the wind would blow from the microtunnel entry points towards Receptor 1 for approximately 21% of the time, and only 5% of the time towards Receptor 5 (which is the closer of the two receptors).

Overall, given the distances between the working areas and the nearest receptors, and the relatively low amount of time that the dust would be blown directly towards these locations, it is not expected that a significant impact on local PM_{10} concentrations or dust deposition rates would occur, provided that good working practices are utilised to minimise dust generation at the construction sites, including where appropriate, dust suppression, covering of long-term stockpiles where practicable and not undertaking exposed tipping activities during periods of high wind speeds blowing in the direction of the receptors. A negligible magnitude of change is expected to existing dust and PM_{10} concentrations at these locations.

Taking into account the high sensitivity of human receptors to dust and particulate matter, the overall significance is considered **Not Significant**.

The vegetation in the immediate vicinity of the Project Area is not known to be sensitive to dust deposition. Juniper is slow growing with low levels of photosynthesis, and significant quantities of dust would not accumulate on the fine leaves. Vulnerable herbaceous species within woodland would also not be affected as the surrounding trees would rapidly attenuate any incoming dust emissions. Any material that is deposited would be washed off during periods of precipitation. Therefore, it is anticipated that flora close to the construction site would be subject to an impact that is **Not Significant**.

Road Traffic Impacts

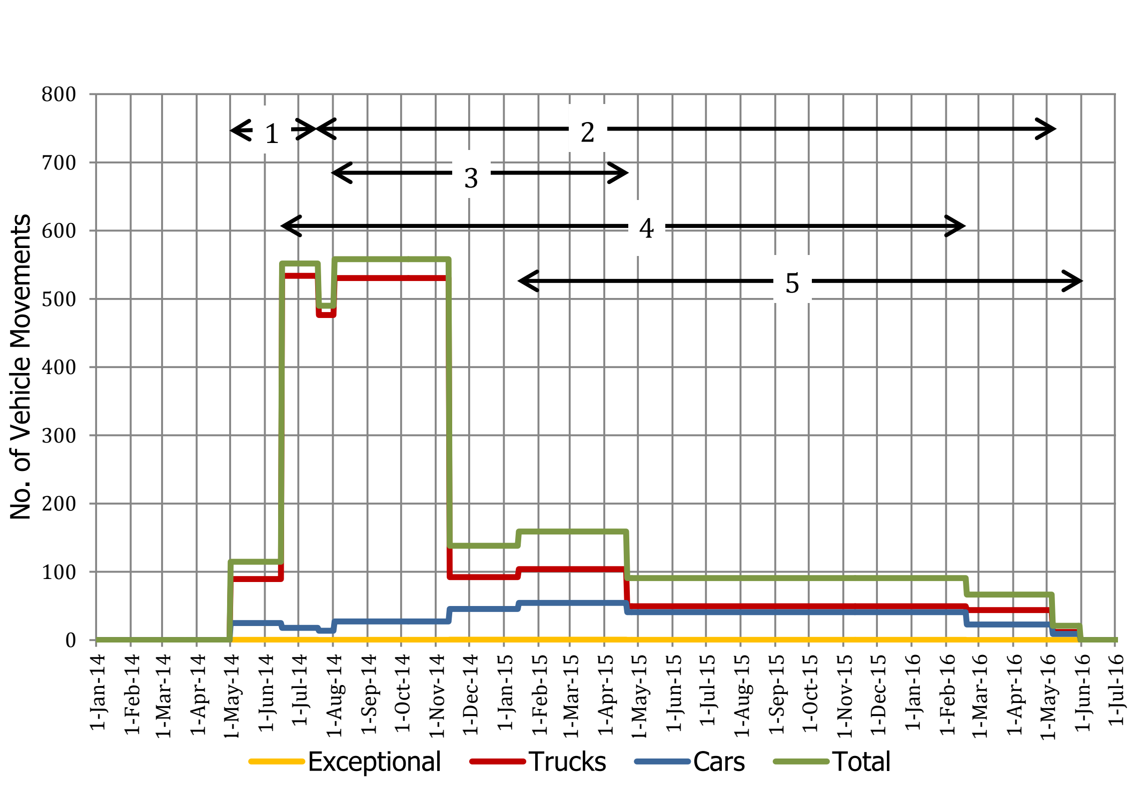
There will be a number of additional road movements in the vicinity of the construction site to deliver workers and materials, which is outlined in further detail in this subsection.

It is proposed that all traffic will come from the main highway M25 about 10 km north of the landfall location and will be diverted around Gai Kodzor to the east and south of the town using the bypass constructed by Gazprom. To the east of Varvarovka traffic will then turn onto the site access road, which is around 35 m from the closest residential properties.

On the access route from the M25, the baseline annual average daily traffic (AADT) vehicle flow is around 5,100 vehicles through Rassvet, falling to around 3,800 vehicles to the north of Gai Kodzor. Around 15% of this traffic is heavy vehicles of greater than 3 tonnes gross vehicle weight (GVW). To the east of Varvarovka close to the turn off onto the site access road, around 4,200 vehicles currently use the western Varvarovka road per day. An estimated 10% of this constitutes trucks, with the remainder being cars and light vehicles. Based on the assumption that each pipeline is built in turn over a single continuous period, the peak construction traffic is expected to occur during Pipeline construction, between an estimated August 2014 and December 2014, lasting approximately five months. During peak construction approximately 260 vehicles would use the access route to the site from the M25 each day, leading to around 520 additional movements. At any times during the construction programme, less than 30 Project vehicles per day would use the main road through Gai Kodzor, none of which would be trucks or other heavy vehicles as these would use the bypass. From the south of Varvarovka, the impact on existing traffic movements would be small, less than 25 vehicles in total, most of which would be trucks.

Figure 9.6 displays the estimated profile for the following five phases of development: (1) Site preparation, (2) Microtunnelling, (3) Pipeline construction, (4) Landfall facilities, and (5) Reinstatement of the Pipeline route.

Figure 9.6 Average Daily Vehicle Movements associated with the Construction Phase



The trip generation associated with the Project will therefore lead to a noticeable increase in traffic along the designated site access route. Despite this, it is not anticipated to lead to a significant air quality impact, as discussed below.

The estimated emissions associated with these vehicle movements are presented in Table 9.29. This is based on the assumption that each road vehicle would make a 100 km round trip from Novorossiysk to the Landfall Facilities construction site, where it is assumed many of the road trips would originate. In reality, this is a worst case assumption as a large number of truck movements would actually originate at locations closer to the construction site.

Russia has implemented European standards for new diesel engine vehicles. The current standards for existing models are based on Euro III standards and apply to both manufactured and imported heavy-duty vehicles (the implementation date of Euro IV for all new vehicles was delayed until 2013). For the purpose of this assessment, it has been assumed the average vehicle would have emissions equivalent to units built between 2000 and 2006, which corresponds with Euro I emission legislation.

Table 9.29 Atmospheric Emissions from Road Trips (tonnes / year)

Activity	NO_X	CO	PM	SO_2	NMVOC	CO_2	CH_4
Road Transport	7.01	25.5	0.14	0.01	3.2	1,342	0.55

The impact of additional road traffic on local air quality in the vicinity of the access route has been screened using the UK DMRB screening tool (Ref. 9.6) to check the effect of this increase in emissions. Although this screening tool is based on a current UK fleet, it has been adjusted to 2000 conditions to best represent Euro I emission factors[7], and using a conservative assumption that the peak trip generation would be sustained for an entire calendar year. The locations that have been assessed are:

- Rassvet, at the junction with the M25;
- South of Rassvet, at residential properties close to the access route;
- East of Varvarovka, in the vicinity of the closest residential properties to the northern construction site access road;
- In the vicinity of the closest residential properties to the Varvarovka bypass access road, SW of the main road;
- Within central Varvarovka; and
- To the south of Varvarovka, at residential properties near to the Gazprom access road turning.

Table 9.30 presents the estimated contribution of road traffic (at residential properties) to local pollutant concentrations for the two key pollutants of concern, NO_2 and PM_{10}. The results show that the change in road traffic flows associated with the Project would be **Not Significant** on local air quality, depending on whether the baseline concentrations currently exceed the air quality limits.

Table 9.30 Estimated Contribution of Road Traffic to Local Pollutant Concentration ($\mu g/m^3$)

Road link	Scenario	Contribution of Road Traffic to Mean Annual NO_2 Concentrations ($\mu g/m^3$)	Contribution of Road Traffic to Mean Annual PM concentrations ($\mu g/m^3$)
Rassvet / M25 junction	Current Baseline	12.3	5.0
	Future Year with the Project	15.4	6.8
	Change	+3.1	+1.8

Continued…

[7] Running the screening tool for 2000 is likely to best represent Euro I emission factors, which came into effect in 1992 in the UK. This fits with the conservative assumption that the Project related traffic is adhering to Euro I legislation.

Road link	Scenario	Contribution of Road Traffic to Mean Annual NO_2 Concentrations ($\mu g/m^3$)	Contribution of Road Traffic to Mean Annual PM concentrations ($\mu g/m^3$)
South of Rassvet	Present-day (2012)	7.1	2.5
	Future Year with the Project	9.8	3.7
	Change	+2.7	+1.2
East of Varvarovka, close to site access turning	Current Baseline	1.9	0.5
	Future Year with the Project	3.5	1.0
	Change	+1.6	+0.5
Varvarovka bypass access road, closest properties to access route	Current Baseline	-	-
	Future Year with the Project	2.2	0.6
	Change	+2.2	+0.6
Central Varvarovka	Current Baseline	8.1	3.0
	Future Year with the Project	8.1	3.0
	Change	+<0.1	+<0.1
South of Varvarovka, close to Gazprom road turning	Current Baseline	8.1	3.0
	Future Year with the Project	8.1	3.0
	Change	+<0.1	+<0.1

Complete.

The largest predicted changes in annual mean pollutant concentrations are predicted to occur in the area around Rassvet and the M25 junction, at residential properties close to the affected route. A change in NO_2 concentrations of around 3 µg/m^3 and a change in PM_{10} of up to 2 µg/m^3 would take place. At the closest properties to the Varvarovka bypass access road, the change in annual mean NO_2 concentrations would be up to 2.2 µg/m^3. Monitoring of NO_2 in Gai Kodzor (Tube 3, Table 9.7) and Eastern Varvarovka (Tube 4, Table 9.7) suggests that baseline concentrations of pollutants are well below the annual mean Project standards (NO_2 40ug/m^3) at locations outside of urban centres. The predicted change is less than 10% of the relevant annual mean air quality standards and is considered to be a negligible magnitude of change which is unlikely to lead to an exceedence of the criteria.

Within central Varvarovka, the change in roadside contribution to NO_2 and PM_{10} concentrations is well below 1% of the annual mean criteria for NO_2 and particulate matter. This is considered a negligible magnitude of change (i.e. less than a 5% change in baseline concentrations).

In other areas, including in close proximity to the northern and southern site access roads, there would be a very small change in pollutant concentrations at sensitive receptors and hence would be **Not Significant**.

Taking into account the sensitivity of the receptors, which is high in urban areas, the overall significance of the impact is predicted to be **Not Significant.**

Use of Port Facilities

Existing port facilities at Novorossiysk are likely to be used for the operation of supply and refuelling vessels, temporary storage of construction materials, plant and a limited quantity of pipe sections. The port would also receive vessels wastes. The Port of Novorossiysk is in an existing industrial use area. There are residential areas within approximately 300 m of the port.

As such operations would take place as part of the normal on-going business of the port, any additional emissions which do occur would be considered negligible in comparison to the surrounding existing industrial uses. It has therefore not been deemed necessary to undertake any further assessment of the use of the port facilities, and the magnitude of impact is considered to be negligible.

Pre-Commissioning Compressor Generator Impacts

The assessment of impacts associated with the Pre-Commissioning Phase emissions have focussed on impacts due to emissions from the 80 compressor / booster units to be located to the south of the landfall facilities construction site. The level of activity associated with the operation of diesel construction plant and vessel movements would be well below that assessed in the main onshore Construction Phase, and as such these sources have not been included within the pre- commissioning model.

Table 9.31 presents the results of the modelled pre commissioning scenario at the most affected human health receptor. The predicted impacts are the highest obtained from the modelling of five one year hourly sequential datasets, and as such likely to represent the highest impacts that could be experienced within the range of meteorological conditions at the Project Area.

The compressor / booster units are expected to operate for 24 days per pipeline, and the annual mean results presented below have been factored on the assumption that there would be a maximum of 48 days operation (2 pipeline pre commissioning periods) in any one calendar year.

A contour plot, or isopleth, showing the contribution of the operation of the compressor / booster units to short-term NO_2 is presented in Appendix 9.3.

Table 9.31 Modelled Impacts Associated with Compressor / Booster Unit Operation in the Pre Commissioning Phase

Pollutant	Averaging period	Predicted impact at worst affected sensitive receptor			Total predicted concentration, incl. baseline		
		µg/m³	% of national limit	% of PS*	µg/m³	% of national limit	% of PS*
NO_2	1 hour Maximum	58	n/a	29%	67	n/a	34%
	MPC	91	45%	45%	100	50%	50%
	APC	0.6	2%	2%	9.6	24%	24%
CO	MPC	227	5%	5%	2,027	41%	41%
	APC	0.6	<1%	n/a	1801	60%	n/a
SO_2	Maximum 10 minute	0.3	n/a	<1%	10.3	n/a	<1%
	Maximum 24 hour	<0.1	n/a	<1%	10.1	n/a	51%
	MPC	0.22	<1%	<1%	10.2	<1%	<1%
	APC	<0.1	<1%	<1%	10.0	20%	<1%
Total PM	MPC	13.0	3%	3%	153	31%	31%
	APC	<0.1	<1%	<1%	140	93%	93%
PM_{10} (assuming all PM is PM_{10})	Maximum 24 hour	2.0	n/a	4%	142	n/a	284%
	Annual average	<0.1	n/a	<1%	140	n/a	280%
$PM_{2.5}$ (assuming	Maximum 24 hour	2.0	n/a	4%	142	n/a	284%

Pollutant	Averaging period	Predicted impact at worst affected sensitive receptor			Total predicted concentration, incl. baseline		
		µg/m^3	% of national limit	% of PS*	µg/m^3	% of national limit	% of PS*
all PM is $PM_{2.5}$)	Annual average	<0.1	n/a	<1%	140	n/a	560%

Continued…

Benzene (assuming all VOCs are benzene)	MPC	85	28%	28%	85.5	29%	29%
	APC	0.2	<1%	4%	0.7	1%	14%

* PS = Project Standard

Complete.

For SO_2, CO and particulate matter (including PM_{10} and $PM_{2.5}$), the predicted impact on short term and long term concentrations is less than 5% of the selected criteria for both the short term and long term averaging periods, which is categorised as a negligible magnitude change. According to the criteria presented in Table 9.13, such impacts can be regarded as **Not Significant**.

The predicted impact on benzene concentrations is 4% of the long term standard and 28% of the short term standard, which are categorised as negligible and moderate magnitude changes respectively. According to the criteria presented in Table 9.13, such impacts can be regarded as **Not Significant**.

The maximum predicted impact on annual mean NO_2 concentrations is 5% of the Russian national standard and would not result in an exceedence of the APC limit. An impact of this magnitude can be regarded as **Not Significant**.

The predicted change in maximum 1 hour (IFC guideline) and 20 minute (Russian MPC) NO_2 concentrations is between 25% and 50% of the short term standard of 200 µg/m^3 and as such is categorised as a moderate magnitude impact. As this impact would occur in an area outside of urban centres containing receptors of negligible sensitivity (Table 9.18), it can be regarded as **Not Significant**. The predicted maximum 20 minute concentration is within 80% of the MPC, which should be achieved at locations with relevant exposure within the SPZ.

9.6.3.3 Mitigation and Monitoring

Construction Phase Emissions

Fugitive dust is expected to only represent a potential short-term nuisance to exposed human receptors in immediate proximity to the construction site and will be controlled through the application of a series of good practice measures including, but not necessarily limited to:

Controlling fugitive dust emissions through:

- Personnel will be provided with awareness training in understanding the need to minimise dust and gaseous emissions from construction activities and practical ways to achieve this;
- A trained and responsible environment manager will be located on site during working times to maintain a logbook of instances such as visible dust plumes and detectable odour at the working site boundary, and carry out site inspections, particularly at the start of each new phase of works;
- Use of water as a dust suppressant where appropriate during dry weather and windy conditions;
- Implementation of an appropriate speed limit within the construction corridor;
- Vehicles will be cleaned regularly, including wheel washing before leaving site, in wet conditions;
- All loose material loads entering and leaving site will be covered where practicable;
- No bonfires will be lit onsite and no waste will be burned onsite;
- If soil is to be stockpiled long term then it will be covered where practicable or seeded and vegetated as appropriate; and
- RoW vegetation to be reinstated in line with the contractor restoration and reinstatement plan following installation of the pipelines.

Controlling Construction vehicle emissions through:

- Planning of operation schedules for construction machinery to exclude as far as possible transportation of irregular loads during certain busy periods;
- All site vehicles and plant will switch off engines when not in use; and
- As far as possible, the main equipment used during construction (main plant, diesel generators, etc.) shall conform to Stage III emissions standards. Priority is given to the equipment which ensures compliance with environmental standards and air protection requirements.

Controlling vessel emissions through:

- Minimising the use of vessels as far as practical and adhering to national and international legislation regarding fuels;
- Systematic monitoring of the condition and the adjustment of the fuel systems of ship equipment;

- The main ship engines must be certified in compliance with the MARPOL 73/78 convention, and priority is given to the equipment which ensures compliance with environmental standards and air protection requirements;
- Starting and operating according to manufacturer's recommendations and implanting a schedule of mandatory maintenance to ensure that equipment is functioning properly to minimise emissions; and
- Maintenance services will monitor the malfunctions of internal combustion engine fuel systems and diagnosing them for the permissible level of harmful substance emissions released into the atmosphere.

The main mitigation for vessel emissions is the appropriate design of the emission stacks and the use of marine diesel oil (MDO) fuel with a low sulphur content.

A minimum 3 m high stack will be associated with the pre-commissioning diesel generators, and 10 m for the 4 MW heaters.

A monitoring programme will be set up to track annual emissions and identify pollutant concentrations at sensitive locations in the vicinity of the project. This will be discussed with the Russian Federation and shall adhere with national requirements for inclusion in the Project Environmental and Social Management Plan (ESMP) discussed in **Chapter 22 Environmental and Social Management**. It will include keeping an inventory of emissions based on actual plant or fuel usage, to calculate tonnes emissions per year, and ambient air monitoring at a number of receptors during key construction activities.

The ESMP will provide a compilation of mitigation measures outlined in this section, along with monitoring requirements.

9.6.3.4 Residual Impacts: Construction and Pre Commissioning

Table 9.32 presents a summary of the potential residual impacts to air quality arising from the Project during the Construction and Pre-Commissioning Phase following application of the identified mitigation measures. The Table also presents the pre-mitigation impact significance, before the measures presented in Section 9.6.3.3 are taken into consideration.

In summary, the pre-mitigation impact significance is generally **Not Significant** or **Low** and therefore has not required rigorous additional mitigation measures beyond normal Good International Industry Practice (as listed in Section 9.6.3.3); the residual impacts therefore remain the same.

There are no predicted residual impacts that are considered to be Moderate or High significance.

Table 9.32 Assessment of Potential Impacts: Construction and Pre-Commissioning

Activity	Impact	Receptor	Sensitivity of Receptor	Potential Impact	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impacts
Offshore and nearshore vessel traffic and construction plant emissions during pipeline installation.	Combustion emissions from offshore and nearshore vessels and construction plant affecting onshore receptors.	Nearby communities and dwellings.	Negligible for benzene and NO_2 outside of central Anapa; Low for SO_2; Moderate for CO; High for PM across the Study Area	Deterioration of local air quality conditions; release of GHG emissions which may contribute to global warming.	Negligible or low for most pollutants	Not Significant for benzene, CO and SO_2; Not Significant or Low for PM; Low for NO_2.	Adherence to national legislation and Project standards, minimising usage, and including consideration of fuel consumption, type and emissions within the technical specifications at the tender stage.	Not Significant for benzene, CO and SO_2; Not Significant or Low for PM; Low for NO_2.

Continued…

Activity	Impact	Receptor	Sensitivity of Receptor	Potential Impact	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impacts
Offshore and nearshore vessel traffic and construction plant emissions during pipeline installation.	Combustion emissions from offshore and nearshore vessels and construction plant affecting onshore receptors.	SPZ	Negligible for benzene and NO_2; Low for SO_2; Moderate for CO; High for PM.	Deterioration of local air quality conditions; release of GHG emissions which may contribute to global warming.	Negligible or low for most pollutants, except: High for short-term NO_2	Not Significant for benzene, CO and SO_2; Not Significant or Low for PM; Low for NO_2.		Not Significant for benzene, CO and SO_2; Not Significant or Low for PM Low for NO_2.
		Protected and designated habitats and vegetation	High	Deterioration of vegetation and habitats	Negligible	Not Significant		Not Significant
		Non-protected and non-designated habitats and vegetation	Low	Deterioration of vegetation and habitats	Low	Low		Low

Continued...

Activity	Impact	Receptor	Sensitivity of Receptor	Potential Impact	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impacts
	Dust generation	Nearby communities, crops/vegetation, and dwellings and people present near the construction corridor; the atmosphere.	High for human health and negligible for vegetation	Deterioration of local air quality conditions; release of GHG emissions which may contribute to global warming.	Negligible	Not Significant for human receptors and Not Significant for vegetation	As outlined in Section 9.6.3.3. In particular, using water suppression managing vehicle movements/speed, progressive rehabilitation and having a designated officer onsite responsible for logging dust and emissions issues, where practicable.	Not Significant for human receptors and Not significant for vegetation
Use of port facilities	Plant emissions, vessel traffic	Nearby communities, crops/vegetation, and dwellings; the atmosphere.	Negligible, Low or Moderate, depending on nature of surrounding land use	Deterioration of local air quality conditions; release of GHG emissions which may contribute to global warming.	Negligible	Not Significant	As outlined in Section 9.6.3.3. In particular, using water suppression if necessary and having a designated officer onsite responsible for logging dust and emissions issues and implementing corrective action where necessary.	Not Significant

Continued...

Activity	Impact	Receptor	Sensitivity of Receptor	Potential Impact	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impacts
Road movements during construction	Emissions from road traffic.	Nearby communities and dwellings, and habitats; the atmosphere.	High for NO_2 in urban areas, Low outside of settlement; moderate for total PM in urban areas; Low for SO_2 in urban areas; negligible for other pollutants.	Deterioration of local air quality conditions; release of GHG emissions which may contribute to global warming.	Negligible	Not Significant	As outlined in Section 9.6.3.3. In particular, maintaining vehicles and driving in accordance with manufacturer's instructions and highway codes.	Not Significant

Complete.

9.6.4 Assessment of Potential Impacts: Operational Phase

9.6.4.1 Introduction

The Operational Phase (including the Commissioning Phase and Full Operational Phase) is likely to have a much lower potential to impact air quality in the vicinity of the sensitive receptors identified in Section 9.6.1.1 than the Construction and Pre-Commissioning Phases discussed above. This is mainly due to the very limited vessel, plant and road traffic associated with this phase.

9.6.4.2 Assessment of Potential Impacts (pre-mitigation)

This section of the chapter describes the potential impacts associated with the Operational Phase of the Project.

Offshore and Nearshore Section Vessels

There will be a need to mobilise vessels for Pipeline inspection (and possibly for repair) during operation. Inspection is expected to be an infrequent event (initially annually), using Remote Operated Vehicles to inspect the underwater sections, lasting for only a short duration and using relatively few vessels. The bulk of the emissions will also occur offshore, away from onshore sensitive receptors.

Based on the relatively limited volume of emissions at locations away from onshore receptors the impact magnitude is considered negligible. The overall impact significance, when taking into account the magnitude of emissions and receptor sensitivity is **Not Significant** to **Low** depending on pollutant.

Onsite Plant Exhaust Emissions

It is anticipated that the activities and emissions from onshore site plant during operation (for maintenance or repair work for example) will be negligible and no significant air quality impacts will arise.

The overall significance when taking into account receptor sensitivity is **Not Significant** due primarily to the low volume of vented gas.

Equipment Losses and Venting

Non-combusted, fugitive emissions are inevitable from gas pipelines, arising from leaking valves and flanges during routine operation. These are usually negligible in magnitude (and are expected to be significantly less than venting that may be required during a planned shutdown which is discussed below) and, given the distance to the nearest sensitive receptors, should not cause any detectable change in concentrations. The impact is therefore considered **Not Significant.**

In addition venting episodes of natural gas and nitrogen from the landfall facilities during maintenance activities and pigging activities and facilities during gas filling (commissioning) will occur. During operation, there will be a permanent 21 m high stack located just outside the landfall facilities to vent gas. The stack height has been pre-determined based on safety requirements in the workplace in order to protect workers at the facility from asphyxiation, to ensure adequate dispersion in the atmosphere, and to ensure that an explosive mixture is not present at ground level. There will be some occasional venting of gas during pigging, which will result in the release of small amounts of hydrocarbons, but this will only take place only once every five years on average.

Given that the vent stack has been designed in order to provide for the safe venting of gas during a shutdown situation, it is not expected that this operational venting would pose a risk to the health of residents at nearby receptors given their distance from the vent. Due to the very low concentration of hydrogen sulphide (H_2S) in the gas, perceptible odour impacts on the amenity of residents are unlikely. The vent stack for releases of natural gas has been designed as 21 m in height for the safety reasons discussed in the Safety Design Philosophy for Landfall Stations; this is considered more than sufficient to avoid any significant impacts to nearby sensitive receptors. The impact is therefore considered **Not Significant.** The volume of gas vented during operation will also be monitored and reported annually.

9.6.4.3 Mitigation and Monitoring

In conclusion, no Moderate or High impacts are predicted to local air quality during the Operational Phase of the Project and it is not considered necessary to conduct monitoring or identify receptor specific mitigations strategies at this point in time. A planned maintenance and inspection programme would by necessity be necessary to minimise the potential for fugitive emissions to occur on safety grounds, and this need would also ensure that fugitive emissions to air would also be virtually eliminated.

The standard Good International Industry Practices outlined in Section 9.6.3.3 will be followed for any onshore and offshore plant and vessels required during the operational phase for maintenance and repair work.

9.6.4.4 Residual Impacts: Operational Phase

Table 9.33 presents a summary of the potential residual impacts to air quality arising from the Project during the Commissioning Phase and Full Operational Phase following application of the identified mitigation measures. Table 9.33 also presents the pre-mitigation impact significance, before the measures presented in Section 9.6.3.3 are taken into consideration.

It is not anticipated that any significant impacts to the ambient air quality conditions will arise from the Operational Phase of the Project; the emissions during operation are anticipated to be of negligible magnitude, resulting in an effect that is **Not Significant**.

Table 9.33 Assessment of Potential Impacts: Operational Phase

Activity	Aspect	Receptor	Sensitivity of Receptor	Potential Impact	Magnitude of Impact	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impacts
Offshore and Nearshore Section Vessels for maintenance works	Emissions from offshore and nearshore vessels affecting onshore receptors.	Nearby communities and dwellings, and vegetation and ecosystems.	Negligible for benzene; Low for SO_2 and NO_2; Moderate for CO; High for PM	Deterioration of local air quality conditions; release of GHG emissions which may contribute to global warming	Negligible	Not Significant	As per the construction and pre-commissioning stage	Not Significant
Onshore plant for maintenance works	Emissions from offshore and nearshore vessels affecting onshore receptors.	Nearby communities and dwellings, and vegetation and ecosystems.	Negligible for benzene; Low for SO_2 and NO_2 outside of central urban areas; Moderate for CO; High for PM	Deterioration of local air quality conditions; release of GHG emissions which may contribute to global warming	Negligible	Not Significant	As per the construction and pre-commissioning stage	Not Significant
Equipment losses during operation and pigging	Non-combusted gas release affecting nearby receptors	Nearby communities and dwellings, and habitats; the atmosphere	Negligible	Deterioration of local air quality conditions; release of GHG emissions which may contribute to global warming.	Negligible	Not Significant	losses will be minimised through design and inspection as far as practical	Not Significant

9.6.5 Assessment of Potential Impacts: Decommissioning Phase

9.6.5.1 Introduction

The planned Project lifetime is 50 years, within which there may be changes to statutory decommissioning requirements, as well as advances in technology and knowledge.

The eventual decommissioning requirements will be taken into account several years prior to decommissioning by ensuring that a range of possible options will be available.

9.6.5.2 Assessment of Potential Impacts (pre-mitigation)

At this stage in the Project, the full extent of the decommissioning requirements is not known. However, it is likely that the impacts will be of a similar nature, albeit of a lesser magnitude, than those presented for the Construction Phase. The primary tasks to be undertaken would be associated with:

- The demolition of facilities and infrastructure;
- Equipment and vehicle movements;
- Earthworks; and
- Removal of wastes from site.

Given the timeframe involved there is also considerable uncertainty associated with what the baseline conditions will be like in 50 years' time, and whether the receptor sensitivity is likely to differ. Generally, it is expected that vehicle emissions will improve through technological advancements, although this would be offset to some extent by a net increase in vehicle movements in the area in line with population growth. Overall, it is considered that impacts could be controlled to an acceptable standard during the Decommissioning Phase. An assessment, to be prepared at the time decommissioning takes place, will be conducted to assess the impacts in the light of prevailing air quality conditions and consider appropriate mitigations.

9.6.5.3 Mitigation and Monitoring

The potential impacts during the Decommissioning Phase would be no worse than that of the Pre-Commissioning and Construction Phases. It would be possible to design mitigation and monitoring measures to control fugitive dust arisings such that significant impacts would not occur at sensitive receptors, and the measures outlined in Section 9.6.3.3 will therefore be relevant.

9.6.5.4 Residual Impacts: Decommissioning Phase

As detailed above, an assessment will be produced at the time of decommissioning. At the current time, it is not anticipated that any significant impacts to the ambient air quality conditions will arise from the Decommissioning Phase of the Project.

9.6.6 Country Emissions of GHG and Pollutants

An important component to the assessment is the calculation of the tonnes emissions of greenhouse gases and pollutants emitted by the Project during construction and operation. Although there are no international, national or Project standards against which to assess these emissions, they can be compared against the existing regional or national emissions and a judgment made as to the scale and importance of these emissions.

Furthermore, the IFC Performance Standard 2012 (Ref. 9.14) states that:

"…for projects that are expected to or currently produce more than 25,000 tonnes of CO_2-equivalent annually, the client will quantify direct emissions from the facilities owned or controlled within the physical project boundary".

According to the EIA for the Krasnodar 410 megawatt (MW) combined cycle gas turbine (CCGT) Combined Heat and Power (CHP) Plant (Ref. 9.15) the key emissions sources in the Anapa/Krasnodar region are road vehicles which contribute an estimated 92% of total atmospheric emissions in the Krasnodar region. Almost all of the remaining approximately 8% of emissions are from industrial sources, including Krasnodar Thermoelectric Power Plant (Krasnodarskaya TETs), AO Novorostsement in Novorossiysk, and the Krasnodar CCGT CHP Plant mentioned above.

The EMEP Centre on Emission Inventories and Projections (CEIP) presents the following country-wide emissions for Russia in 2010 (the latest year of available data) (Ref. 9.5):

- 1,314 thousand tonnes per annum of SO_2;
- 2,421 thousand tonnes per annum of NO_X; and
- 10,122 thousand tonnes per annum of CO.

The United Nations Framework Convention on Climate Change (UNFCC) provides the following country-wide data for Russia during 2010 (Ref. 9.16):

- 950 million tonnes per annum of CO_2; and
- 600 million tonnes per annum of non-CO_2 GHGs.

Emissions data could not be identified on a regional basis for the Anapa/Krasnodar region.

Table 9.34 to Table 9.37 present the estimated emissions for all vessels associated with the nearshore and offshore Pipeline installation operations. It is conservatively assumed that up to 2 pipelines would be constructed per year.

In the absence of a detailed programme of works at this stage of the Project it has been assumed that all vessels associated with a particular area will be operating simultaneously. This is particularly unlikely for the nearshore area, which spans a relatively short distance and is more likely to have specialist vessels being used in succession as each sub-task is completed rather than simultaneously.

Full details of methodology and calculations for total emissions are provided in Appendix 9.5.

Table 9.34 Estimated GHG Atmospheric Emissions from Construction / Pre-Commissioning Vessels (Tonnes/Pipeline)

Activity	NO_x	CO	PM	SO_2	NMVOC	CO_2
Near shore <30 mbsl	271	26	5	104	10	10,912
Offshore 30-600 mbsl	773	73	15	296	28	31,131
Offshore >600 mbsl	2,817	266	54	1,077	100	113,410
Pre Commissioning	108	10	2	41	4	4,359
Total	3,970	374	76	1,517	142	159,812
Total (all 4 pipelines)	***15,880***	***1,497***	***303***	***6,069***	***566***	***639,249***

Table 9.35 GHG Atmospheric Emissions from Construction / Pre-Commissioning road traffic (Tonnes)

Activity	NO_x	CO	PM	NMVOC	SO_2	CO_2
Total	***7***	***26***	***0.1***	***3***	***0.01***	***1,342***

Table 9.36 GHG Atmospheric Emissions from Construction Site Plant (Tonnes)

Activity	NO_x	CO	PM	NMVOC	SO_2	CO_2
Construction - Site Preparation	7.0	9.0	0.6	1.0	0.01	521
Construction - Microtunnelling	279.5	88.7	20.9	27.1	0.09	7,142
Construction - Landfall Facilities	18.8	21.6	1.3	2.7	0.02	1,401
Construction - Trench Excavations	3.1	3.5	0.2	0.5	0.00	229
Construction - Pipe Installation	7.2	7.5	0.5	1.1	0.01	514
Construction - Demob/Reinstatement of pipelines area	3.6	4.3	0.3	0.5	0.00	268
Total	***319***	***135***	***24***	***33***	***0.13***	***10,076***

Table 9.37 GHG Atmospheric Emissions from Pre-commissioning Site Plant (Tonnes/Pipeline)

Activity	NO_x	CO	PM	NMVOC	SO_2	CO_2
Pre-Commissioning (Landfall and Nearshore Section)	2.2	0.5	0.2	0.2	0.0005	40.5
Pre-Commissioning (Landfall hydrotesting per pipeline)	0.4	0.4	0.0	0.1	0.0004	29.9
Pre-commissioning Landfall Facilities (Combined Compressor and Booster Units per pipeline)	71	71	4	10	0.07	5,364
Total per pipeline	***74***	***72***	***4***	***10***	***0.07***	***5,434***
Total (4 pipelines)	***294***	***287***	***17***	***42***	***0.28***	***21,738***

Table 9.38 presents the total emissions and emissions in tonnes per year (equally split between 3 years) during the Construction and Pre-Commissioning Phase and represents the sum of Totals for all pipelines as presented in Tables 9.34, 9.35, 9.36, and 9.37.

The Construction and Pre-Commissioning phase of the Project is predicted to increase national reported emissions of NO_X by 0.2%, most of which is attributed to the offshore vessels. The expected increase in PM, SO_2, and NMVOC emissions is expected to be less than 0.2% of national emissions. As CO_2 emissions are expected to exceed 25,000 tonnes per year a monitoring plan will be put into place to quantify direct emissions from the Project, as outlined in Section 9.6.3.3.

Table 9.38 Total Atmospheric Emissions during Construction and Pre Commissioning (Tonnes)

Activity	NO_x	CO	PM	NMVOC	SO_2	CO_2
Total emissions	16,501	1,944	344	644	6,069	672,405
Total emissions per year	5,500	648	115	215	2,023	224,135
% increase in national emissions per year	0.2%	0.01%	n/a	n/a	0.2%	0.02%

9.7 Unplanned Events

There is the potential for unplanned releases of non-combusted gas from the landfall section of and offshore sections of the Pipeline. The only possible sources of large scale releases of gas into the atmosphere would be the result of a pipeline rupture (or blowout). Statistically, a pipeline rupture is a very rare event and the probability of such an extreme situation is very low.

In the unlikely event of rupture of one of the Project pipelines during operation a shutdown sequence would be initiated from the pipelines control room.

During operation, there will be a permanent 21 m stack located just outside the landfall facilities. This will be used to depressurise the landfall facilities during a planned shutdown, for example to allow repairs to be undertaken, or (if absolutely necessary) to vent gas from the offshore pipelines to allow repairs to be undertaken in the event of a leak.

The vented gas composition is presented in Table 9.39.

Table 9.39 Vented Gas Composition

Component	Mole %	Component	Mole %
Methane	97.5389	n-pentane	0.0171
Nitrogen (N_2)	0.9305	Hexane	0.0205
CO_2	0.4101	Heptane	0.0033
Ethane	0.8800	Octane	0.0004
Propane	0.1399	Nonane	0.0001
i-butane	0.0150	Water	0.0014
n-butane	0.0249	Methanol	0.0005
i-pentane	0.0171	Hydrogen sulphide (H_2S)	0.0003

Ambient air quality limits have not been set by the Russian Federation or IFC for the compounds listed in Table 9.39. Due to the very low concentration of H_2S in the gas, perceptible odour impacts on the amenity of residents are unlikely. The vent stack has already been designed as 21 m in height for safety reasons; this is considered more than sufficient to avoid any significant impacts to nearby sensitive receptors. The volume of gas vented during operation will also be monitored and reported annually.

Further discussion on unplanned events is presented in **Chapter 19 Unplanned Events.**

9.8 Cumulative Impact Assessment

The cumulative impacts associated with the Project relating to air quality are assessed in **Chapter 20 Cumulative Impact Assessment**.

9.9 Conclusions

The Pre-Commissioning and Construction Phase will result in the majority of the Project's emissions to the atmosphere and therefore have the greatest potential to affect air quality. In summary, the pre-mitigation impact significance is generally **Not Significant** or **Low** and therefore has not required rigorous additional mitigation measures beyond normal Good Industry International Practice (outlined in Section 9.6.3.3). The residual impacts, therefore, remain at the same level of significance.

There are no predicted impacts considered to be of High significance to air quality.

The impact on the Utrish National Reserve will be **Not Significant** due to the negligible magnitude of change predicted for this high sensitivity receptor. Emissions to air during the Commissioning and Operational Phases will be minimal. Consequently it is not anticipated that any significant impacts to the ambient air quality will arise from the Commissioning Phase and Full Operational Phase. The impacts during operation are anticipated to be of negligible magnitude, resulting in an effect that is **Not Significant**.

At this stage, the full extent of the decommissioning requirements are not known; however, at the current time, it is not anticipated that any significant impacts to the ambient air quality conditions will arise from the Decommissioning Phase of the Project.

The impacts relating to the construction and pre-commissioning activities are temporary in nature, and will cease at the end of this phase of works. No significant impacts are expected during the Operational Phase of the Project.

References

Number	Reference
Ref. 9.1	Hygiene Regulations, GN 2.1.6.1338-03. Maximum permissible concentration (MPC) Of pollutants in the Air Populated Places.
Ref. 9.2	International Finance Corporation (IFC) (2007), General Environmental, Health and Safety (EHS) Guidelines.
Ref. 9.3	World Health Organization (WHO) (2005), Air Quality Guidelines Global Update.
Ref. 9.4	Krasnodar Regional Centre for Hydrometeorology and Environmental Monitoring. Letter No. 43 dated February, 8 2011 to Peter Gaz.
Ref. 9.5	European Monitoring and Evaluation Programme (EMEP) Centre on Emission Inventories and Projections (CEIP). Officially Reported Emission Data. http://www.ceip.at/webdab-emission-database/officially-reported-emission-data/, accessed on 20 July 2013.
Ref. 9.6	UK Department for Transport (2008), Design Manual for Roads and Bridges (DMRB) Screening Tool.
Ref. 9.7	Environment Agency (UK) (2011), Horizontal Guidance Note H1 Overview Document.
Ref. 9.8	Official Journal of the European Union. 2004. DIRECTIVE 2004/ 26/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 21 April 2004.
Ref. 9.9	Janssen KHJM, van Wakeren JHA, van Duuren H, Elshout A (1988), 'A classification of NO oxidation rates in power plant plumes based on atmospheric conditions', Atmospheric Environment, Volume 22 (1) pp. 43-53.
Ref. 9.10	EMEP/ European Environment Agency (EEA) Air Pollutant Emission Inventory Guidebook — 2009. Technical Report No 9/2009.
Ref. 9.11	Resolution MEPC.76(40) Standard Specification for Shipboard Incinerators. http://www.imo.org/OurWork/Environment/PollutionPrevention/Garbage/Documents/76(40).pdf Accessed on 20th July 2013.
Ref. 9.12	Department for Communities and Local Government of England and Wales. Minerals Planning Statement 2: Controlling and Mitigating the Environmental Effects of Minerals Extraction in England, Annex 1: Dust.
Ref. 9.13	Ove Arup and Partners (1995), The Environmental Effects of Dust from Surface Mineral Workings Vol 1.
Ref. 9.14	IFC (2012), IFC Performance Standard 3.

Number	Reference
Ref. 9.15	Environmental Impact Assessment for the Construction of a 410 MW Combined Cycle Gas Turbine Power Unit at the existing Combined Heat and Power Plant in Krasnodar (Subsidiary of OAO “UGK TGK-8”), Russian Federation. February – March 2009. www.ebrd.com/pages/project/eia/38714.pdf, access on 20 July 2013.
Ref. 9.16	United Nations Framework for Climate Change (UNFCC). Summary of GHG Emissions for Russian Federation http://unfccc.int/files/ghg_emissions_data/application/pdf/rus_ghg_profile.pdf, accessed on 20 July 2013.

Chapter 10: Noise and Vibration

URS-EIA-REP-204635

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Tables

Figures

10 Noise and Vibration

10.1 Introduction

This chapter presents an assessment of the likely impacts of noise and vibration generated by the Project on human receptors. Assessment of noise and vibration impacts on ecological receptors is addressed in **Chapter 11 Terrestrial Ecology** and in **Chapter 12 Marine Ecology**.

Both noise and vibration may impact the health and wellbeing of human receptors particularly with regards to disturbance of relaxation and sleep (Ref. 10.1). This could lead to elevated stress levels and other health impacts (Ref. 10.1). As such, both regional and international legislation and guidance have been used when assessing noise and vibration at sensitive receptor locations.

Aside from health impacts, noise and vibration can also impact community areas such as cemeteries, beaches and public open spaces, where elevated noise levels can be a nuisance.

This chapter characterises the existing ambient noise and vibration environment of the closest receptors to the Project Area (Section 10.3). Calculations have been undertaken to determine the noise and vibration levels that will be generated by the Project at sensitive receptors. The resulting noise and vibration assessments have been used to determine potentially significant impacts in terms of relevant international and Russian national standards and guidance. Where significant impacts are likely to occur, suitable mitigation measures are identified.

This chapter has been prepared in tandem with **Chapter 14 Socio-Economics**. Where relevant, **Chapter 14 Socio-Economics** draws upon the findings of this noise and vibration assessment.

10.2 Scoping

The scope of this noise and vibration impact assessment was defined through a scoping process that identified sensitive receptors and potentially significant impacts related to the Project. Key steps in the scoping process comprised:

- A review of the Project details to identify activities with the potential to generate significant levels of noise and vibration;
- Identification of sensitive receptors within the likely noise and vibration Zone of Influence (Section 10.3) through a review of secondary data (Section 10.4), a review of studies undertaken for the South Stream Offshore Pipeline and using professional expertise; and
- A review of relevant national and international legislative requirements and standards and guidelines for financing to ensure legislative and policy compliance.

An Environmental Issues Identification (ENVIID) process was undertaken to assist in the identification of impacts and receptors. During the ENVIID process, each activity was examined, drawing upon the experience of technical specialists and their understanding of the extent and nature of the Project Activities and the natural environment, to understand:

- How activities may give rise to noise and vibration impacts; and
- Which receptors would potentially be impacted by each activity and the potential significance of each impact.

The output of the ENVIID was an ENVIID register, which identified the various elements of the Project and their interaction with, or potential impact on, sensitive receptors.

10.3 Spatial and Temporal Boundaries

The Project Area is defined in **Chapter 1 Introduction**.

The Project will consist of the following phases: Construction and Pre-Commissioning, Operational, and Decommissioning Phase. The impact of each of these has been considered separately, and the assessment of the impact has considered the duration of each phase.

Sources of noise and vibration during the Construction Phase will include vehicles, vessels, plant and machinery used to undertake earthworks, pipeline fabrication and laying, construction of the microtunnels, and offshore dredging works at the microtunnel exit locations.

The Pre-Commissioning Phase will involve cleaning, gauging and hydro-testing of the Pipeline. During hydro-testing, pumps that provide the necessary testing pressure after flooding the Pipeline are likely to generate noise.

Sources of noise and vibration during the Operational Phase will be limited to activities associated with maintenance and repair, vessel operation, noise from vehicles, and unplanned events.

Decommissioning activities are not anticipated to give rise to higher noise levels than the Construction Phase.

The temporal boundaries of the impacts related to each phase are defined by the duration of each activity associated with the phase. All the sources of noise and vibration associated with the Project are temporary in nature and no noise and vibration will be generated that will last beyond each phase.

The spatial boundaries of the impact assessment of each phase will be defined by the presence of terrestrial receptors that are sensitive to noise and vibration resulting from the Project Activities. These include present and proposed human receptors, such as residential properties, and any sensitive ecological areas. These are identified and described in Section 10.6.1.3. Thus, sensitive terrestrial receptors closest to the Project Activities define the Study Area.

The applicable standards that have been used during the impact assessment (Section 10.6.1.4) include Russian noise and vibration limits for day and night-time periods. These standards apply absolute noise and vibration level criteria at sensitive receptors.

For the purpose of the noise and vibration assessment, two study areas have been defined and are referred to as follows:

- The Study Area comprises the landfall and the nearshore sections of the Project and encompasses terrestrial receptors sensitive to noise and vibration located in close proximity to these locations (Figure 10.2). Marine receptors are not included in the Study Area as these are discussed in **Chapter 12 Marine Ecology**; and

- The Wider Study Area comprises the Study Area along with the port at Novorossiysk, and includes representative receptors in proximity to the proposed access roads used for the transportation of material from the port to the landfall section. Whilst a final decision on the use of the Novorossiysk port has not been made at this point in time, it is considered to be a fair representation of a potential scenario which defines the Wider Study Area.

As this chapter is concerned only with effects on *terrestrial* noise and vibration receptors, a list of impacts which are excluded from assessment in this chapter is included below:

- The impact of occupational noise and vibration on the employees in the Project team. Occupational health and safety is discussed in Appendix 15.1: Occupational Health Appendix;
- The impact of noise on ecological receptors. This chapter provides the baseline noise levels at ecological receptors, and the noise levels that will be present at them due to the Project Activities. These are provided for information only, and are used to determine the magnitude of impact and significance of effect in **Chapter 11 Terrestrial Ecology**;
- The impact of offshore works (i.e. those beyond the nearshore) as these will have no impact on terrestrial noise and vibration receptors, owing to the considerable distance and resulting attenuation of noise and vibration levels;
- The impact of underwater noise and vibration which is discussed in Appendix 12.3: Underwater Noise Study; and
- The impact of vibration on indirect human receptors, such as infrastructure, livestock and fisheries. The criteria for impact magnitude on human receptors, such as residential, are much more stringent than those that could be applied to indirect human receptors. Hence the assessment of the impact on human receptors will be the worst case, and the significance of the impact on indirect human receptors will be lower than that for human receptors.

The Wider Study Area for noise and vibration, therefore, incorporates the sensitive human receptors in proximity to the landfall and nearshore sections of the Project (Figure 10.2), the port, and the access roads that will be used for the transportation of material to the landfall section.

10.4 Baseline Data

10.4.1 Methodology and Data

Baseline noise and vibration data are necessary to provide a description of the current ambient conditions at receptor locations. The secondary data review, gap analysis and further baseline monitoring that have been undertaken are discussed within the following sections.

10.4.2 Secondary Data

No baseline information regarding the ambient noise and vibration characteristics at sensitive receptor locations throughout the Wider Study Area was available at the Scoping Stage[1]. This was not unexpected given the rural and semi-rural nature of the Wider Study Area.

There are a number of development proposals in the area; however, assessments and reports[2] could not be obtained at the time of baseline review.

Consequently, no secondary data was identified for any of the sensitive receptor locations within the Wider Study Area. Baseline surveys were therefore scoped and planned.

10.4.3 Primary Data and Baseline Surveys

Baseline surveys were undertaken in December 2011, December 2012, June through July 2013 (Ref. 10.2 and 10.3), and September / October 2013 to characterise the ambient noise environment within the Wider Study Area. The noise survey locations are shown in Figure 10.1. The measurements were taken in accordance with the requirements of the standards and legislation adopted.

Given that many of the identified noise monitoring locations are representative of remote properties, and that there were no identifiable sources of vibration, vibration baseline monitoring was not undertaken at all locations. Baseline vibration monitoring has been undertaken at four of the monitoring locations, 10, 12, 22 and 23. These locations were selected for baseline vibration monitoring owing to their proximity to the existing road network, which has the potential to result in ground borne vibration from passing vehicles.

During the baseline surveys a number of noise parameters were measured, in order to provide a detailed understanding of the variability of the ambient noise levels at the monitoring locations. The most important parameters, because of their use in the Russian legislation, were considered as follows:

- L_{Aeq} - Equivalent continuous A-weighted sound pressure level over a given period of time (i.e. the single continuous sound level that conveys the same acoustic energy as a variable noise source over a given period of time); and
- L_{AFmax} - The maximum A-weighted sound pressure level over a given period of time (i.e. to the human ear, the maximum sound level recorded in a given time).

The vibration monitoring surveys at the identified receptor locations measured the ground borne vibration in terms of the acceleration (mm/s^2) as defined within the Russian legislation.

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[1] Peter Gaz report on 'Complex Engineering Surveys…' (2011, Ref. 10.2) reviewed available secondary data, and concluded that there were no Project-relevant secondary data for noise and vibration. Consequently, primary data were collected specifically for the Project.

[2] Although these reports were not obtained at the time of baseline review, it is unlikely that they would have contained valuable secondary data; Russian standards rely on absolute noise level criteria, and therefore baseline ambient surveys of noise and vibration are not required for the acceptability assessment of most developments.

Received noise within the Wider Study Area varies significantly depending upon the location of the receptor. In particular, the proximity of the receptor to urban development is a defining factor. Two general receptor types with associated noise climates were identified:

- Rural Residential (and Ecological Receptors) - the noise climate outside of the major residential areas is not dominated by any one noise source but is instead made up of road traffic noise (from the inter village roads), ecological noise (primarily bird song), and meteorological noise (primarily wind through trees); and
- Urban Residential Receptors - the dominant noise source in urban areas, such as Varvarovka, is road traffic noise. Other significant noise sources include aircraft, construction activities, and operation of industrial and commercial facilities.

The baseline surveys included measurements of the day (0700 – 2200), and night (2200 – 0700) noise levels. The survey locations were selected considering both the location of human settlements and isolated residents, as well as key potential ecological receptors in the area immediately surrounding the proposed Pipeline corridor or in proximity to the access road and Varvarovka bypass road. A summary of the baseline measurements is provided in Table 10.1.

The measured ground borne vibration levels for the day (0700 – 2200), and night (2200 – 0700) time periods are summarised in Table 10.2.

10.4.4 Data Gaps

The primary baseline data are considered adequate to facilitate a robust assessment of existing ambient noise and vibration levels at key human receptors within the Wider Study Area. No data gaps exist that could limit the assessment of the impacts associated with the Project.

10.5 Baseline Characteristics

10.5.1 Baseline Summary

Details of the baseline ambient noise surveys (Ref. 10.2 and Ref. 10.3) are presented below in Table 10.1.

The measured noise levels are shown to reach or exceed the Russian daytime noise limit (Ref. 10.4) for residential areas (55 dB L_{Aeq}) at measurement points 2, 3, 6, 7, and 21. All other positions are below the limit.

The measured night-time noise levels are shown to reach or exceed the Russian noise limit (Ref. 10.4) for residential areas (45 dB L_{Aeq}) at measurement points 1 to 10 (inclusive), 12, and 21. All other positions are below the limit.

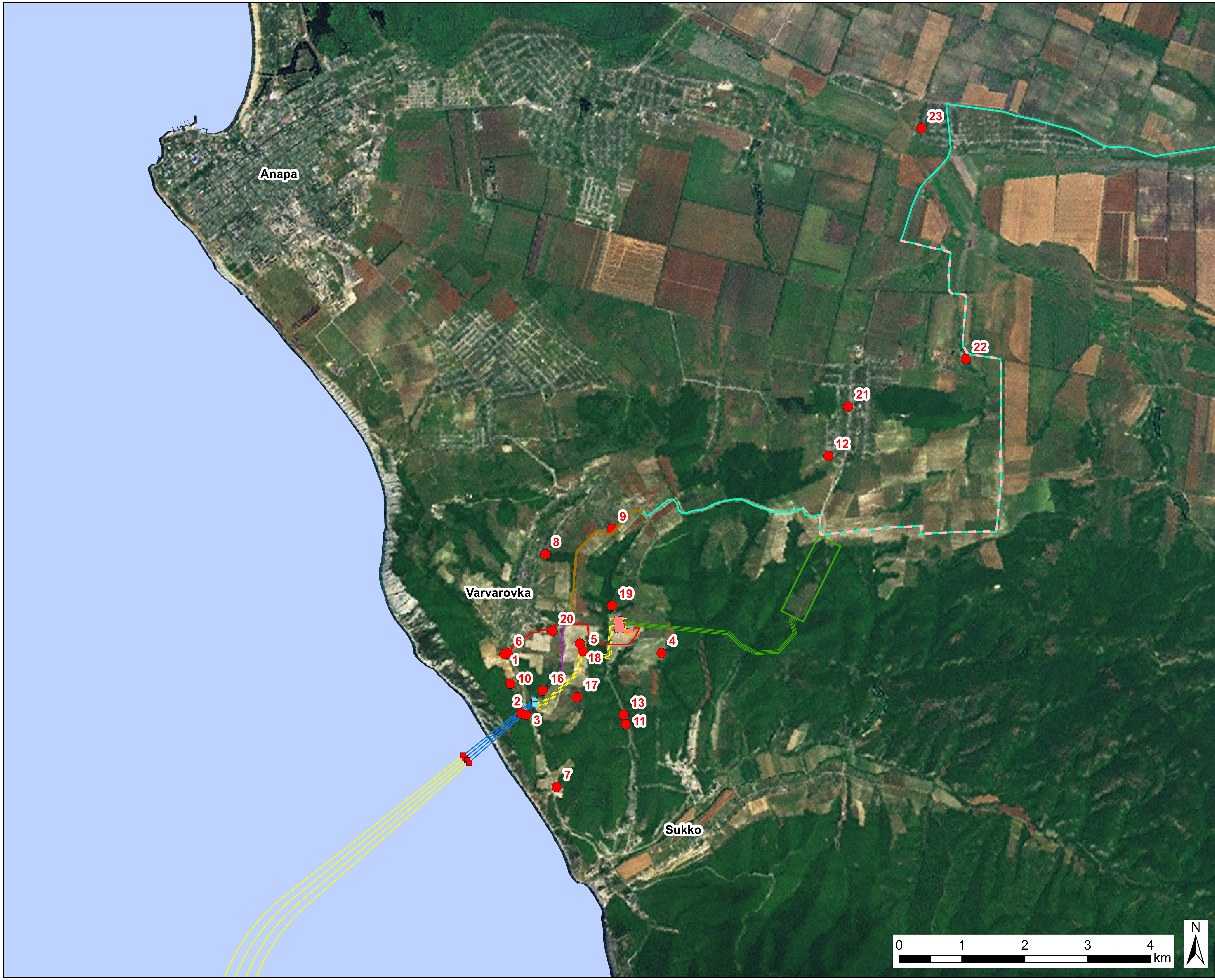
It is considered that, for the sites sampled, the main noise sources were:

- Road traffic;
- Ecological noise (e.g. bird song); and
- Meteorological processes (e.g. wind in vegetation).

This is reflected in the L_{AFmax} results (Table 10.1), which are consistent with passing of vehicles as likely sources of the maximum noise levels recorded.

The measured vibration levels are presented in Table 10.2.

The measured vibration levels are shown to reach or exceed the Russian vibration limit (Ref. 10.5) for residential receptors (4 mm/s^2) at positions 10 and 23 during the night, and at positions 22 and 23 during the day. These levels were likely due to the vibration generated by the nearby road traffic. It should be noted that the Russian vibration criteria do not distinguish different limits for day and night time periods.



LEGEND

Noise monitoring location

Access Roads

Proposed delivery route from Novorossiysk Port

Permanent access road to be constructed by SSTTBV

Temporary access road constructed by SSTTBV

Varvarovka bypass road (used by Project during construction only)

Permanent access road to be constructed by Gazprom Invest

Gazprom Invest temporary bypass road to be utilised by SSTTBV

Russian Sector of South Stream Offshore Pipeline

Proposed landfall section pipelines

Landfall facilities

Proposed microtunnels

Proposed offshore pipelines

Microtunnel entry shaft

Microtunnel exit pit

United Gas Supply System

Russkaya compressor station

United Gas Supply System pipelines

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue

For Information

Client

South Stream Offshore Pipeline — Stream ENERGISING EUROPE

Project Title

SOUTH STREAM OFFSHORE PIPELINE

Drawing Title

NOISE MONITORING LOCATIONS

Drawn	Checked	Approved	Date
DH	RW	MW	28/02/2014

URS Internal Project No.	Scale @ A3
46369082	1:55,000

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Drawing Number

Figure 10.1

Rev

Plot Date: 28 Feb 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 10 Noise\Figure 10.1 Noise Monitoring Locations.mxd

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Table 10.1 Baseline Noise Results

No.	Measurement location	Average L_{Aeq}, (dB)		Maximum L_{Amax}, (dB)	
		Day (0700 – 2300)	Night (2300 – 0700)	Day (0700 – 2300)	Night (2300 – 0700)
1	AAL-1 (along the road of Bol. Utrish - Varvarovka)	54.5	*50.1*	61.9	56.1
2	AAL -2 (near the road of Bol. Utrish - Varvarovka)	*58.2*	*52.1*	68.6	54.1
3	AAL -3 (near the road of Bol. Utrish - Varvarovka)	*55.9*	*50.1*	56.4	53.3
4	AAL -4 (near country road)	48.5	*47.3*	51.6	48.0
5	AAL -5 (near country road)	53.2	*52.3*	55.2	53.1
6	A group of residential dwellings situated in the southern extremity of the nearby town Varvarovka, approximately 800 m north of the microtunnel entry points.	*66.0*	*58.2*	*88.3*	*73.6*
7	A group of dwellings on the coast, which include the Shingari holiday complex and the Don holiday complex, approximately 1.3 km south of the microtunnel entry points.	*64.7*	*60.3*	*84.0*	*87.0*
8	Residential area in Varvarovka, approximately 1.5 km northwest of the landfall facilities.	49.2	*46.5*	*75.9*	59.7
9	A residential dwelling situated in the north-eastern part of Varvarovka, approximately 1.4 km north of the landfall facilities, and 50 m to the north of the Varvarovka bypass road.	46.2	*48.5*	67.8	*60.1*
10	The southern boundary of a proposed residential development currently under construction, approximately 500 m northwest of the landfall facilities. An extension of the town of Varvarovka.	53.8	*45.6*	68.0	*70.8*

Continued...

No.	Measurement location	Average L_{Aeq}, (dB)		Maximum L_{Amax}, (dB)	
		Day (0700 – 2300)	Night (2300 – 0700)	Day (0700 – 2300)	Night (2300 – 0700)
11	A group of residential dwellings situated 1.5 km south of the landfall facilities.	49.4	35.6	*71.8*	*63.2*
12	The southern edge of the nearby town, Gai Kodzor, approximately 4.5 km northeast of the landfall facilities.	42.5	50.8	*70.3*	*75.4*
13	Two log cabins that have recently been built on cleared land, approximately 1.1 km south of the landfall facilities.	50.6	29.5	62.7	*64.0*
16	Ecological receptors along the proposed Pipeline corridor.	53.2	39.6	73.2	57.3
17	Ecological receptors along the proposed Pipeline corridor.	51.7	38.4	40.1	52.1
18	Ecological receptors along the proposed Pipeline corridor.	43.0	40.7	62.7	52.0
19	Ecological receptors along the proposed Pipeline corridor.	50.3	40.7	58.4	62.7
20	Varvarovka village cemetery located to the northwest of the Pipeline corridor at a closest approach of approximately 530 m.	48.8	44.9	*79.1*	*66.8*
21	Gai Kodzor war memorials located to the northeast of the proposed landfall facilities at a distance of approximately 4.5 km.	*66.8*	*53.5*	*87.3*	*84.5*
22	Residential properties to the far east of Gai Kodzor.	39.6	35.8	*71.7*	57.0
23	Residential properties within Rassvet.	49.9	40.4	68.8	*69.2*

Note - The measured baseline noise levels that exceed the Russian regulation criteria (as given in Table 10.7) are shown in italics above for human receptors only.

Complete.

Table 10.2 Baseline Vibration Results

No.	Measurement point	Acceleration (mm/s^2)	
		Day (0700 – 2300)	Night (2300 – 0700)
10	The southern boundary of a proposed residential development currently under construction, approximately 430 m northwest of the landfall facilities. An extension of the town of Varvarovka.	3.3	*4.1*
12	The southern edge of the nearby town, Gai Kodzor, approximately 4.0 km northeast of the landfall facilities.	3.3	3.5
22	Residential properties to the far east of Gai Kodzor.	*4.4*	2.8
23	Residential properties within Rassvet.	*4.4*	*4.4*

Note - The measured baseline vibration levels that exceed the Russian regulation criteria (as given in Table 10.9) are shown in italics above.

10.6 Impact Assessment

10.6.1 Impact Assessment Methodology

The assessment of potential noise and vibration impacts took into consideration applicable international standards, Russian national standards and recognised Good International Industry Practice (GIIP) regarding the control of environmental noise and vibration.

The closest human receptors to the Project Activities have been identified within the Wider Study Area to define the spatial scope of the assessment; as defined in Section 10.6.1.3. The sensitivities of individual receptors have been categorised by their nature using the criteria in Table 10.6 to help determine the potential significance of effects.

The assessment of impacts has been undertaken by identifying and evaluating a range of activities and scenarios that are likely to occur throughout the phases of the Project. The key activities likely to generate noise and vibration during each of the Project phases are included below in Table 10.3.

It is important to note that the methodology has been designed specifically to assess noise and vibration impacts upon a recipient population and cannot be applied to the assessment of occupational noise and vibration effects associated with the Project works. Occupational health and safety is discussed in Appendix 15.1.

Table 10.3 Key Project Activities Likely to Result in Noise and Vibration

Phase	Activity	Project Section		
		Offshore	Nearshore	Landfall
Construction	Micro-tunnel construction			N, V
	Construction plant, equipment and construction generator operation associated with the onshore construction spread			N, V
	Dredging of the micro-tunnel exit pits		N	N
	Vehicle and rail movements onshore			N, V
Pre-Commissioning and Commissioning	Operation of extraction pumps, flooding pumps, compressors, and associated generators			N, V

Continued...

Phase	Activity	Project Section		
		Offshore	Nearshore	Landfall
Operational	Mobilisation of vessels for checking the Pipeline or repairs	N	N	
	Gas flow through the Pipeline			N, V
	Pigging activities and venting of gas during a planned shut down or maintenance activities			N
Decommissioning	Assumed to be similar to construction		N	N, V

N- Noise, V – Vibration

Complete.

10.6.1.1 Impact Assessment Criteria

Criteria have been developed for assessing the potential impacts of noise and vibration from the Construction and Pre-Commissioning, Operational and Decommissioning Phases of the Project, and include impact magnitude and receptor sensitivity. The impact significance matrix in **Chapter 3 Impact Assessment Methodology** is used to determine the significance of each impact.

Sensitive human receptors have been identified (Section 10.6.1.3, Table 10.5) in proximity to the proposed Pipeline route, potential port and along construction traffic routes. Human receptors have been classified based on their likely sensitivity to noise and vibration impacts.

Specific ecological receptors have been identified in proximity to the Pipeline route. No assessment of the potential impacts on ecological receptors has been addressed within this chapter, although predicted noise levels are presented. The assessment of such impacts is considered within **Chapter 11 Terrestrial Ecology** and **Chapter 12 Marine Ecology**.

Impacts have been assessed and classified using the appropriate noise level criteria as described in **Chapter 2 Policy, Regulatory and Administrative Framework** and Section 10.6.1.4.

10.6.1.2 Receptor Sensitivity

The sensitivity of receptors to noise and vibration is primarily dependent upon the activities which take place at the receptor location. Locations where people rest or sleep are considered to be more sensitive to noise and vibration than industrial areas. This approach is supported by the applicable Russian noise legislation (Section 10.6.1.4), which delineates standards based on the nature of the potentially affected receptors and the time at which the impact may arise (e.g. night or day). A combination of professional judgement, GIIP experience and Russian noise and vibration legislation (Section 10.6.1.4) has been used to develop noise and vibration receptor sensitivity categories as shown in Table 10.4.

Table 10.4 Noise and Vibration Receptor Sensitivity

Sensitivity	Description
Noise and Vibration	
High	Locations used for rest, sleep and quiet reflection such as residential properties, hospitals, cemeteries, educational establishments and places of worship.
Moderate	Locations used for work requiring concentration, such as offices.
Low	Locations used for recreation and industrial activities, such as industrial units, workshops, etc.
Negligible	Locations not regularly utilised.

10.6.1.3 Receptor Identification

The nearest human receptors (and ecological receptors for the purpose of **Chapter 11 Terrestrial Ecology** and **Chapter 12 Marine Ecology**) were identified through use of available aerial photography and field surveys. It is considered that the selection of the closest sensitive receptors to the Project Activities will reflect the largest impacts, as noise and vibration levels will attenuate with greater distance.

The proposed pipelines cross under the coastline approximately 1 km to the north of the Shingari holiday complex and 1 km to the south of Varvarovka. The pipelines then proceed in a northeast direction for approximately 2.5 km where they terminate at the proposed landfall facilities.

In addition to Varvarovka and the Shingari holiday complex, residential dwellings are located to the south of the proposed Pipeline route.

Receptor 8 is representative of the closest residential receptors located to the south of the Pipeline corridor. The settlement of Sukko is located to the south of the Pipeline corridor at a distance of approximately 3 km. It is considered that achieving the noise level criteria at Receptor 8 would ensure that noise levels would be well below the criteria at Sukko, owing to its greater distance from the Pipeline corridor, and the topographical screening from the inter-lying hills.

A description of the identified receptors used for the assessment and corresponding assigned sensitivities are presented in Table 10.5 and shown on Figure 10.2.

Receptor 5 is representative of a site for proposed residential use, located at a distance of approximately 430 m to the northwest of the microtunnels. This site has been considered within the assessment as having a negligible sensitivity, as it is anticipated that the site will not be developed and occupied during the Construction Phase of the Project. Consequently, it is anticipated that there will be no residential receptors at this location during the Construction Phase.

Receptors 13 and 14 are representative of the Varvarovka village cemetery and Gai Kodzor War Memorials, respectively. Russian legislation does not stipulate noise levels for such land uses, and therefore noise levels are not regulated at these locations. However, people visit these sites during the day and evening periods and such sites may be used for services and burials. Therefore, these locations have been considered as receptors with a high sensitivity within this assessment; the sensitivity classification assigned for cemeteries and war memorials is the same as for residential dwellings.

Receptors 9-12 (inclusive) are identified as ecological receptors. The sensitivity of specific ecological receptors will be dependent upon the species affected. A diverse range of fauna has been identified within the area surrounding the proposed Pipeline including mammals, reptiles and avian species. Sensitivities have therefore not been assigned to ecological receptor locations; receptor sensitivity and impact significance for ecological receptors is discussed under **Chapter 11 Terrestrial Ecology**.

Table 10.5 Description of Identified Receptors

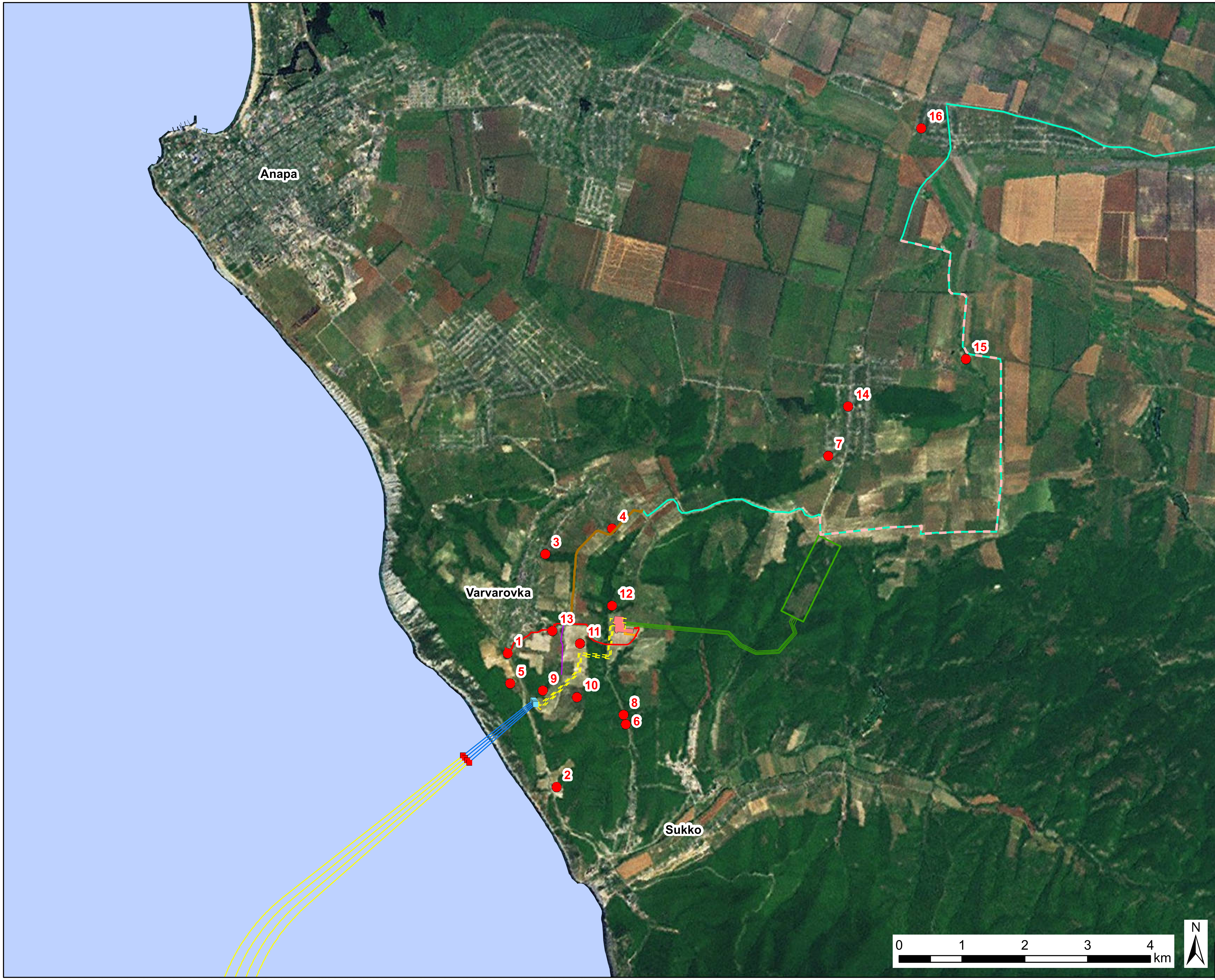
Receptor Number	Measurement location	Description	Receptor Sensitivity*
Landfall			
1	6	A group of residential dwellings situated in the southern extremity of the nearby town Varvarovka, approximately 800 m north of the microtunnel entry points.	High
2	7	A group of dwellings on the coast, which include the Shingari holiday complex and the Don holiday complex, approximately 1.3 km south of the microtunnel entry points.	High
3	8	Residential area in Varvarovka, approximately 1.5 km northwest of the landfall facilities.	High
4	9	A residential dwelling situated in the north-eastern part of Varvarovka, approximately 1.5 km north of the landfall facilities, and 50 m to the north of the Varvarovka bypass road.	High
5	10	The southern boundary of a proposed residential development currently under construction, approximately 500 m northwest of the landfall facilities. An extension of the town of Varvarovka.	Negligible
6	11	A group of residential dwellings situated 1.5 km south of the landfall facilities.	High

Continued...

Receptor Number	Measurement location	Description	Receptor Sensitivity*
7	12	The southern edge of the nearby town, Gai Kodzor, approximately 3.5 km northeast of the landfall facilities at a position representative of residential properties located along the construction traffic route.	High
8	13	Two log cabins that have recently been built on cleared land, approximately 1.1 km south of the landfall facilities.	High
9 – 12	16 – 19	Ecological receptors along the proposed Pipeline corridor.	†
13	20	Varvarovka village cemetery located to the northwest of the Pipeline corridor at a closest approach of approximately 530 m.	High
14	21	Gai Kodzor war memorials located to the northeast of the proposed landfall facilities at a distance of approximately 4.5 km.	High
15	22	Residential properties to the far east of Gai Kodzor, which are representative of the closest property to the proposed construction traffic bypass route.	High
16	23	Residential properties within Rassvet, which are representative of the properties closest to the proposed construction traffic route	High

Complete.

* Receptor sensitivities are applicable to both noise and vibration.
† Addressed in **Chapter 11 Terrestrial Ecology**.
Note: The receptor locations defined and described in the above table are in the same position as the measurement location numbers specified, as taken from Table 10.1.



LEGEND

Noise and vibration receptor location

Access Roads

Proposed delivery route from Novorossiysk Port

Permanent access road to be constructed by SSTTBV

Temporary access road constructed by SSTTBV

Varvarovka bypass road (used by Project during construction only)

Permanent access road to be constructed by Gazprom Invest

Gazprom Invest temporary bypass road to be utilised by SSTTBV

Russian Sector of South Stream Offshore Pipeline

Proposed landfall section pipelines

Landfall facilities

Proposed microtunnels

Proposed offshore pipelines

Microtunnel entry shaft

Microtunnel exit pit

United Gas Supply System

Russkaya compressor station

United Gas Supply System pipelines

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

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10.6.1.4 Standards and Guidance

The significance criteria utilised are based on applicable Russian legislation, international guidance (e.g. International Finance Corporation (IFC) performance standards) and recognised GIIP. The required and voluntary standards for noise are detailed below in Table 10.6.

Table 10.6 Summary of Applicable Standards and Guidance

Standard	Description	Criteria
International Guidance		
IFC General Environmental, Health and Safety (EHS) Guidelines: Environmental – Section 1.7 noise (Ref. 10.6)	This document provides criteria and guidance to inform the control of noise from a development beyond the property boundaries. The guidance provided relates more to the control of operational noise impacts and is not well suited for the assessment of temporary construction noise effects. The guidance provides absolute noise level limits. However, where the existing ambient noise level is above the prescribed level, it suggests that the noise source being considered should not elevate the ambient by more than 3 dB.	*Residential; institutional and educational receptors* Daytime (07:00 – 22:00) - $L_{Aeq,1\ hr}$ 55 dB Night-time (22:00 – 07:00) $L_{Aeq,1hr}$ 45 dB *Industrial and commercial receptors* Daytime (07:00 – 22:00) - $L_{Aeq,1\ hr}$ 70 dB Night-time (22:00 – 07:00) $L_{Aeq,1hr}$ 70 dB
World Health Organisation (WHO) Guidelines for Community Noise (Ref. 10.1)	This document details the results of research undertaken by the WHO into effects of noise on the community. It provides guidance on the levels of internal noise which can have a detrimental effect on resting, sleeping and work requiring concentration amongst others. This is specifically related to noise sources such as road traffic and is not applicable to construction noise.	*Inside dwellings* Speech intelligibility, and moderate annoyance, day time and evening L_{Aeq} 35 dB Sleep disturbance L_{Aeq} 30 dB Effective communication in office and schools L_{Aeq} 35 dB *Outside dwellings* To prevent serious annoyance during the daytime and evening L_{Aeq} 55 dB. To prevent sleep disturbance during the night-time period for occupants sleeping with an open bedroom window L_{Aeq} 45 dB.

Continued…

Standard	Description	Criteria
Russian Regulations		
Sanitary norms (CH 2.2.4 / 2.1.8.562-96) – Noise at the working places in rooms of residential and public buildings and in residential areas (Ref. 10.4)	The health requirements for noise pollution (p.9 Table 3) provide regulatory requirements to determine environmental noise impact levels. The allowable broadband noise levels are given within the criteria section. However, octave band limits and L_{Amax} levels are also incorporated into the limits and these are provided below.	*Areas adjacent to residential dwellings* Daytime (07:00 – 23:00) L_{Aeq} 55 dB Night-time (23:00 – 07:00) L_{Aeq} 45 dB *Areas adjacent to hospitals and sanatoria* Daytime (07:00 – 23:00) L_{Aeq} 55 dB Night-time (23:00 – 07:00) L_{Aeq} 45 dB
Sanitary-epidemiological rules and regulations SanPin 2.1.2.2645-10 (Ref. 10.5)	This document details allowable vibration levels in dwellings, due to internal and external sources.	Shown in Table 10.10

Complete.

The Russian regulations (Ref. 10.4) provide a more stringent approach to the limiting of noise than that given in the IFC General EHS Guidelines (Ref. 10.6) as there is no allowance for elevated noise levels where the prevailing ambient noise climate is already over the prescribed noise limit. The Russian standards also incorporate limits within each octave band level, in addition to a limit value on the maximum noise level L_{Amax}. Therefore, as the Russian regulations provide the most stringent criteria from the standards and guidance applicable, these have been adopted for the purposes of assessing noise impacts. The noise level criteria from page 9, Table 3 of the Russian regulations (Ref. 10.4) are reproduced below in Table 10.7.

Table 10.7 Allowable Sound Levels from Russian Regulation Sanitary Norms

Receptor	Time of day	Octave Band Centre Frequency / Hz with corresponding sound pressure level / dB									L_{Aeq} / dB	L_{Amax} / dB
		31.5	63	125	250	500	1k	2k	4k	8k		
Areas immediately adjacent to residential receptors	07:00 – 23:00	90	75	66	59	54	50	47	45	44	55	70
	23:00 – 07:00	83	67	57	49	44	40	37	35	33	45	60

Continued…

Receptor	Time of day	Octave Band Centre Frequency / Hz with corresponding sound pressure level / dB									L_{Aeq} / dB	L_{Amax} / dB
		31.5	63	125	250	500	1k	2k	4k	8k		
Areas immediately adjacent to hospital and sanatoria	07:00 – 23:00	83	67	57	49	44	40	37	35	33	45	60
	23:00 – 07:00	76	59	48	40	34	30	27	25	23	35	50

Complete.

It should be noted that according to Note 2 which accompanies the above Russian regulations (Ref. 10.4), the equivalent and maximum noise levels for noise generated by motor vehicles and railway transport are allowable at levels 10 dB(A) above the limit stipulated. However, it is understood that this limit is solely used for the purposes of noise from railway transport, and noise from motor vehicles should instead be assessed against the noise criteria given in Table 10.7. Therefore, Note 2 has not been considered in the assessment for the impacts of noise from construction equipment and vehicle movements; a more conservative appraisal of the potential noise impacts has thus been undertaken.

The above standards were considered to develop impact assessment criteria compliant with Russian legislation and which can be meaningfully applied to the Project.

As the Russian legislation defines a single absolute noise level limit, it has been necessary to develop noise level criteria that can be applied to define the "high" to "not significant" impact magnitudes. It is considered that as the broadband daytime (55 dB(A)) and night time (45 (dB(A)) noise levels correspond to the WHO levels to prevent serious annoyance and to prevent sleep disturbance during the night time with an open bedroom window, respectively, these noise levels are attributed to correspond to a "low" impact magnitude.

The defined absolute noise level limits apply solely to noise emitted by the Project, and have no regard to prevailing baseline noise levels. It has been established that the prevailing ambient noise climate at a range of receptors already exceeds the absolute criteria. These exceedances are considered to be part of prevailing baseline environment and are not as a result of activities associated with the Project. Therefore, it will be necessary to attribute the noise from activities associated with the Project at these locations in the absence of the prevailing ambient noise. This issue will be further detailed within the overarching Monitoring Programme.

Adoption of the absolute noise level criteria and applying these to the noise from the South Stream Offshore Pipeline operations only will ensure that there is no significant change in the noise climate where prevailing ambient noise levels may exceed the limit. In such circumstances where the ambient noise climate may exceed the adopted day and night time limits, the IFC guidelines suggest that the overall change in noise level should be limited to no more than 3 dB(A). Adopting the Russian legislation noise limits and applying these to noise from the South Stream Offshore Pipeline operations will ensure that, where prevailing ambient noise levels are greater than the limit, the resulting change in noise level will be no more than 3 dB(A), and therefore compliant with the IFC guidelines.

It should be noted that the IFC guidelines define the daytime period as 07:00 to 22:00 hours, and the night time period as 22:00 to 07:00 hours. However, the Russian regulation Sanitary Norms specify the daytime period as 07:00 to 23:00 hours, and the night time period as 23:00 to 07:00 hours. Therefore the IFC guidelines time periods are considered to be slightly more onerous as they specify a slightly longer night time period. Therefore, for the assessment of the noise impacts the IFC guideline time periods for day and night time have been adopted, thereby ensuring a worst case approach to the assessment.

The development of the noise impact magnitude classifications has also considered human perception to changes in noise levels. A 3 dB(A) change in noise level is only just perceptible to the human ear. Therefore, noise level bands covering 5 dB have been adopted where changes in the corresponding noise level would be clearly perceptible to any receptors. The adopted noise bands corresponding to defined impact magnitudes are shown in Table 10.8.

10.6.1.5 Impact Magnitude

Table 10.8 defines the magnitude of noise impacts on human receptors during all Project phases. The limit values and categorisation criteria are based on applicable noise legislative requirements and guidance. Russian standards and legislation do not differentiate between long and short duration noise sources affecting residential receptors. Therefore, the magnitude of impacts has been developed on the absolute noise level criteria within these standards.

Table 10.8 Noise Impact Magnitude at Receptors

Magnitude	Description	Limits Values										
High	Noise levels greater than 5 dB above the Allowable Sound Levels from Russian Standard Sanitary norms (CH 2.2.4 / 2.1.8.562-96) (Ref. 10.4)	*Time of day*	*Octave Band Centre Frequency / Hz with corresponding sound pressure level / dB*								*LAeq / dB*	*Lmax / dB*
			31.5	*63*	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*		
		07:00 – 22:00	>=95	>=80	>=71	>=64	>=59	>=55	>=52	>=50	>=49	>=60	>=75
		22:00 – 07:00	>=88	>=72	>=62	>=54	>=49	>=45	>=42	>=40	>=38	>=50	>=65
Moderate	Noise levels up to 5 dB above the Allowable Sound Levels from Russian Standard Sanitary norms (CH 2.2.4 / 2.1.8.562-96) (Ref. 10.4)	*Time of day*	*Octave Band Centre Frequency / Hz with corresponding sound pressure level / dB*								*LAeq / dB*	*Lmax / dB*
			31.5	*63*	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*		
		07:00 – 22:00	90=<95	75=<80	66=<71	59=<64	54=<59	50=<55	47=<52	45=<50	44=<49	55=<60	70=<75
		22:00 – 07:00	83=<88	67=<72	57=<62	49=<54	44=<49	40=<45	37=<42	35=<40	33=<38	45=<50	60=<65

Continued…

Magnitude	Description	Limits Values											
Low	Noise levels below 5 dB of the Allowable Sound Levels from Russian Standard Sanitary norms (CH 2.2.4 / 2.1.8.562-96) (Ref. 10.4)	*Time of day*	*Octave Band Centre Frequency / Hz with corresponding sound pressure level / dB*									*LAeq / dB*	*Lmax / dB*
			31.5	***63***	***125***	***250***	***500***	***1k***	***2k***	***4k***	***8k***		
		07:00 – 22:00	85=<90	70=<75	61=<66	54=<59	49=<54	45=<50	42=<47	40=<45	39= <44	50=<55	65= <70
		22:00 – 07:00	78=<83	62=<67	52=<57	44=<49	39=<44	35=<40	32=<37	30=<35	28= <33	40=<45	55= <60
Negligible	Noise levels less than 5 dB below the Allowable Sound Levels from Russian Standard Sanitary norms (CH 2.2.4 / 2.1.8.562-96) (Ref. 10.4)	*Time of day*	*Octave Band Centre Frequency / Hz with corresponding sound pressure level / dB*									*LAeq / dB*	*Lmax / dB*
			31.5	***63***	***125***	***250***	***500***	***1k***	***2k***	***4k***	***8k***		
		07:00 – 22:00	<85	<70	<61	<54	<49	<45	<42	<40	<39	<50	<65
		22:00 – 07:00	<78	<62	<52	<44	<39	<35	<32	<30	<28	<40	<55

Complete.

Vibration impact magnitude criteria were developed based on Russian Regulation SanPin 2.1.2.2645-10, which imposes absolute limits on vibration within residential buildings (Ref. 10.5). The specific vibration limits at residential receptors are summarised in Table 10.9.

Table 10.9 Vibration Limits at Residential Receptors

Octave Band Centre Frequency / Hz	Vibration Acceleration Limit mm/s^2	Vibration Velocity Limit mm/s
2	4.0	0.32
4	4.5	0.18
8	5.6	0.11
16	11.0	0.11
31.5	22.0	0.11
63	45.0	0.11
Overall	4.0	0.11

The adopted vibration criteria have been derived from the above limits and are based upon the vibration velocity. For vibration velocities below the criterion of 0.11 mm/s the resulting levels are unlikely to be perceptible to human subjects. Therefore, for vibration levels below 0.11 mm/s, the impact magnitude is classified as being negligible. Vibration velocities less than 1 mm/s are generally tolerable by human subjects for short-term construction operations, where the residents are kept informed of the progress of such works (Ref. 10.7). Therefore, for vibration velocities below 1 mm/s the impact magnitude is categorised as low. At vibration velocities of 10 mm/s, there is the potential for superficial damage to building structures, for example cracks may appear in plaster. Therefore, for vibration velocities up to 10 mm/s the impact magnitude is classified as being moderate. For vibration velocities of 10 mm/s and above the impact magnitude is classified as being high. The above criteria have been used to derive the vibration magnitude criteria presented in Table 10.10.

The adopted criteria for construction vibration impact magnitudes are shown in Table 10.10. The laying of the Pipeline below ground and the relatively low levels of vibration anticipated from gas flow through the Pipeline or pigging activities, coupled with the offshore exclusion zone that will prohibit certain types of development within 410 metres of the Pipeline corridor have been collectively considered and it is concluded that the resulting potential impacts from operational vibration will be negligible. As there are no identified significant sources of ground borne vibration during other phases of the development, vibration has not been considered for other phases.

Table 10.10 Construction Vibration Impact Magnitude

Magnitude	Description
High	Vibration velocity >= 10 mm/s
Moderate	Vibration velocity 1 mm/s =< 10 mm/s
Low	Vibration velocity 0.11 mm/s =< 1 mm/s
Negligible	Vibration velocity less than 0.11 mm/s

10.6.1.6 Modelling Methodology

Noise predictions have been carried out using International Organisation for Standardisation (ISO) Standard 9613, Acoustics – Attenuation of Sound during Propagation Outdoors (Ref. 10.8). The propagation model described in Part 2 of this standard provides for the prediction of sound pressure levels based on either short-term downwind (i.e. worst case) conditions or long-term overall averages. For a downwind condition (for wind blowing 1 to 5 m/s from the proposed site towards the nearby receptors) worst-case noise levels will occur. When the wind is blowing in the opposite direction, noise levels may be significantly lower than those predicted. The ISO propagation model calculates the predicted sound pressure level by taking the source sound power level for each source and subtracting a number of attenuation factors according to the following:

Predicted Noise Level = $L_{WA} + D - A_{geo} - A_{atm} - A_{gr} - A_{bar} - A_{misc}$

These factors are discussed in detail below.

The Sound Power Level (L_{WA}) defines the total acoustic power radiated by a noise source expressed in decibels (dB) per 1 pico Watt (pW). Source noise terms for the various noise sources that will be utilised during the Construction Phase have been obtained from published data detailed within British Standard 5228 (Ref. 10.7).

The directivity factor (D) allows for an adjustment to be made where the sound radiated in the direction of interest is higher than that for which the sound power level is specified. For the purposes of the assessment, which considers construction plant operating at ground level and vessels on water, no directivity factor is considered. Other Project Activities as part of the Pre-Commissioning and Operational Phases have a different directivity factor; however, these have not been modelled for reasons explained in the relevant sections.

The geometrical divergence (A_{geo}) accounts for spherical spreading of the noise from the source within free-field conditions. The construction plant and associated noise sources can be considered as point noise sources, given the distance of receptors from proposed works, and therefore the attenuation due to distance may be calculated from:

- A_{geo} = 20.log (d) + 11; and
- Where (d) is the distance from the source to the receptor.

The atmospheric absorption factor (A_{atm}) considers the attenuation offered by the atmosphere as a result of the conversion of sound to heat. The degree of attenuation is dependent on the relative humidity and temperature of the air through which the sound is travelling and is frequency dependent. Increasing attenuation occurs towards the higher frequencies of sound.

Modelling parameters have assumed an ambient temperature of 10°C and 70% relative humidity which are found to result in worst case noise propagation. The annual average air temperature is 12.1°C, which fits well with the modelled parameters. The corresponding atmospheric attenuation factors are summarised below in Table 10.11.

Table 10.11 Atmospheric Attenuation (dB/km) at 10°C and 70% Relative Humidity

Octave Band Centre Frequency / Hz	63	125	250	500	1k	2k	4k	8k
Atmospheric Absorption Coefficient dB / km	0.122	0.411	1.04	1.93	3.68	9.66	32.8	117

The ground effect (A_{gr}) is the result of sound reflected by the ground interfering with the sound propagating directly from source to receiver, and the interaction of the sound with porous and absorptive ground cover. The prediction of ground effects depends on the source height, receiver height, propagation height between the source and receiver and the ground conditions.

The ground conditions are described according to a variable defined as G, which varies between 0 for 'hard' ground (includes paving, water, ice, concrete and any locations with low porosity) and 1 for 'soft' ground (includes ground covered by grass, trees or other vegetation). Predictions have been carried out using a receiver height of 1.5 m and an assumed ground factor (G=0.8). This ground factor corresponds to 20% of the ground being hard ground conditions between the source and receiver and represents a worst-case scenario. All areas where the sound is travelling over water are treated as being acoustically reflective (G=0).

The effect of any barrier or topographical obstruction (A_{bar}) between the noise source and the receiver position is that noise will be reduced according to the relative heights of the source, receiver and barrier and the frequency spectrum of the noise.

The predicted noise levels have been calculated using CADNA-A noise modelling software (Ref. 10.9), which implements the ISO 9613-2 prediction methodology. The predicted noise levels at receptors consider solely the noise from activities associated with the Project. Pre-existing ambient noise levels are not considered within the predictions, as the Russian regulations require that noise from South Stream activities achieves the absolute noise level criteria.

Noise levels have been calculated at the identified discrete receptor locations. Additionally, noise contour maps have been produced across the Wider Study Area at a height of 1.5 m above ground level.

Construction activity will vary in both intensity and location over time. Consequently, for the purposes of this noise impact assessment, eight different sub-phases within the Construction Phase were identified, focusing on stages where different activities overlap, some with pre-commissioning phases, and which likely represent peak activity levels for the Project (Table

10.12). It should be noted that this includes pre-commissioning activities during the later stages of the construction schedule.

Seven of these sub-phases relate to daytime construction activities and the eighth to night time construction activities

There are seven sub-phases that were used as the basis for different model simulations during the daytime period (Model References 1 – 7 in Table 10.12), which have been used to generate the set of noise contour plots. The different model simulations consider the peak activities that would occur throughout the Construction Phase. These, therefore, consider the worst-case noise impacts that may arise.

The scenarios have not considered the effects of offshore pipe-laying vessels. However, the Scenarios 4 to 7, inclusive, incorporate the impacts associated with the dredging of the micro-tunnel exit pits. This is considered to be representative of the worst case offshore noise impacts associated with the construction of the Pipeline. This is as a result of the dredger being moored at the closest point to the shore, and assumed to be operating continuously, thereby having a great impact at onshore receptor locations. Noise sources terms for the dredger and gantry cranes on the pipe-laying vessels, are broadly comparable. Therefore as pipe-laying vessels will be located at a greater distance offshore than the dredger, and will move further offshore as the construction of the Pipeline progresses, reduced noise levels at onshore receptor locations are anticipated to the levels predicted from dredging activities.

The noise impacts associated with the Varvarovka bypass access road have been modelled based on the vehicle flow data for each of the Scenario time periods. The vehicle flow data comprises a majority of HGV traffic with a small percentage of light vehicles. For the purposes of the assessment it has been assumed that all vehicles predicted to use the Varvarovka bypass route are HGVs, which represents a worst case scenario. The noise impacts have been predicted assuming point noise sources travelling along the access road at the vehicular flow rates shown in Table 10.12. For the purposes of the assessment it has also been assumed that vehicles speeds on the access road are 30 km/h, as a higher speed would not be representative of producing a worst case noise impact.

Night-time noise will result from tunnel boring activities and the operation of generator sets to supply power. This has been assessed in Model Reference 8.

Table 10.12 details the noise models run for the different time periods within the construction and pre-commissioning programme. The source references within Table 10.12 relate to the general activities undertaken. A further breakdown of the plant utilised for each source reference is given in Table 10.13.

Table 10.12 Summary of Noise Models Considered

Model Reference	Time period	General Construction and Pre-Commissioning Activities Involved	Source Reference
1	Q1 2014	Landfall mobilisation (Construction of site facilities and access roads)	S01
		Microtunnel 1 preparation of launch pit (excavation etc.)	S02
		Secant Piling for Microtunnel 1	S09
		Varvarovka Bypass Traffic – 55 vehicle movements / day	S11
2	Q2 2014	Landfall mobilisation (Construction of site facilities and access roads)	S01
		Pipeline Trench excavation (Pipe line 1)	S04
		Microtunnel 1 tunnel boring	S02
		Generator Sets	S10
		Varvarovka Bypass Traffic – 55 vehicle movements / day	S11
3	Q3 2014	Backfill Trench (pipe line 1)	S08
		Pipe lay (pipe line 2)	S07
		Pipe trench excavation (pipe line 3)	S04
		Landfall mobilisation (Construction of site facilities and access roads)	S01
		Landfall facilities (ground levelling, foundations, etc.)	S06
		Microtunnel 1 tunnel boring	S10
		Generator Sets	S10
		Varvarovka Bypass Traffic – 558 vehicle movements / day	S11

Continued…

Model Reference	Time period	General Construction and Pre-Commissioning Activities Involved	Source Reference
4	Q1 2015	Backfill Trench (pipe line 1)	S08
		Pipe lay (pipe line 2)	S07
		Pipe lay (pipe line 3)	S07
		Pipe trench excavation (pipe line 4)	S04
		Landfall mobilisation (Construction of site facilities and access roads)	S01
		Landfall facilities (ground levelling, foundations etc.)	S06
		Microtunnel 1 tunnel boring	S10
		Dredging Exit of Microtunnels	S03
		Varvarovka Bypass Traffic – 138 vehicle movements / day	S11
5	Q2 2015	Backfill Trench (pipe line 2)	S08
		Backfill Trench (pipe line 3)	S08
		Pipe lay (pipe line 4)	S07
		Landfall civils (ground levelling, foundations etc.)	S08
		Microtunnel 1 tunnel boring	S10
		Microtunnel 2 (prepare launch pit)	S02
		Generator Sets	S10
		Dredging Exit of Microtunnels	S03
		Varvarovka Bypass Traffic – 159 vehicle movements / day	S11

Continued...

Model Reference	Time period	General Construction and Pre-Commissioning Activities Involved	Source Reference
6	Q3 2015	Backfill Trench (pipe line 3)	S08
		Backfill Trench (pipe line 4)	S08
		Landfall civils (ground levelling, foundations etc)	S06
		Microtunnel 1 tunnel boring	S10
		Microtunnel 2 (prepare launch pit)	S02
		Generator Sets	S10
		Dredging Exit of Microtunnels	S03
		Varvarovka Bypass Traffic – 91 vehicle movements / day	S11
7	Q4 2015	Microtunnel 2 tunnel boring	S10
		Microtunnel 3 (prepare launch pit)	S02
		Generator Sets	S10
		Dredging Exit of Microtunnels	S03
		Secant Piling of ramps	S09
		Varvarovka Bypass Traffic – 91 vehicle movements / day	S11
		Pre-commissioning landfall and nearshore Pipeline via hydro-testing	S12
8	Night-time period Q4 2014 – Q1 2016	Microtunnel boring	S10
		Generator Sets	S10
		Pre-commissioning whole Pipeline	S13

Complete.

To account for the shifting nature of work locations, various point source locations were used to aggregate the impacts of multiple noise sources, as detailed by the source reference number shown in Table 10.12. Point source locations were selected to represent the areas that would be expected to have the highest levels of activity and greatest number of noise sources.

Work to be undertaken in the nearshore section of the Project is included in the assessment. Activities considered include the dredging of the microtunnel exits. These activities are close to the shoreline and have the potential to impact on terrestrial receptors.

The details of the different plant items used for each source reference given in Table 10.12 are given below in Table 10.13. Source noise data have mainly been sourced from British Standard 5228-1 (Ref. 10.7), which provides sound level data (L_{Aeq}), maximum (L_{Amax}), and octave band data for a wide range of construction machinery. Each of the model simulations utilised this equipment data to predict construction noise level contours, as well as to predict noise levels at the closest sensitive receptors. All the simulations assumed a worst case scenario in which all equipment was operating simultaneously.

Table 10.13 Summary of Source Reference Plant Used in Models

Source Reference	Plant Type	Number	Sound Data Source
S01 – Landfall Mobilisation	Bull-Dozer	4	British Standard 5228 Table C.2 Ref 10
	Grader	2	British Standard 5228 Table D.3 Ref 74
	Tracked Excavator	4	British Standard 5228 Table C.2 Ref 3
	Tipper Lorry	6	British Standard 5228 Table C.2 Ref 32
	Shovel	2	British Standard 5228 Table C.2 Ref 5
	Generator	2	British Standard 5228 Table C.4 Ref 84
S02 – Microtunnel Launch Pit Preparation	Mobile Crane	1	British Standard 5228 Table C.3 Ref 28
	Excavators	4	British Standard 5228 Table C.2 Ref 3
S03 – Dredging Microtunnel Exit Pits	Dredging Vessel	1	British Standard 5228 Table C.7 Ref 2
S04 – Trench Excavation	Bull-Dozer	1	British Standard 5228 Table C.2 Ref 10
	Grader	1	British Standard 5228 Table D.3 Ref 74
	Tracked Excavator	4	British Standard 5228 Table C.2 Ref 3
	Tipper Lorry	2	British Standard 5228 Table C.2 Ref 32
	Shovel	2	British Standard 5228 Table C.2 Ref 5
	Generator	2	British Standard 5228 Table C.4 Ref 84
S05 – Generator Sets	1130 kVA gen set	2	Manufacturers' data – included in overall source terms of micro-tunnelling operations source S10
	810 kVA gen set	2	

Continued...

Source Reference	Plant Type	Number	Sound Data Source
S06 – Landfall Facilities	Bull-Dozer	2	British Standard 5228 Table C.2 Ref 10
	Grader	1	British Standard 5228 Table D.3 Ref 74
	Tracked Excavator	2	British Standard 5228 Table C.2 Ref 3
	Tipper Lorry	2	British Standard 5228 Table C.2 Ref 32
	Shovel	1	British Standard 5228 Table C.2 Ref 5
	Crane	2	British Standard 5228 Table C.4 Ref 52
	Generator	4	British Standard 5228 Table C.4 Ref 84
S07 – Pipeline Installation	Bull-Dozer	1	British Standard 5228 Table C.2 Ref 10
	Grader	1	British Standard 5228 Table D.3 Ref 74
	Tracked Excavator	2	British Standard 5228 Table C.2 Ref 3
	Tipper Lorry	1	British Standard 5228 Table C.2 Ref 32
	Shovel	1	British Standard 5228 Table C.2 Ref 5
	Tracked Side booms	6	British Standard 5228 Table C.2 Ref 5
	Welding Machine	10	British Standard 5228 Table C.4 Ref 85
	Generator	4	British Standard 5228 Table C.4 Ref 84

Continued…

Source Reference	Plant Type	Number	Sound Data Source
S08 – Demobilisation / Reinstatement	Bull-Dozer	1	British Standard 5228 Table C.2 Ref 10
	Grader	1	British Standard 5228 Table D.3 Ref 74
	Tracked Excavator	2	British Standard 5228 Table C.2 Ref 3
	Tipper Lorry	1	British Standard 5228 Table C.2 Ref 32
	Shovel	1	British Standard 5228 Table C.2 Ref 5
	Tracked Side booms	6	British Standard 5228 Table C.2 Ref 5
	Welding Machine	10	British Standard 5228 Table C.4 Ref 85
	Generator	4	British Standard 5228 Table C.4 Ref 84
S09 – Secant Piling	Large rotary bored piling rig	2	British Standard 5228 Table C.3 Ref 14
	Excavator	4	British Standard 5228 Table C.2 Ref 3
	100t-120t rated Tracked Crawler Crane	4	British Standard 5228 Table C.3 Ref 28
	Hydraulic power pack	2	British Standard 5228 Table C.3 Ref 7
S10 – Microtunnel Plant	Separation Plant	2	Manufacturers' data
	Centrifugal Plant	3	
S11 – Varvarovka Bypass Traffic	4 axle HGVs	Variable	British Standard 5228 Table C.2 Ref 34

Continued…

Source Reference	Plant Type	Number	Sound Data Source
S-12 – Pre-commissioning landfall and nearshore Pipeline	Diesel water extraction pumps	2	Manufacturers' data
	Diesel flooding pumps	2	
	Diesel hydrostatic test pumps	2	
	Primary high pressure compressor	2	
	Air drying unit	1	
	Nitrogen membrane unit	1	
S-13 – Pre-commissioning whole Pipeline	Booster compressor	80	Manufacturers' data

Complete.

Each of the source references has been used to establish the overall sound power level for the plant in octave bands. The resulting agglomeration of plant for each source reference has been modelled as a point source within the model. A summary of the sound power levels used for each of the source references is given Table 10.14.

Table 10.14 Summary of Source Reference Sound Power Levels / dB(A)

Source Reference	Octave Band Centre Frequency / Hz							
	63	125	250	500	1k	2k	4k	8k
S01 – Landfall Mobilisation	98.4	109.3	109.0	108.0	111.3	109.2	109.1	101.8
S02 - Microtunnel Launch Pit Preparation	85.7	89.2	96.2	97.6	99.7	99.9	106.6	96.5
S03 – Dredging Microtunnel Exits	86.2	104.3	100.8	104.2	107.4	103.6	96.4	86.3
S04 – Trench Excavation	94.9	106.0	107.2	107.9	110.4	109.0	109.4	102.3
S05 – Generator Sets	91.1	98.2	109.7	109.1	111.3	108.5	99.3	88.2
S06 – Landfall Facilities	97.0	108.0	107.4	107.3	111.4	108.8	108.4	101.4
S07 – Pipeline Installation	93.9	103.7	106.8	106.8	109.3	108.2	110.9	102.0
S08 – Demobilisation/Reinstatement	94.9	105.5	106.9	107.1	109.8	108.2	109.0	101.2
S09 – Secant Piling	91.0	105.7	103.6	106.9	108.4	107.6	103.0	97.1
S10 – Microtunnel Plant	74.0	86.0	100.0	104.0	107.0	106.0	102.0	65.0
S11 – HGV per vehicle	101	106	106	106	102	101	96	94
S12 - Pre-commissioning plant (all)	109.5	109.5	109.5	109.5	109.5	109.5	109.5	109.5
S13 – Booster compressor (single)	122.6	127.6	126.6	124.6	127.6	132.6	129.6	122.6

It is also necessary to consider the L_{Amax} noise levels from construction operations, with regard to the criteria defined within the Russian Standard (Ref. 10.4).

Therefore, a review of available L_{Amax} data has been undertaken from the published data contained within British Standard 5228. Data have been identified for specific items of plant where data exists for both the L_{Aeq} and L_{Amax} noise levels. The corresponding L_{Amax} levels have been compared with the L_{Aeq} levels to identify how much higher they are. A summary of the plant identified, the corresponding noise levels, and noise level difference are given below in Table 10.15.

Table 10.15 Comparison of L_{Aeq} and L_{Amax} Noise Levels for Specific Plant

Plant	British Standard 5228 Reference	Activity L_{Aeq} @10 m / dB	British Standard 5228 Reference	Activity L_{Amax} @10 m/ dB	Difference / dB(A)
Bull-Dozer	C.2 Ref 10	80	C.5 Ref 11	86	6
Grader	D.3 Ref 74	77	C.6 Ref 31	86	9
Tipper	C.2 Ref 32	85	C.6 Ref 15	90	5
Shovel	C.2 Ref 5	76	C.10 Ref 16	85	9

The analysis of typical construction plant noise levels indicates that typically the L_{Amax} noise levels range from 5 to 9 dB(A) above the corresponding L_{Aeq} noise level. Therefore, in order to assess the typical L_{Amax} noise levels that may arise from construction activities, it is assumed that L_{Amax} noise levels are 10 dB(A) above the predicted L_{Aeq} noise levels at all receptor locations.

10.6.2 Assessment of Potential Impacts: Construction and Pre-Commissioning Phase

10.6.2.1 Introduction

This section of the chapter assesses the noise and vibration impacts arising during the Construction and Pre-Commissioning Phase in the nearshore and landfall sections of the Project.

10.6.2.2 Assessment of Potential Impacts (pre-mitigation)

Pipeline and Landfall Construction and Pre-Commissioning Activities

The noise emissions from activities associated with traffic on existing roads and port operations are treated separately.

The following noise generating activities have been identified:

- Onshore construction activities (e.g. noise emissions associated with the operation of construction vehicles, plant and equipment);
- Microtunnelling activities (e.g. noise emissions associated with the operation of construction vehicles, plant and equipment); and
- Pre-commissioning activities (e.g. noise emissions associated with operation of pumps used during hydro-testing, and boost compressors).

The assessment of noise impacts on human receptors resulting from these activities is discussed below. Only human receptors in the vicinity of the landfall area have been included in this assessment.

The predicted daytime noise levels for Model References 1 to 7, inclusive, are presented below in Table 10.16 to Table 10.22 respectively.

The predicted night time noise levels from Model Reference 8 are presented below in Table 10.23. The tables also provide the Impact Magnitude, based on the criteria in Table 10.8, developed from the Russian Standard (Ref. 10.4).

It should be noted that Model Reference 8 considers the impacts associated with the operations that will be undertaken 24 hour per day. These have been assessed with regard to the night time noise level criteria only. Achieving the night time noise level limit, which is 10 dB below the daytime limit, will ensure that noise from these sources will make a negligible contribution to cumulative construction and pre-commissioning daytime noise levels.

Table 10.16 Model Reference 1 - Predicted Daytime Construction Noise Levels

Receptor	Predicted Noise Level (dB)										Impact Magnitude
	Octave Band Centre Frequency / Hz										
	63	125	250	500	1k	2k	4k	8k	L_{Aeq}	L_{Amax}	
1	55	47	36	35	33	22	22	0	38	48	Negligible
2	51	42	31	31	28	16	16	0	33	43	Negligible
3	44	43	32	31	27	18	18	0	33	43	Negligible
4	47	46	38	41	41	40	40	33	45	55	Negligible
5	60	55	40	43	46	42	42	27	49	59	Negligible
6	46	45	34	31	28	16	16	0	34	44	Negligible
7	36	33	21	16	8	0	0	0	20	30	Negligible
8	47	46	35	32	29	18	18	0	35	45	Negligible
9	55	59	46	48	47	43	43	34	51	61	N/A
10	58	50	38	38	37	28	28	3	42	52	N/A
11	54	55	43	41	41	37	37	26	46	56	N/A
12	65	57	43	41	45	40	40	28	49	59	N/A

Continued...

Receptor	Predicted Noise Level (dB)										Impact Magnitude
	Octave Band Centre Frequency / Hz										
	63	125	250	500	1k	2k	4k	8k	L_{Aeq}	L_{Amax}	
13	50	49	38	37	35	29	29	17	40	50	Negligible
14	34	32	19	13	4	0	0	0	18	28	Negligible
15	31	28	14	7	0	0	0	0	14	24	Negligible
16	28	24	8	0	0	0	0	0	9	19	Negligible

Note - The predicted noise levels for receptors of low sensitivity (Receptor 5 – unoccupied residential property) and ecological receptors (Receptors 9, 10, 11, and 12) are presented within the greyed out cells. The impact magnitude for Receptor 5 within the table is based on the property being occupied during construction works and hence having a high sensitivity – although it is not expected that this will occur. Predicted noise levels above the criteria are shown in bold italics.

Complete.

Table 10.17 Model Reference 2 - Predicted Daytime Construction Noise Levels

Receptor	Predicted Noise Level (dB)										Impact Magnitude
	Octave Band Centre Frequency / Hz										
	63	125	250	500	1k	2k	4k	8k	L_{Aeq}	L_{Amax}	
1	55	45	42	39	36	26	26	1	41	51	Negligible
2	51	40	37	35	33	21	21	0	37	47	Negligible
3	45	42	35	33	29	19	19	0	34	44	Negligible
4	47	46	39	41	41	40	40	33	45	55	Negligible
5	62	51	48	47	***51***	46	***46***	33	53	63	Low
6	47	44	38	34	31	18	18	0	36	46	Negligible
7	36	33	23	17	8	0	0	0	21	31	Negligible
8	48	45	38	34	31	19	19	0	37	47	Negligible
9	56	54	53	52	52	48	48	41	56	66	N/A
10	58	48	44	41	40	31	31	8	44	54	N/A

Continued…

Receptor	Predicted Noise Level (dB)										Impact Magnitude
	Octave Band Centre Frequency / Hz										
	63	125	250	500	1k	2k	4k	8k	L_{Aeq}	L_{Amax}	
11	55	55	44	42	42	37	37	26	46	56	N/A
12	65	57	43	42	45	40	40	28	49	59	N/A
13	50	48	41	39	37	30	30	17	41	51	Negligible
14	35	31	21	15	4	0	0	0	19	29	Negligible
15	32	28	16	8	0	0	0	0	14	24	Negligible
16	28	24	8	0	0	0	0	0	9	19	Negligible

Note - The predicted noise levels for receptors of low sensitivity (Receptor 5 – unoccupied residential property) and ecological receptors (Receptors 9, 10, 11, and 12) are presented within the greyed out cells. The impact magnitude for Receptor 5 within the table is based on the property being occupied during construction works and hence having a high sensitivity – although it is not expected that this will occur. Predicted noise levels above the criteria are shown in bold italics

Complete.

Table 10.18 Model Reference 3 - Predicted Daytime Construction Noise Levels

Receptor	Predicted Noise Level (dB)										Impact Magnitude
	Octave Band Centre Frequency / Hz										
	63	125	250	500	1k	2k	4k	8k	L_{Aeq}	L_{Amax}	
1	58	49	40	39	38	29	29	5	42	52	Negligible
2	56	44	35	34	34	22	22	0	38	48	Negligible
3	48	46	37	39	34	28	28	9	40	50	Negligible
4	54	55	48	51	***51***	***50***	***50***	43	***55***	65	Moderate
5	64	55	44	45	49	45	45	34	52	62	Low
6	50	48	38	36	34	24	24	0	39	49	Negligible
7	39	36	25	24	15	0	0	0	25	35	Negligible
8	50	49	39	38	35	26	26	1	40	50	Negligible

Continued...

Receptor	Predicted Noise Level (dB)										Impact Magnitude
	Octave Band Centre Frequency / Hz										
	63	125	250	500	1k	2k	4k	8k	L_{Aeq}	L_{Amax}	
9	67	63	52	52	54	51	51	48	58	68	N/A
10	62	55	46	45	45	39	39	32	49	59	N/A
11	57	58	47	47	48	45	45	34	52	62	N/A
12	67	59	46	45	49	43	43	30	52	62	N/A
13	53	52	43	43	42	39	39	27	46	56	Negligible
14	37	34	23	21	11	0	0	0	22	32	Negligible
15	34	31	18	13	0	0	0	0	17	27	Negligible
16	31	27	12	7	0	0	0	0	13	23	Negligible

Note - The predicted noise levels for receptors of low sensitivity (Receptor 5 – unoccupied residential property) and ecological receptors (Receptors 9, 10, 11, and 12) are presented within the greyed out cells. The impact magnitude for Receptor 5 within the table is based on the property being occupied during construction works and hence having a high sensitivity – although it is not expected that this will occur. Predicted noise levels above the criteria are shown in bold italics

Complete.

Table 10.19 Model Reference 4 - Predicted Daytime Construction Noise Levels

Receptor	Predicted Noise Level (dB)										Impact Magnitude
	Octave Band Centre Frequency / Hz										
	63	125	250	500	1k	2k	4k	8k	L_{Aeq}	L_{Amax}	
1	60	49	40	39	39	30	30	7	43	53	Negligible
2	55	45	36	34	33	21	21	0	37	47	Negligible
3	51	45	36	34	32	21	21	1	37	47	Negligible
4	49	49	41	44	43	42	42	35	48	58	Negligible
5	63	52	43	43	48	43	43	31	50	60	Low
6	51	49	40	37	35	24	24	0	40	50	Negligible

Continued...

Receptor	Predicted Noise Level (dB)										Impact Magnitude
	Octave Band Centre Frequency / Hz										
	63	125	250	500	1k	2k	4k	8k	L_{Aeq}	L_{Amax}	
7	39	36	24	20	11	0	0	0	23	33	Negligible
8	52	50	41	39	36	26	26	2	41	51	Negligible
9	59	58	50	50	50	47	47	43	54	64	N/A
10	67	59	47	46	49	45	45	38	53	63	N/A
11	67	60	47	46	49	44	44	33	53	63	N/A
12	66	56	44	43	47	41	41	27	50	60	N/A
13	54	52	42	41	40	33	33	19	44	54	Negligible
14	38	34	22	17	7	0	0	0	21	31	Negligible
15	35	31	18	10	0	0	0	0	17	27	Negligible
16	31	27	11	3	0	0	0	0	12	22	Negligible

Note - The predicted noise levels for receptors of low sensitivity (Receptor 5 – unoccupied residential property) and ecological receptors (Receptors 9, 10, 11, and 12) are presented within the greyed out cells. The impact magnitude for Receptor 5 within the table is based on the property being occupied during construction works and hence having a high sensitivity – although it is not expected that this will occur. Predicted noise levels above the criteria are shown in bold italics

Complete.

Table 10.20 Model Reference 5 - Predicted Daytime Construction Noise Levels

Receptor	Predicted Noise Level (dB)										Impact Magnitude
	Octave Band Centre Frequency / Hz										
	63	125	250	500	1k	2k	4k	8k	L_{Aeq}	L_{Amax}	
1	57	48	40	39	38	29	29	6	42	52	Negligible
2	54	45	36	35	34	23	23	0	38	48	Negligible
3	45	43	34	34	29	20	20	1	35	45	Negligible
4	48	48	40	43	43	42	42	35	48	58	Negligible

Continued...

Receptor	Predicted Noise Level (dB)										Impact Magnitude
	Octave Band Centre Frequency / Hz										
	63	125	250	500	1k	2k	4k	8k	L_{Aeq}	L_{Amax}	
5	64	54	44	44	48	43	43	30	51	61	Low
6	48	46	38	36	32	21	21	0	37	47	Negligible
7	36	33	22	18	9	0	0	0	21	31	Negligible
8	49	47	39	36	33	23	23	0	38	48	Negligible
9	62	62	53	52	52	50	50	49	57	67	N/A
10	63	56	45	43	45	40	40	29	49	59	N/A
11	64	57	46	45	47	43	43	34	51	61	N/A
12	62	53	42	41	44	39	39	28	47	57	N/A
13	52	50	41	40	39	33	33	19	43	53	Negligible
14	35	32	20	16	5	0	0	0	19	29	Negligible
15	32	28	15	9	0	0	0	0	14	24	Negligible
16	25	20	7	0	0	0	0	0	6	16	Negligible

Note - The predicted noise levels for receptors of low sensitivity (Receptor 5 – unoccupied residential property) and ecological receptors (Receptors 9, 10, 11, and 12) are presented within the greyed out cells. The impact magnitude for Receptor 5 within the table is based on the property being occupied during construction works and hence having a high sensitivity – although it is not expected that this will occur. Predicted noise levels above the criteria are shown in bold italics

Complete.

Table 10.21 Model Reference 6 - Predicted Daytime Construction Noise Levels

Receptor	Predicted Noise Level (dB)										Impact Magnitude
	Octave Band Centre Frequency / Hz										
	63	125	250	500	1k	2k	4k	8k	L_{Aeq}	L_{Amax}	
1	56	47	38	36	36	25	25	0	39	49	Negligible
2	52	44	34	33	31	20	20	0	36	46	Negligible

Continued...

Receptor	Predicted Noise Level (dB)										Impact Magnitude
	Octave Band Centre Frequency / Hz										
	63	125	250	500	1k	2k	4k	8k	L_{Aeq}	L_{Amax}	
3	45	43	33	32	28	18	18	0	34	44	Negligible
4	47	46	38	40	40	38	38	31	44	54	Negligible
5	61	51	42	43	46	42	42	27	49	59	Negligible
6	48	46	37	34	31	20	20	0	37	47	Negligible
7	37	34	22	18	9	0	0	0	21	31	Negligible
8	49	47	37	35	33	22	22	0	38	48	Negligible
9	56	56	47	48	48	44	44	37	52	62	N/A
10	60	51	42	40	40	31	31	9	44	54	N/A
11	62	56	44	43	45	41	41	30	49	59	N/A
12	65	56	43	42	47	40	40	28	50	60	N/A
13	51	49	39	38	37	29	29	15	41	51	Negligible
14	35	32	20	15	5	0	0	0	19	29	Negligible
15	32	29	15	8	0	0	0	0	15	25	Negligible
16	29	24	9	1	0	0	0	0	10	20	Negligible

Note - The predicted noise levels for receptors of low sensitivity (Receptor 5 – unoccupied residential property) and ecological receptors (Receptors 9, 10, 11, and 12) are presented within the greyed out cells. The impact magnitude for Receptor 5 within the table is based on the property being occupied during construction works and hence having a high sensitivity – although it is not expected that this will occur. Predicted noise levels above the criteria are shown in bold italics

Complete.

Table 10.22 Model Reference 7 - Predicted Daytime Construction Noise Levels

Receptor	Predicted Noise Level (dB)										Impact Magnitude
	Octave Band Centre Frequency / Hz										
	63	125	250	500	1k	2k	4k	8k	L_{Aeq}	L_{Amax}	
1	66	48	37	36	33	24	24	0	44	54	Negligible
2	62	43	32	32	29	18	18	0	40	50	Negligible
3	55	43	33	31	26	16	16	0	35	45	Negligible
4	55	45	36	38	37	36	36	29	43	53	Negligible
5	66	54	41	43	47	42	42	27	50	60	Low
6	57	45	35	33	28	17	17	0	37	47	Negligible
7	46	34	21	17	6	0	0	0	25	35	Negligible
8	58	46	36	34	29	19	19	0	38	48	Negligible
9	59	59	46	49	48	45	45	37	53	63	N/A
10	69	50	39	39	37	29	29	4	47	57	N/A
11	65	55	43	42	39	37	37	26	47	57	N/A
12	76	57	44	43	43	40	40	29	54	64	N/A
13	60	49	38	38	34	28	28	13	41	51	Negligible
14	45	32	19	14	2	0	0	0	23	33	Negligible
15	42	28	14	7	0	0	0	0	20	30	Negligible
16	39	24	8	0	0	0	0	0	17	27	Negligible

Note - The predicted noise levels for receptors of low sensitivity (Receptor 5 – unoccupied residential property) and ecological receptors (Receptors 9, 10, 11, and 12) are presented within the greyed out cells. The impact magnitude for Receptor 5 within the table is based on the property being occupied during construction works and hence having a high sensitivity – although it is not expected that this will occur. Predicted noise levels above the criteria are shown in bold italics

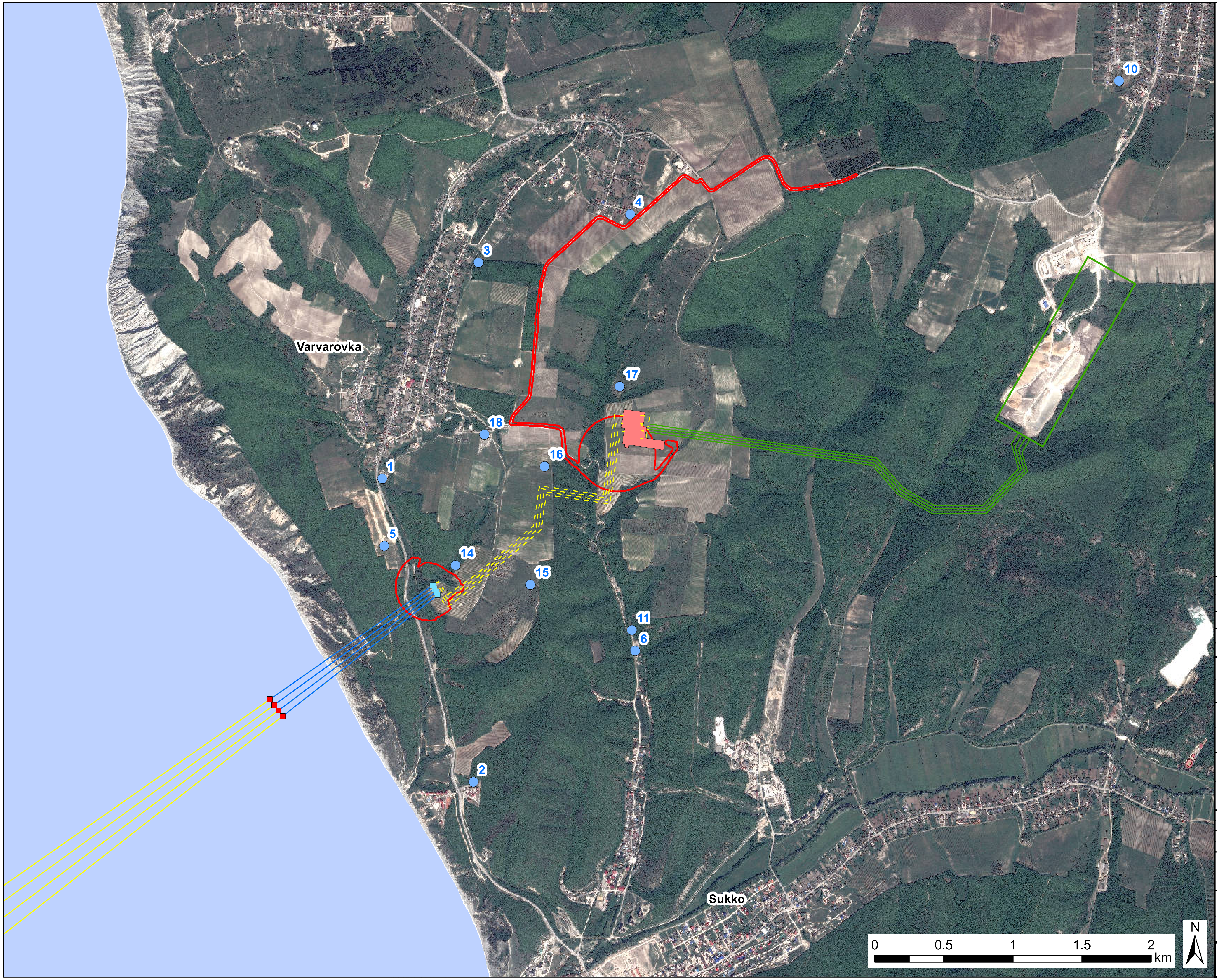
Table 10.23 Model Reference 8 - Predicted Night Time Construction Noise Levels

Receptor	Predicted Noise Level (dB)										Impact Magnitude
	Octave Band Centre Frequency / Hz										
	63	125	250	500	1k	2k	4k	8k	L_{Aeq}	L_{Amax}	
1	**70**	**66**	**61**	**60**	**63**	**58**	**58**	14	**66**	**66**	High
2	63	**62**	**58**	**55**	**55**	**46**	**46**	0	**58**	58	High
3	60	**63**	**59**	**56**	**56**	**50**	**50**	5	**60**	**60**	High
4	62	**65**	**61**	**59**	**59**	**52**	**52**	6	**62**	**62**	High
5	**68**	**65**	**61**	**59**	**62**	**56**	**56**	24	**64**	**64**	High
6	65	**68**	**64**	**62**	**63**	**59**	**59**	25	**66**	**66**	High
7	52	54	48	42	38	15	15	0	44	44	Low
8	66	**69**	**65**	**64**	**65**	**62**	**62**	32	**69**	**69**	High
9	62	64	60	57	58	54	54	29	62	62	N/A
10	71	70	66	65	68	67	67	39	72	72	N/A
11	80	77	72	72	77	80	80	62	83	83	N/A
12	78	77	72	72	76	78	78	61	81	81	N/A
13	66	**69**	**65**	**63**	**65**	**64**	**64**	**36**	**69**	**69**	High
14	49	50	44	38	33	6	6	0	40	40	Low
15	46	46	38	31	23	0	0	0	35	35	Negligible
16	45	46	37	27	13	0	0	0	33	33	Negligible

Note - The predicted noise levels for receptors of low sensitivity (Receptor 5 – unoccupied residential property) and ecological receptors (Receptors 9, 10, 11, and 12) are presented within the greyed out cells. The impact magnitude for Receptor 5 within the table is based on the property being occupied during construction works and hence having a high sensitivity – although it is not expected that this will occur. Predicted noise levels above the criteria are shown in bold italics. The predicted noise levels from daytime construction operations are shown graphically within Figures 10.3 to 10.9 for Model References 1 to 7, inclusive. The 55 dB L_{Aeq} noise level contour is shown in red on the figures relative to the identified receptor locations.

The predicted daytime noise impacts from Models References 1 to 7, inclusive, are given in Figure 10.3 to Figure 10.9, respectively, which indicates the location of the 55 dB L_{Aeq} noise contour.

Plot Date: 28 Feb 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 10 Noise\Figure 10.3 Scenario 1 Daytime Noise Levels.mxd



LEGEND

Scenario 1

55dB(A)

Noise survey locations

Russian Sector of South Stream Offshore Pipeline

Proposed landfall section pipelines

Landfall facilities

Proposed microtunnels

Proposed offshore pipelines

Microtunnel entry shaft

Microtunnel exit pit

United Gas Supply System

Russkaya compressor station

United Gas Supply System Pipelines

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue

For Information

Client

South Offshore Pipeline Stream ENERGISING EUROPE

Project Title

SOUTH STREAM
OFFSHORE PIPELINE

Drawing Title

SCENARIO 1
DAYTIME NOISE LEVELS

Drawn	Checked	Approved	Date
DH	RW	MW	28/02/2014

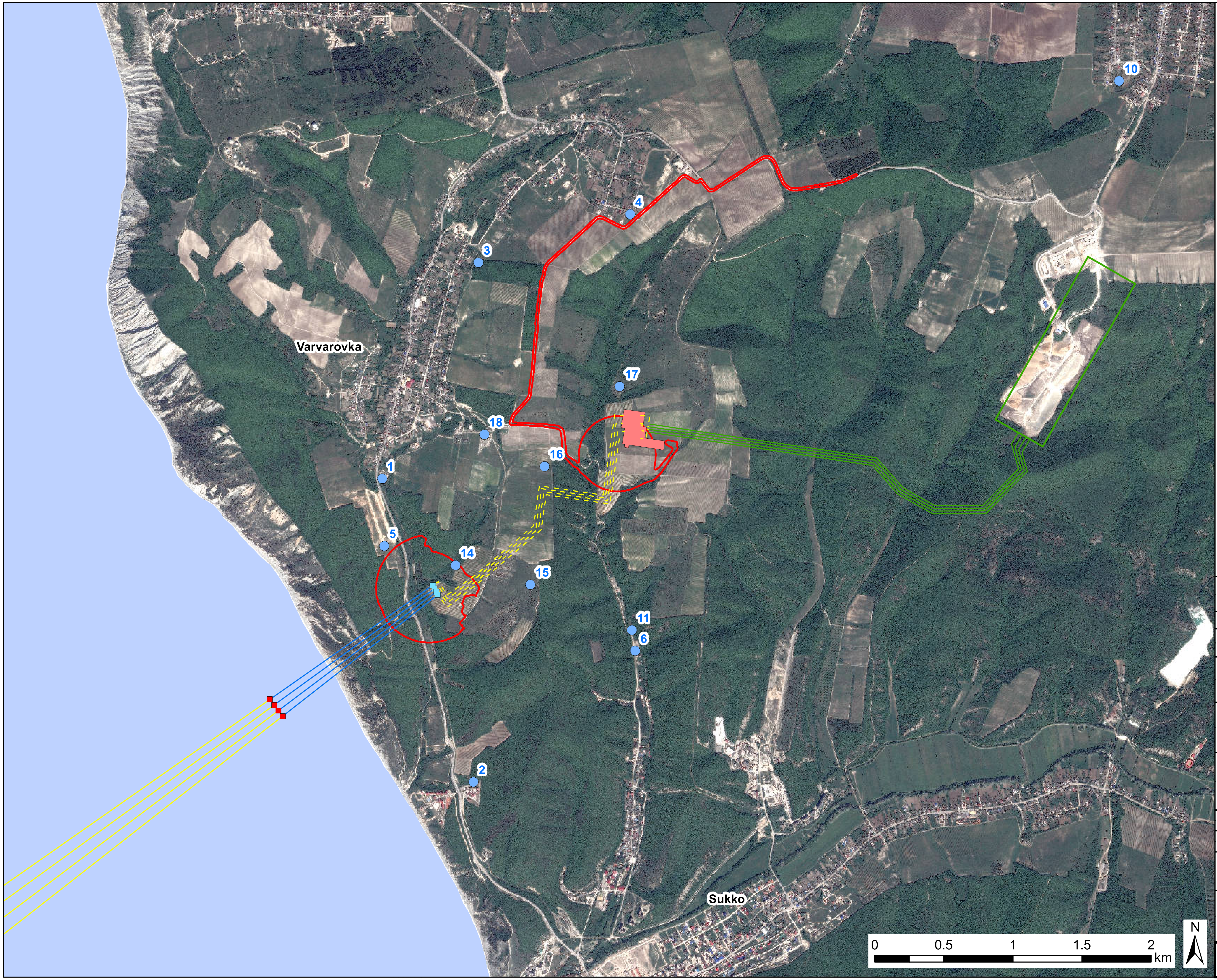
URS Internal Project No.	Scale @ A3
46369082	1:25,000

URS Infrastructure & Environment UK Limited
Scott House
Alencon Link, Basingstoke
Hampshire, RG21 7PP
Telephone (01256) 310200
Fax (01256) 310201
www.ursglobal.com

Drawing Number

Figure 10.3

Rev



LEGEND

Scenario 2

55dB(A)

Noise survey locations

Russian Sector of South Stream Offshore Pipeline

Proposed landfall section pipelines

Landfall facilities

Proposed microtunnels

Proposed offshore pipelines

Microtunnel entry shaft

Microtunnel exit pit

United Gas Supply System

Russkaya compressor station

United Gas Supply System Pipelines

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue

For Information

Client

South Stream Offshore Pipeline ENERGISING EUROPE

Project Title

SOUTH STREAM
OFFSHORE PIPELINE

Drawing Title

SCENARIO 2
DAYTIME NOISE LEVELS

Drawn	Checked	Approved	Date
DH	RW	MW	28/02/2014

URS Internal Project No. 46369082

Scale @ A3 1:25,000

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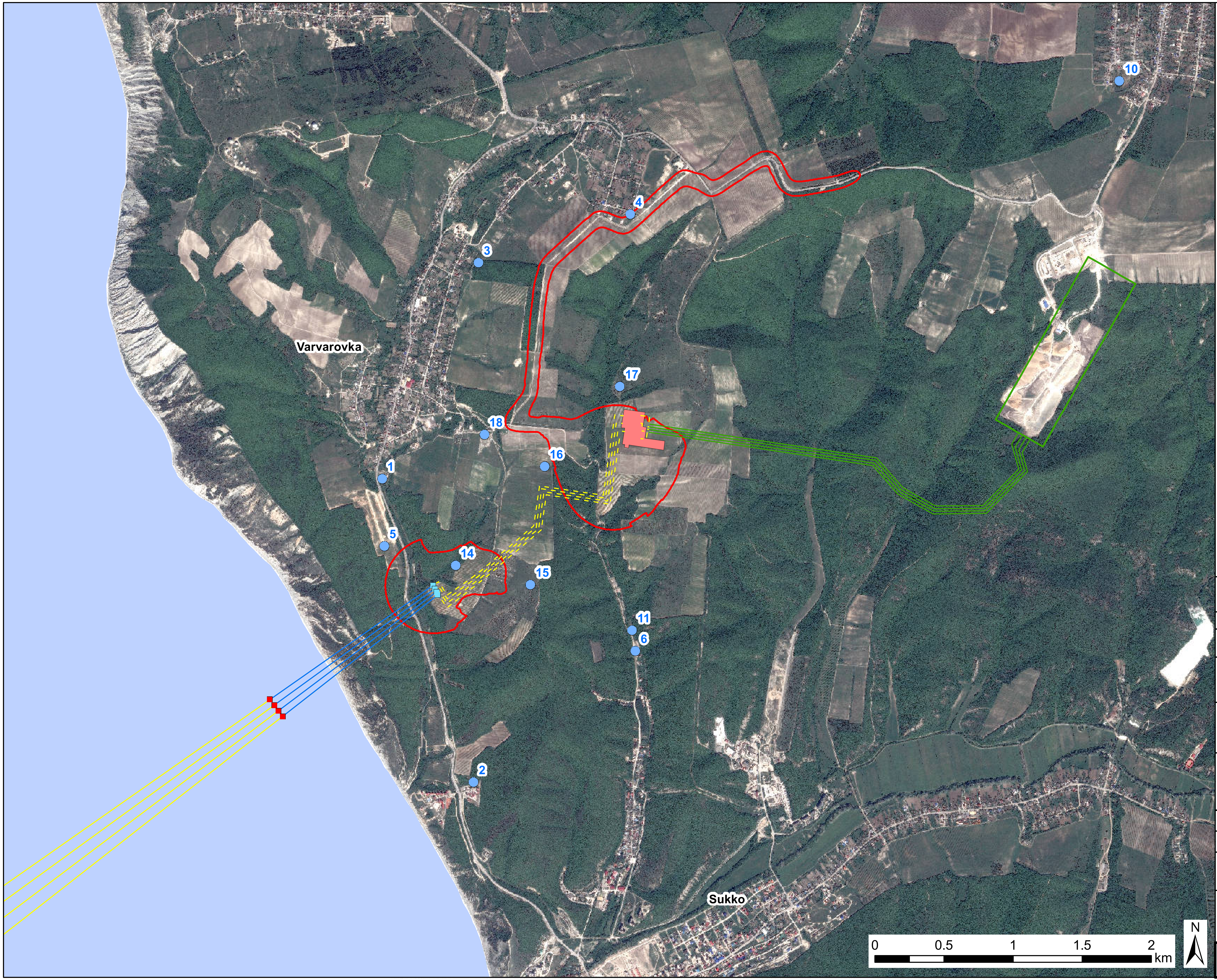
Drawing Number

Figure 10.4

Rev

Plot Date: 28 Feb 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 10 Noise\Figure 10.4 Scenario 2 Daytime Noise Levels.mxd



LEGEND

Scenario 3

- 55dB(A)
- Noise survey locations

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Landfall facilities
- Proposed microtunnels
- Proposed offshore pipelines
- Microtunnel entry shaft
- Microtunnel exit pit

United Gas Supply System

- Russkaya compressor station
- United Gas Supply System Pipelines

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue

For Information

Client

South Stream Offshore Pipeline ENERGISING EUROPE

Project Title

SOUTH STREAM
OFFSHORE PIPELINE

Drawing Title

SCENARIO 3
DAYTIME NOISE LEVELS

Drawn	Checked	Approved	Date
DH	RW	MW	28/02/2014

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Figure 10.5

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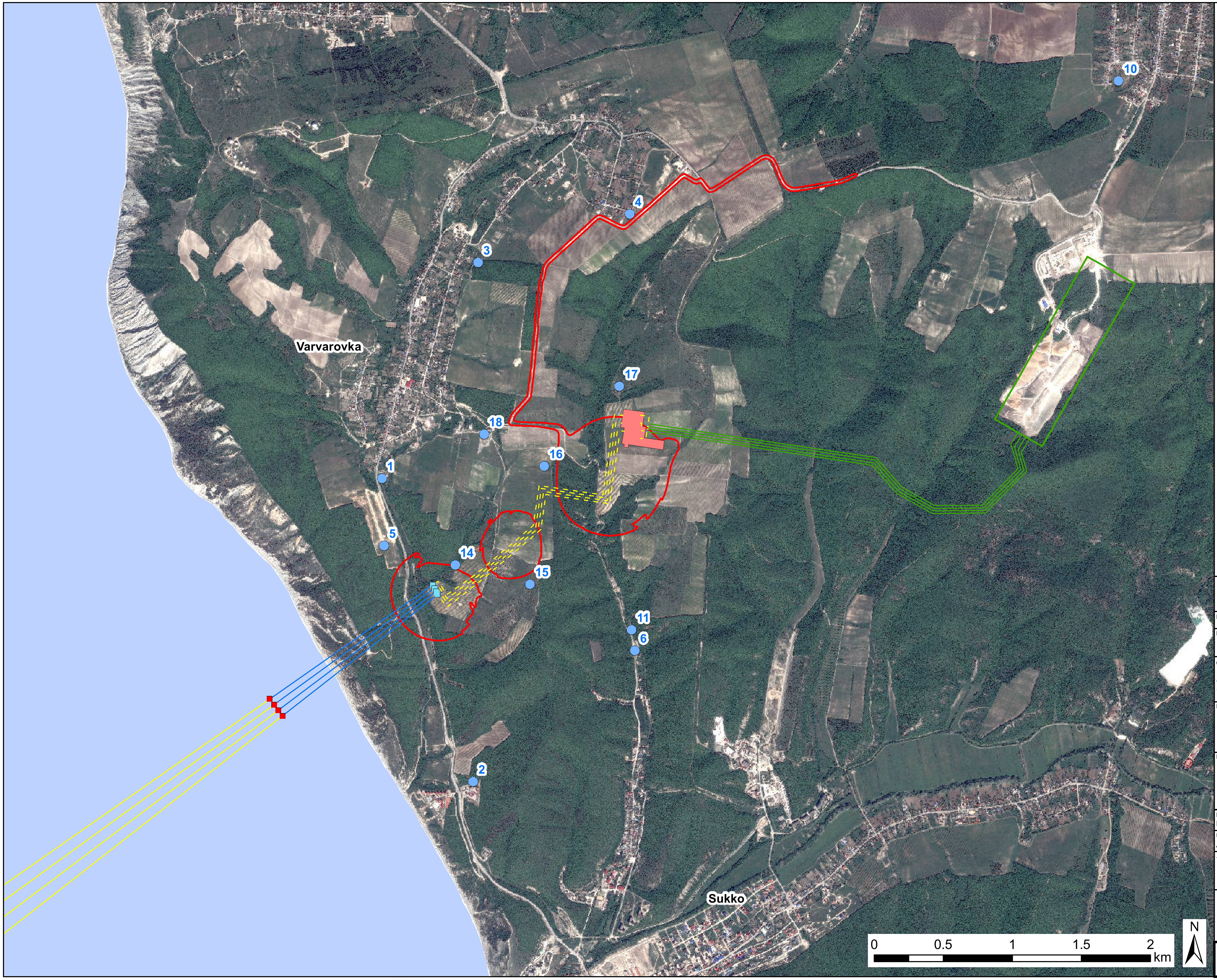

LEGEND

Scenario 4

55dB(A)

Noise survey locations

Russian Sector of South Stream Offshore Pipeline

Proposed landfall section pipelines

Landfall facilities

Proposed microtunnels

Proposed offshore pipelines

Microtunnel entry shaft

Microtunnel exit pit

United Gas Supply System

Russkaya compressor station

United Gas Supply System Pipelines

Projection: Lambert Conformal Conic

Revision Details	By Check	Check Date	Suffix

Purpose of Issue

For Information

Client

South Stream Offshore Pipeline ENERGISING EUROPE

Project Title

SOUTH STREAM OFFSHORE PIPELINE

Drawing Title

SCENARIO 4 DAYTIME NOISE LEVELS

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Figure 10.6	

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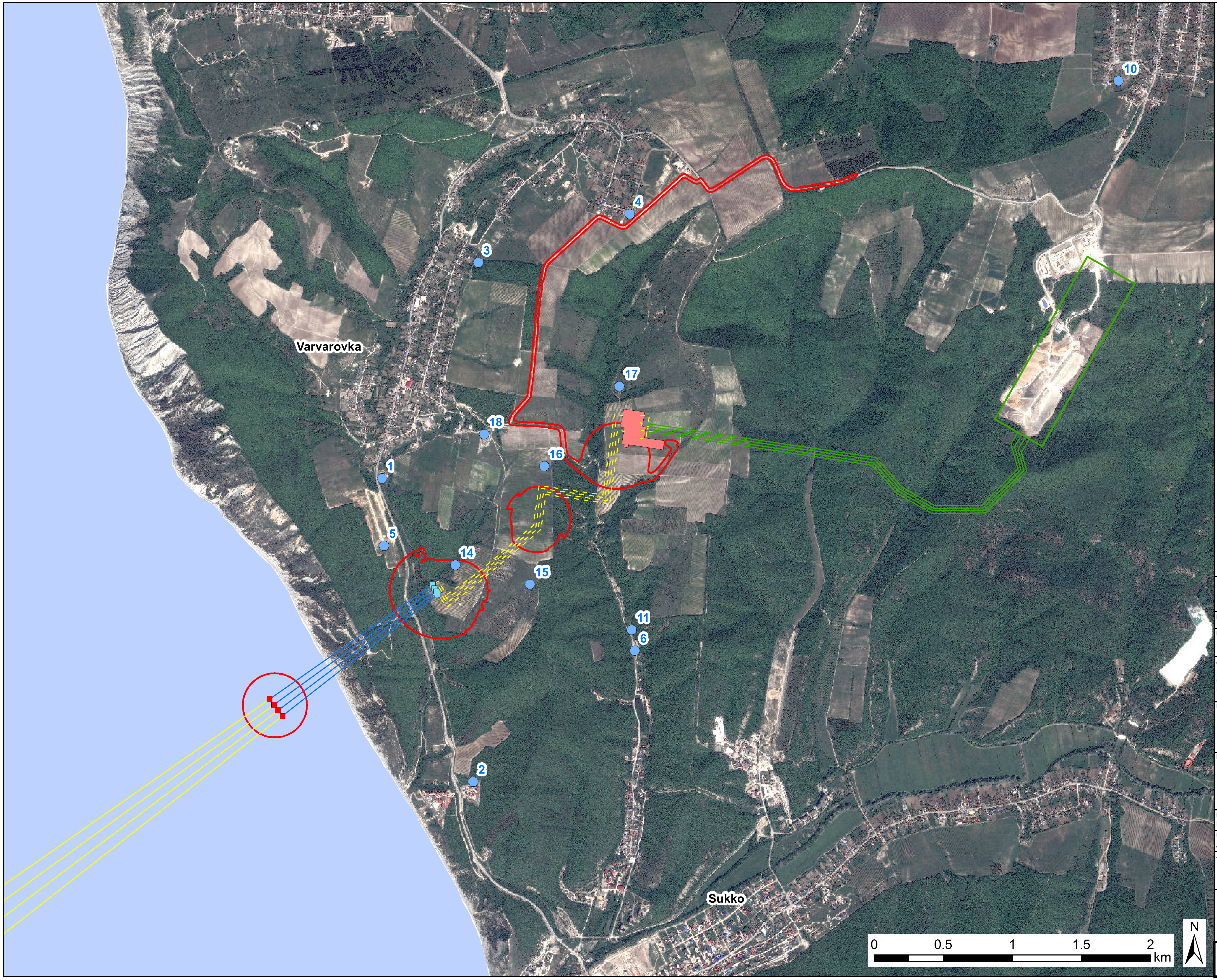

LEGEND

Scenario 5

55dB(A)

Noise survey locations

Russian Sector of South Stream Offshore Pipeline

Proposed landfall section pipelines

Landfall facilities

Proposed microtunnels

Proposed offshore pipelines

Microtunnel entry shaft

Microtunnel exit pit

United Gas Supply System

Russkaya compressor station

United Gas Supply System Pipelines

Projection: Lambert Conformal Conic

Revision Details	By Check	Check Date	Suffix

Purpose of Issue

For Information

Client

South Stream Offshore Pipeline — ENERGISING EUROPE

Project Title

SOUTH STREAM
OFFSHORE PIPELINE

Drawing Title

SCENARIO 5
DAYTIME NOISE LEVELS

Drawn	Checked	Approved	Date
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Figure 10.7	

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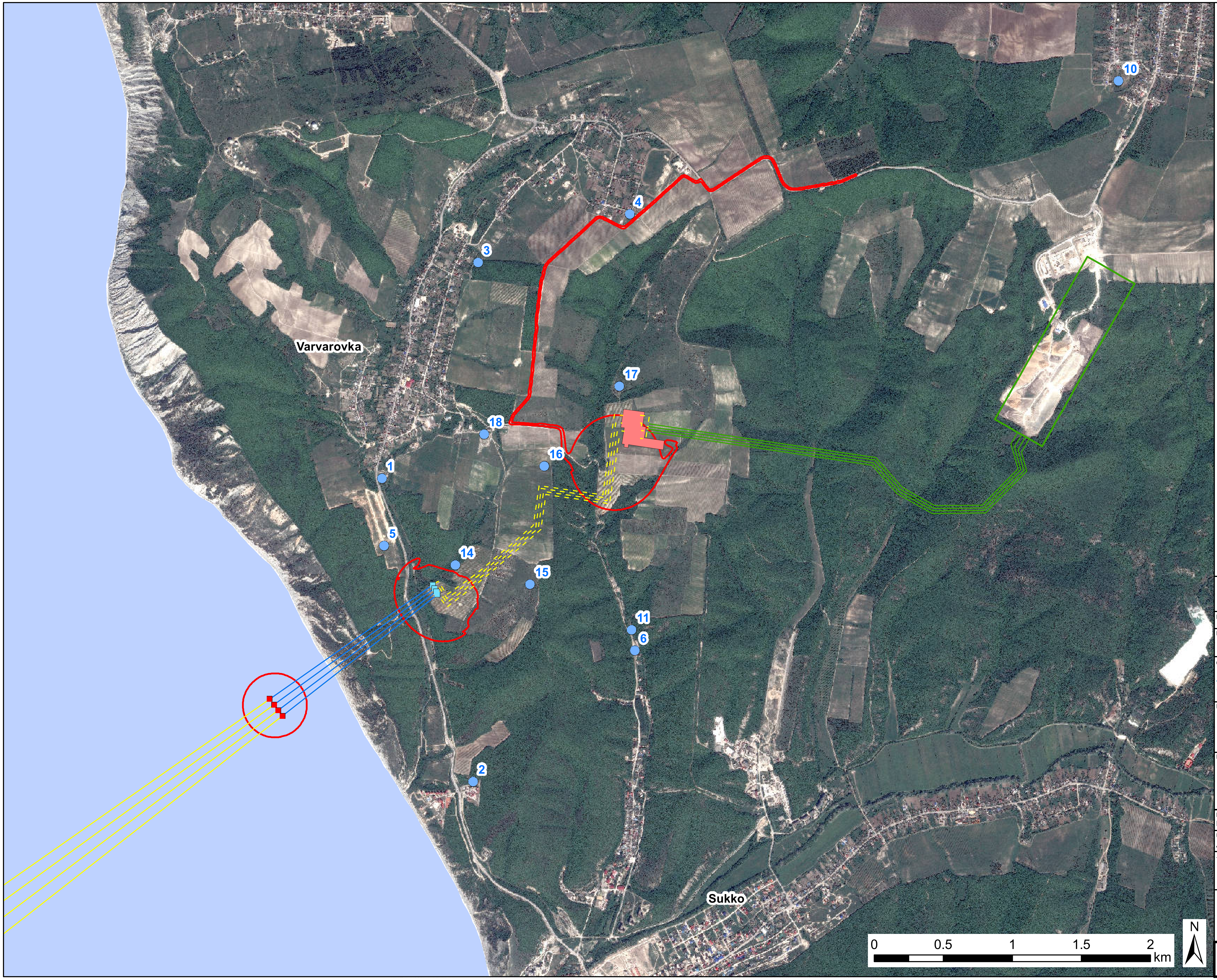

LEGEND

Scenario 6

- 55dB(A)
- Noise survey locations

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Landfall facilities
- Proposed microtunnels
- Proposed offshore pipelines
- Microtunnel entry shaft
- Microtunnel exit pit

United Gas Supply System

- Russkaya compressor station
- United Gas Supply System Pipelines

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue

For Information

Client

South Stream Offshore Pipeline — ENERGISING EUROPE

Project Title

SOUTH STREAM OFFSHORE PIPELINE

Drawing Title

SCENARIO 6 DAYTIME NOISE LEVELS

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Drawing Number: Figure 10.8

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Plot Date: 28 Feb 2014
File Name:\\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 10 Noise\Figure 10.8 Scenario 6 Daytime Noise Levels.mxd

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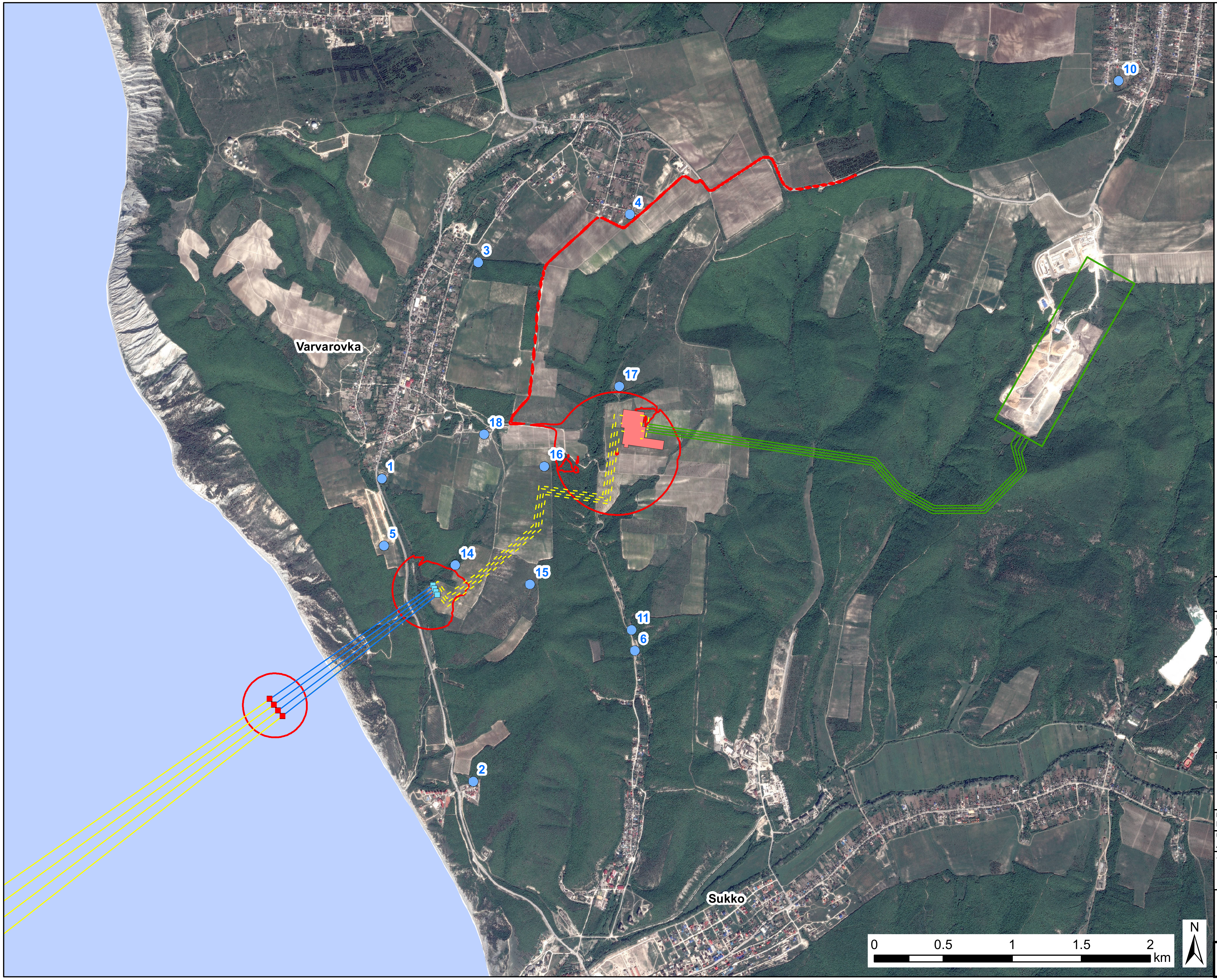

LEGEND

Scenario 7

55dB(A)

Noise survey locations

Russian Sector of South Stream Offshore Pipeline

Proposed landfall section pipelines

Landfall facilities

Proposed microtunnels

Proposed offshore pipelines

Microtunnel entry shaft

Microtunnel exit pit

United Gas Supply System

Russkaya compressor station

United Gas Supply System Pipelines

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check / Date	Suffix

Purpose of Issue: For Information

Client: South Stream Offshore Pipeline — ENERGISING EUROPE

Project Title: SOUTH STREAM OFFSHORE PIPELINE

Drawing Title: SCENARIO 7 DAYTIME NOISE LEVELS

Drawn	Checked	Approved	Date
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Drawing Number: Figure 10.9

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Plot Date: 17 Apr 2014
File Name: I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 10 Noise\Figure 10-9 Scenario 7 Daytime Noise Levels.mxd

The night-time noise levels are shown graphically within Figure 10.10 for Model Reference 8. This figure indicates the location of the 45 dB LAeq noise contour which is the applicable night-time noise limit. It should be noted that the plant will operate during both the day and night time period. However, as the night time noise limit is more stringent than the daytime the noise impacts have therefore been assessed the night time criterion (45 dB LAeq) in both Table 10.23 and Figure 10.10.

As mentioned previously, the noise levels at the ecological receptors (receptors 9 to 12) have been calculated for use in **Chapter 11 Terrestrial Ecology**. Only the predicted noise levels at these receptors have been presented and no assessment of impact significance is included within this chapter.

A summary of the predicted impact significance for the construction noise Model References 1 to 8, inclusive, is given below in Table 10.24. This summary utilised the impact significance matrix provided in **Chapter 3 Impact Assessment Methodology** employing the predicted magnitude of the impact (Table 10.16 to Table 10.23) in combination with the sensitivity of the receptor (Table 10.6).

For the daytime period for the majority of the existing receptors, currently identified as occupied sites in proximity to the construction activities, sensitivity is high and the impact magnitude is negligible; therefore, according to the impacts significance matrix, the overall impact is **Not Significant**.

However, during Scenario 3 the impacts at Receptor 4, representative of a cluster of residential dwellings on the north-eastern part of Varvarovka, are moderate. As these receptors have a high sensitivity, the impact significance is **High**.

At Receptor 5, which is a new-build proposed residential building that is unlikely to be occupied during the Construction Phase, the sensitivity is negligible and the impact magnitude is, at worst, low; therefore the overall impact significance is **Not Significant**. Table 10.24 assumes that receptor location 5 is uninhabited during the Construction Phase.

The predicted noise levels have the potential to create greater impacts should Receptor 5 support human occupants during the Construction Phase. If this were to happen, the sensitivity would be high and the worst case impact magnitude would occur during the night-time period and is classified as low; therefore, the overall impact significance would be **Moderate**, as based on the overall broadband noise level (L_{Aeq}).

LEGEND

Scenario 8

- 45dB(A)
- Noise survey locations

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Landfall facilities
- Proposed microtunnels
- Proposed offshore pipelines
- Microtunnel entry shaft
- Microtunnel exit pit

United Gas Supply System

- Russkaya compressor station
- United Gas Supply System Pipelines

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue
For Information

Client
South Stream Offshore Pipeline — Stream ENERGISING EUROPE

Project Title
SOUTH STREAM OFFSHORE PIPELINE

Drawing Title
SCENARIO 8
NIGHTTIME NOISE LEVELS

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Drawing Number: Figure 10.10 | Rev

Plot Date: 17 Apr 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 10 Noise\Figure 10-10 Scenario 8 Nighttime Noise Levels.mxd

The Russian regulations also require an assessment of the spectral noise levels at the receivers. If it is assumed that Receptor 5 is occupied during the Construction Phase it can be seen from

Table 10.17 (Scenario 2) that the noise level within the 1 KHz octave band may exceed the limit by 1 dB(A). The noise levels during the night time also exceed the 1 kHz and 2 kHz octave band levels by 2 dB(A) and 1 dB(A). The sensitivity of Receptor 5 (if occupied) is high and the impact magnitude is moderate; therefore, the overall impact significance would be **High**.

The predicted noise impacts during the night time period (Scenario 8), which indicate the cumulative noise impacts from micro-tunnelling and pre-commissioning using the booster compressor spread, indicate a high impact magnitude at the majority of receptors. As the receptors have a high sensitivity, the impact significance is **High**, for the majority of receptor locations. It should be noted that the significant noise source during this scenario is the booster compressors. Noise impacts arising from the micro-tunnelling plant, when considered in isolation, are **Not Significant**.

Construction Vibration Impact Significance

There are several sources of ground borne vibration anticipated during construction activities or from plant and equipment to be used (**Chapter 5 Project Description**).

At the microtunnel construction site, secant wall piling will involve the use of continuous flight augers, which give rise to levels of ground borne vibration that would be imperceptible beyond approximately 30 m (Ref. 10.7). Microtunnelling will be undertaken using a remotely controlled tunnel boring machine (TBM). The microtunnels will extend through soft to hard clay (<10 m) and loose to dense clayey gravel over predominantly marlstone, which has subordinate layering of sandstone, limestone and siltstone. When considering the worst case levels of ground borne vibration from the operation of the TBM (e.g. when encountering rock formations) the resulting levels of vibration would be imperceptible to human receptors at a distance of 100 m from the cutting face.

The proposed Pipeline corridors will employ a cut and fill method. Heavy plant associated with such operations will not give rise to high levels of ground borne vibration. Typically, the levels of ground borne vibration from a bulldozer are imperceptible to humans at a distance of approximately 20 m.

As the closest human receptors to the majority of construction works are at a distance of approximately 920 m (430 m for Receptor 5, if occupied) then the resulting levels of ground borne vibration will be imperceptible to occupants.

Table 10.24 Construction Noise Predicted Impact Significance

Receptor	Receptor Sensitivity	Model Reference and Predicted Impact Significance							
		1	2	3	4	5	6	7	8
1	High	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	High
2	High	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	High
3	High	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	High
4	High	Not Significant	Not Significant	High	Not Significant	Not Significant	Not Significant	Not Significant	High
5	Negligible	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Low
6	High	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	High
7	High	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Moderate
8	High	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	High
13	High	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	High
14	High	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Moderate
15	High	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant
16	High	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant

Note: The impact significance table assumes that Receptor 5 will not be occupied during the Construction Phase.

The Varvarovka bypass road is not anticipated to generate any significant level of ground borne vibration during construction as dynamic compaction, vibro compaction or piling techniques are not proposed to be used. The construction of a new level road surface, which will be adequately maintained, will ensure that ground borne vibration from vehicle movements will be negligible.

The booster compressors utilised during the pre-decommissioning stage are not anticipated to give rise to significant levels of ground borne vibration, as modern reciprocating engines are well balanced. Typically ground borne vibration would be imperceptible within tens of metres from such engines. Whilst there may be cumulative increases in the ground borne vibration where 80 such units are employed, given that the closest sensitive receptor is at a distance of approximately 1 km, it can be concluded that any ground borne vibration impacts will be negligible.

The existing residential receptors, cemetery and places of worship sensitivity classifications are high and the impact magnitude is negligible; therefore, the overall impact significance is **Not Significant**.

The impact of ground borne vibration on ecological receptors is not considered within this chapter, but is considered in **Chapter 11 Terrestrial Ecology**.

Construction Traffic

The impact of construction traffic is determined by assessing changes in road traffic noise levels due to the incidence of construction vehicles. The proposed construction traffic route will pass from the M25 through Rassvet, bypass Gai Kodzor and then onto the access road. The only other vehicles accessing the site will travel via the Anapa-Varvarovka road. The proposed transport routes are shown in **Chapter 5 Project Description**.

Data on the road traffic flows on the proposed transport routes have been gathered, the results of which have been presented in Appendix 9.1: Traffic and Transport Study. This includes figures showing the road links at which the traffic flow was counted. These locations were as follows:

- Link 1 – Varvarovka, southern end of settlement, south of junction with access road;
- Link 2 – Varvarovka, southern end of settlement, north of junction with access road;
- Link 3 – North of Varvarovka, south of junction of Anapa to Sukko road and road from Gai Kodzor;
- Link 4 – North of Varvarovka, east of junction of Anapa to Sukko road and road from Gai Kodzor;
- Link 5 – Supsekh, western edge of settlement on Anapa to Sukko road;
- Link 6 – Gai Kodzor, south of junction of temporary construction bypass and road from Rassvet;
- Link 7 – Gai Kodzor, north of junction of temporary construction bypass and road from Rassvet;

- Link 8 – Gai Kodzor, east of junction of temporary construction bypass and road from Rassvet;
- Link 9 – Rassvet, south of junction of M25 and road to Gai Kodzor;
- Link 10 – Rassvet, east of junction of M25 and road to Gai Kodzor; and
- Link 11 – Rassvet, west of junction of M25 and road to Gai Kodzor southbound.

The total construction traffic proposed for the Project comprises a maximum of 531 HGV and 27 light vehicle movements per day; this peak will last from August to November 2014. During June and July 2014, there will be 498 HGV and 14 light vehicle movements per day. The proportions of vehicles that will access the different roads around the site have been estimated in Appendix 9.1.

The absolute change in the noise levels that will be generated by the increase in road traffic flow at these locations has been predicted using the Calculation of Road Traffic Noise (Ref. 10.10). The absolute change in the noise level generated by the increased traffic flow resulting from construction traffic using the pre-existing routes is shown below in Table 10.25.

Table 10.25 Predicted Change in Road Traffic Noise Levels from Construction Movements

Location	Predicted Change in Noise Level L_{Aeq} (dB) – June to July 2014	Predicted Change in Noise Level L_{Aeq} (dB) – August to November 2014
Link 1	0.03	0.04
Link 2	0.01	0.01
Link 3	0.01	0.01
Link 4	0.01	0.01
Link 5	0.00	0.00
Link 6	0.01	0.01
Link 7	2.96	3.14
Link 8	1.56	1.67
Link 9	1.26	1.34
Link 10	0.62	0.67
Link 11	0.54	0.58

According to GIIP, it is generally accepted that a change of less than 3 dB in noise level is not perceptible to human subjects, and therefore the magnitude of the impact at Links 1 to 6 and 8 to 11 will be negligible, and the magnitude of impact at Link 7 will be low. The sensitivity of the receptors in the vicinity of the Links is high; therefore, the significance of the noise impact is **Not Significant** at receptors neighbouring Links 1 to 6 and 8 to 11, and **Moderate** at receptors neighbouring Link 7.

Port Activities

At the time of writing, a decision had not been made on the port that will be used to receive equipment and material for the purposes of the onshore construction activities. As detailed in **Chapter 5 Project Description**, the port of Novorossiysk is a potential option.

The port selected will be an existing commercial port. Consequently, ship movements and the handling of material would be part of the existing noise climate. It is therefore considered that whichever port is selected for the delivery of equipment and materials, it would be operated within the existing confines of potential impacts on neighbouring receptors.

10.6.2.3 Mitigation and Monitoring

The impact significance has been assessed as being **Not Significant** for the majority of the Construction and Pre-Commissioning Phase, and therefore the implementation of mitigation measured are not required for the majority of phases.

The exceptions where greater impacts have been identified, whereby mitigation measures need to be considered, result from periods of higher road traffic volumes (daytime), and pre-commissioning using the booster compressor spread (night time).

The residential area around Receptor 4 during Scenario 3, when the greatest road traffic flows will be experienced on the Varvarovka bypass road, will require mitigation to be implemented.

An acoustic screen along the boundary of the properties and Varvarovka bypass road will be installed to mitigate the noise impact. Typically this can be constructed from a timber fence, wall or earth bund, or any combination of the two. For fencing, example design principles to ensure effective mitigation include two layers of staggered boards, giving a minimum superficial mass of 10 kg/m^2, and ensuring that no air gaps exist at the base of the structure. The specification will be determined based on the number of vehicle movements on the road along with consultation with the owners of adjacent properties. An indicative location of the screen along with the noise contour plot is shown in Figure 10.11.

The predicted noise levels at the closest premises to the Varvarovka bypass road are predicted to fall to below 50 dB(A) with the implementation of a 3 m high barrier.

The resulting impact magnitude, with mitigation, is negligible, the receptor sensitivity is high, and the impact significance is **Low**.

The impact significance of Pre-Commissioning has indicated that during the cleaning, gauging and drying of the Pipeline between the Russian and Bulgarian landfall facilities (i.e. booster compressor spread operations) there is the potential for **High** impact significance to occur, and as such, mitigation measures need to be considered.

In order to reduce these noise levels by up to approximately 24 dB(A), it is expected that a combination of measures will need to be employed. These include the selection of inherently quiet plant with far lower sound power levels than used in the assessment; careful siting and orientation of the plant to minimise noise emissions at receptor locations; and the use of acoustic berms / barriers close to the pre-commissioning compound.

However, the degree of mitigation cannot be provided at this point in time, as the extent of mitigation will be dependent upon how great a reduction in noise levels can be achieved by the use of inherently quiet plant.

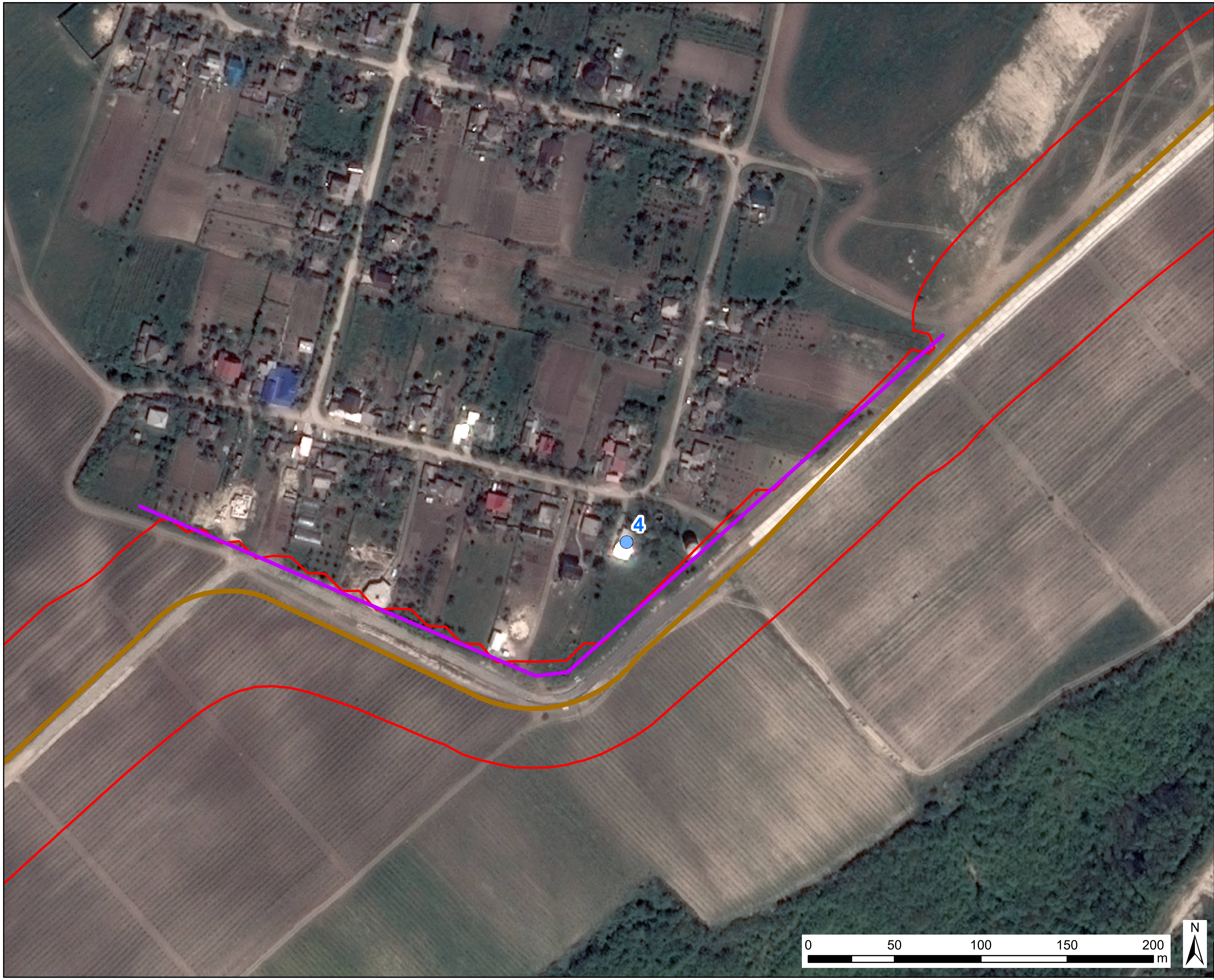
The predicted noise and vibration effects from the landfall and nearshore pre-commissioning cleaning and drying works have indicated that no mitigation measures need to be considered.

In addition to the above it is considered that the Project will adhere to GIIP in order to reduce the impact of construction noise and vibration upon all receptors. Mitigation measures will be documented within the Project Environmental and Social Management Plan (ESMP) (**Chapter 22 Environmental and Social Management**), and are described below:

- Equipment will be throttled to a minimum or switched off when not in use;
- Internal access roads will be kept well-maintained to minimise noise impacts generated by vehicles dealing with difficult terrain;
- Drop heights of materials will be minimised which will reduce the noise levels generated by the collision of materials with the ground or other materials;
- As far as reasonably practicable, sources of significant noise will be enclosed;
- Plant and equipment will be used and maintained regularly in accordance with manufacturers' instructions;
- Where possible, equipment and loading and unloading activities will be located away from noise-sensitive areas; and
- In consideration of the potential impacts arising from several noisy activities occurring at the same time, activities will be scheduled, where possible, to minimise overall noise levels.

Mitigation measures may need to be employed to reduce noise at Receptor 5 to acceptable levels; however, this is only in the event that this location is developed and occupied by residents during the Construction Phase. If this does occur, then consideration would be given to the following suitable measures:

- Selection of plant that gives rise to the lowest feasible noise emissions;
- Careful on-site location and orientation of plant; and
- The use of temporary soil screening bunds to reduce noise levels.



LEGEND
- 55dB(A)
- Varvarovka bypass noise barrier
- Noise survey locations
- Varvarovka bypass road (used by Project during construction only)

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue
For Information

Client
South Stream
Offshore Pipeline
ENERGISING EUROPE

Project Title
SOUTH STREAM
OFFSHORE PIPELINE

Drawing Title
VARVAROVKA BYPASS
NOISE BARRIER

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Figure 10.11	

Details of the compliance noise and vibration monitoring that will be undertaken are included in the overarching Environmental and Social Monitoring Programme (**Chapter 22 Environmental and Social Management**).

The document collates the assessments undertaken for both this ESIA Report and the in-country EIA Report, and the monitoring commitments made in each.

The in-country monitoring requirements are based on fixed timescales for sampling and do not provide flexibility to capture the start of specific activities. In addition, the in-country requirements for noise monitoring are based on both receptor locations, and points that are not representative of sensitive receptors.

Therefore, the monitoring programme has collated the commitments from both the ESIA Report and the EIA Report into a single working document that fulfils the requirements of both.

The committed monitoring regime goes beyond the in-country requirements in terms of both monitoring location numbers and frequency of monitoring.

This has been undertaken in order to capture the range of activities being undertaken, and a risk based approach has been adopted in order to target compliance noise monitoring at the starting time when specific activities which have the potential to exceed the noise limits occur.

With regard to the construction activities monitoring has been specified to occur at the start of the following activities:

- Daytime construction traffic during period of maximum movements (mid-June to November 2014);
- Daytime trenching, pipe fabrication, pipe laying and landfall facilities construction; and
- Night-time microtunnelling works.

Further to the above the assessment of the Pre-Commissioning Phase noise levels has highlighted that cleaning, gauging and drying of the pipelines between the Russian and Bulgarian landfall facilities is likely to be a key stage when compliance monitoring will be required. Given that this plant will operate on a 24 / 7 basis, and that the night time noise criteria is more stringent, compliance monitoring during the night time period will need to be scheduled during the first night of such plant operations. Compliance noise monitoring would be undertaken at the closest receptor locations to the pre-commissioning plant. Demonstrating compliance with the noise criteria at the closest receptors would ensure compliance with the criteria at all receptor locations.

10.6.2.4 Residual Impacts: Construction and Pre-Commissioning

The residual impact significance of both noise and ground borne vibration at sensitive receptors during the Construction and Pre-Commissioning Phases is summarised in Table 10.26.

For the majority of impacts are predicted to be **Not Significant** with the exception of two sub-phase scenarios.

During periods of the highest traffic flows there is predicted to be an impact on the boundary of the **Low** impact significance following the inclusion of a noise barrier to mitigate noise levels.

The activities associated with the use of the compressor booster spread for the cleaning, gauging and drying of the pipelines between the Russian and Bulgarian landfall facilities during Pre-Commissioning, which will result in an estimated **Low** impact significance at neighbouring receptors. It should be noted that the degree of mitigation feasible cannot be directly quantified at this point in time.

10.6.3 Assessment of Potential Impacts: Operational Phase

10.6.3.1 Introduction

The activities associated with the Operational Phase of the Project are:

- Operation of the pipeline inspection gauge (PIG) launching facility on an infrequent basis;
- Occasional vehicle movements and associated routine maintenance activities;
- Gas flow within the Pipeline; and
- Venting of gas from the landfall facilities during a shut down for maintenance or repairs.

10.6.3.2 Assessment of Potential Impacts (pre-mitigation)

The operation of the PIG launching facility will not involve any significant noise generating plant or machinery. The closest residential receptor is at a distance of over 1 km from the facility. As receptor sensitivity is high and the impact magnitude is negligible, the resulting noise impact significance is **Not Significant**.

Noise impacts resulting from infrequent routine maintenance and associated vehicle movements to the facility are considered to be of negligible magnitude given the large distances to the nearest noise sensitive receptors. As receptor sensitivity is high and the impact magnitude is negligible, the resulting noise impact significance is **Not Significant**.

Gas flow within the Pipeline has the potential to generate relatively low levels of sound. However, as the Pipeline will be buried below a minimum of 1.5 m of backfill, the resulting sound levels above ground level are anticipated to be inaudible. The resulting noise impact at sensitive residential receptors at considerable distance from the Pipeline corridor is therefore considered to be of negligible impact magnitude. As receptor sensitivity is high and the impact magnitude is negligible, the resulting noise impact significance is **Not Significant**.

Table 10.26 Assessment of Potential Impacts: Construction and Pre-Commissioning Phases

Activity	Potential Impact	Receptor(s)	Receptor Sensitivity	Impact Magnitude / Likelihood	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Operation of Construction Plant	Noise	Residential Dwellings, Cemeteries and Places of Worship	High	Negligible	Not Significant	None Required*	Not Significant
Varvarovka Bypass Access Road Traffic	Noise	Residential Dwellings	High	Moderate at Receptor 4	High at Receptor 4	Noise Barrier to protect properties	Low
Operation of Construction Plant	Vibration	Residential Dwellings, Cemeteries and Places of Worship	High	Negligible	Not Significant	None Required	Not Significant
Construction Traffic on Public Highways	Noise	Residential Dwellings, Cemeteries and Places of Worship	High	Negligible	Not Significant	None Required*	Not Significant
Pre-Commissioning – landfall and nearshore section pipelines	Noise	Residential Dwellings, Cemeteries and Places of Worship	Negligible	Not Significant	Not Significant	None Required	Not Significant
Pre-Commissioning – landfall and nearshore section pipelines	Vibration	Residential Dwellings, Cemeteries and Places of Worship	High	Negligible	Not Significant	None Required	Not Significant

Continued…

Activity	Potential Impact	Receptor(s)	Receptor Sensitivity	Impact Magnitude / Likelihood	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Pre-Commissioning – whole Pipeline (Russia to Bulgaria)	Noise	Residential Dwellings, Cemeteries and Places of Worship	High	High	High	Selection of inherently quiet plant; careful siting and orientation of plant; use of earth berms and temporary acoustic barriers.	Estimated as Low
Pre-Commissioning – whole Pipeline (Russia to Bulgaria)	Vibration	Residential Dwellings, Cemeteries and Places of Worship	High	Negligible	Not Significant	None Required	Not Significant

*Note – if Receptor 5 is constructed and becomes occupied during the Construction Phase, mitigation measures may need to be implemented.

Complete.

The impact of operational noise on ecological receptors is addressed within **Chapter 11 Terrestrial Ecology**.

The landfall facility will house a vent stack for the venting of gas from the pipelines during maintenance activities. The venting of gas from the Pipeline has the potential to generate jet noise. The resulting noise that may be generated has therefore been assessed using the procedures for estimating gas jet noise given within Engineering Noise Control (Ref. 10.11). The resulting overall acoustic power is determined to be $5.7*10^{-9}$ Watts, which equates to a sound power level (Lw) of 37.6 dB. The sound power level is further corrected to account for the directivity of the noise and the number of the pipes within the stack (eight), each of which will vent to atmosphere.

The predicted impact magnitude at all receptor locations is shown to be negligible. Though the sensitivity is high the resulting impact significance at all receptors is **Not Significant**.

10.6.3.3 Mitigation and Monitoring

No mitigation of noise or vibration from the Operational Phase is required.

The compliance noise and vibration monitoring is detailed in the overarching Environmental and Social Monitoring Programme (**Chapter 22 Environmental and Social Management**).

The document collates the assessments undertaken for both this ESIA Report and the in-country EIA Report, and the monitoring commitments made in each.

The Russian National EIA Report has committed to undertaking noise monitoring once per year during the Operational Phase.

Given that this ESIA Report has not identified any significant noise impacts, and no requirement for mitigation during the Operational Phase, it is concluded that noise monitoring at a greater frequency that the in-country commitment is not required.

10.6.3.4 Residual Impacts: Operational Phase

The noise and vibration impacts associated with the Operational Phase are not anticipated to require any form of mitigation. The resulting impact magnitudes for both noise and vibration are considered to be negligible, and noise and vibration levels are expected to be compliant with Russian Regulations; as the receptor sensitivity is high, the resulting impact significance is **Not Significant**, as summarised in Table 10.27.

Table 10.27 Assessment of Potential Impacts: Operational Phase

Activity	Potential Impact	Receptor(s)	Receptor Sensitivity	Impact Magnitude / Likelihood	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
PIG launching facility	Noise and Vibration	Residential Dwellings, Cemeteries and Places of Worship	High	Negligible	Not Significant	None Required	Not Significant
Routine maintenance and associated vehicle movements	Noise and Vibration	Residential Dwellings, Cemeteries and Places of Worship	High	Negligible	Not Significant	None Required	Not Significant
Gas flow within the Pipeline	Noise and Vibration	Residential Dwellings, Cemeteries and Places of Worship	High	Negligible	Not Significant	None Required	Not Significant
Venting of gas within the landfall facilities during a planned shutdown for maintenance / repairs	Noise and Vibration	Residential Dwellings, Cemeteries and Places of Worship	High	Negligible	Not Significant	None Required	Not Significant

10.6.4 Assessment of Potential Impacts: Decommissioning Phase

10.6.4.1 Introduction

A decommissioning programme will be developed during the Operational Phase. The South Stream Pipeline System has a design life of 50 years, although this may be extended subject to close monitoring.

The decommissioning of onshore facilities has the potential to result in noise impacts at sensitive receptor locations, including human and ecological receptors. Offshore decommissioning of the Pipeline is considered to be at suitably large distances from terrestrial receptors and, therefore, there would be no impact.

10.6.4.2 Assessment of Potential Impacts (pre-mitigation)

The anticipated onshore noise and vibration impacts are expected to arise from the following activities;

- The demolition of facilities and infrastructure;
- Equipment and vehicle movements; and
- Earthworks.

The intensity and duration of works associated with the Decommissioning Phase are expected to be no greater than the Construction Phase. Given that the noise and vibration impacts associated with the non-construction traffic related activities, and excluding pre-commissioning activities which would not be undertaken, have been shown to be **Not Significant** for human receptors, it is considered that decommissioning activities would be likely to give rise to similar insignificant impacts, subject to no further residential buildings being built closer to the Pipeline over the course of the Operational Phase, and selection of appropriate routes for traffic away from habitable areas.

However, it is likely that Receptor 5 would be occupied during the Decommissioning Phase of the Project. As this receptor is located closer to the Pipeline corridor, there is the potential for elevated noise levels at this location during decommissioning. If noise levels equivalent to those generated during construction are received at this location, the impact at Receptor 5 could be of **High** significance, prior to the implementation of mitigation measures.

Given that the Decommissioning Phase will be undertaken a considerable time in the future, a re-appraisal of the following would be undertaken:

- A review of prevailing international and national legislation, regulations and GIIP;
- An assessment of new receptors that may have been introduced into the immediate vicinity; and
- An assessment of potential noise and vibration impacts once a detailed methodology and programme has been developed for the Decommissioning Phase.

Assessments will be undertaken during the Operational Phase to confirm that the planned decommissioning activities are the most appropriate to the prevailing circumstances and proposed future land use.

10.6.4.3 Mitigation and Monitoring

The requirements for mitigation and monitoring will be identified as part of the assessment to decommission the Project. As noise levels equivalent to those generated during the Construction Phase are expected, and that Receptor 5 is occupied, it is considered that by careful selection and orientation of plant, combined with the implementation of noise barriers, it is feasible to reduce noise impact from **High** to **Low** significance.

10.6.4.4 Residual Impacts: Decommissioning Phase

It is anticipated that the resulting impacts from decommissioning are likely to be of **Low** impact significance. However, this will be assessed in full as part of once a decommissioning methodology has been developed.

10.7 Unplanned Events

There are no significant sources of noise that will occur in the event of an unplanned event. Hence the significance of the impact of the noise generated by unplanned events will be **Not Significant**. Further details on unplanned events relevant to the Project are detailed in **Chapter 19 Unplanned Events**.

10.8 Cumulative Impact Assessment

The cumulative impacts associated with the Project relating to noise and vibration are assessed in **Chapter 20 Cumulative Impact Assessment**.

Table 10.28 Assessment of Potential Impacts: Decommissioning Phase

Activity	Potential Impact	Receptor(s)	Receptor Sensitivity	Impact Magnitude / Likelihood	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Decommissioning	Noise and Vibration	Occupants of Residential Dwellings	High	Negligible to Moderate	Not Significant to High	To be determined when decommissioning methodology is finalised	Expected to be Not Significant to Low

10.9 Conclusions

An assessment of the worst case noise and vibration impacts associated with construction and pre-commissioning has been undertaken. The results predict that the majority of noise and vibration impacts will be **Not Significant** at existing sensitive receptors neighbouring the Project, with a number of exceptions.

At Receptor 4 a **High** impact is predicted. The Receptor 4 location is mainly effected by road traffic noise using the Varvarovka bypass road, and the **High** impact significance is only predicted to occur during periods when the greatest vehicle movements will occur. Mitigation in the way of a noise barrier is proposed along the boundary of the Varvarovka bypass road. Post mitigation noise impacts are predicted to be of **Low** impact significance.

The pre-commissioning stage that utilises the booster compressor plant is predicted to give rise to a **High** impact at the majority of neighbouring receptors. By selection of inherently quiet plant, careful siting, and the use of acoustic bunds / barriers it is potentially feasible to reduce noise impacts to **Low** significance. This would however, be dependent on being able to source inherently quieter plant than the type used in the assessment. Vibration impacts are classified as being **Not Significant**.

The assessment at a proposed residential site (Receptor 5) has indicated that the impact significance at this location is also considered to be **Not Significant/Low** during all construction and pre-commissioning scenarios considered. This is based upon the receptor having a negligible sensitivity through the Construction and Pre-Commissioning phases, as the development is not anticipated to be complete for occupation during this period.

The assessment of the Operational Phase has also concluded that noise and vibration impacts will be **Not Significant**.

The assessment of decommissioning activities will be undertaken during the Operations Phase of the Project. However, it is anticipated that decommissioning works can be suitably mitigated so that the majority of impacts are considered likely to be **Not Significant** to **Low** significance. An assessment of potential impacts will be undertaken prior to decommissioning.

References

Number	Reference
Ref. 10.1	World Health Organisation (WHO) (1999), Guidelines for Community Noise.
Ref. 10.2	Peter Gaz (2011), 'Complex Engineering Surveys at the Phase 'Design Documentation' within the Framework of the South Stream Gas Pipeline Marine Sector Project Implementation. Volume 5 Environmental Survey and Archaeological Studies. Part 1 Environmental survey. The Russian sector. Book 4 Technical report. Technical appendices. P. 1-796, 'LLC PGAZ', 2011 (Ref. No. 6976.101.004.21.14.05.01.04-02).
Ref. 10.3	Peter Gaz (2013) 'Report on additional land studies of noise and vibration on the landfall section in the area of the resort town of Anapa, on access roads and the temporary materials and equipment warehouse site in the port of Temryuk as part of the South Stream Offshore Pipeline section (Russian sector) project'.
Ref. 10.4	Sanitary Norms (CH 2.2.4 / 2.1.8.562-96) – Noise at the working places in rooms of residential and public buildings and in residential areas.
Ref. 10.5	Russian Regulation SanPin 2.1.2.2645-10.
Ref. 10.6	IFC General EHS Guidelines (2012): Environmental – Section 1.7 Noise.
Ref. 10.7	British Standard Institution (2009) 5228-1 Code of practice for noise and vibration control on construction and open sites – Part 1 and 2.
Ref. 10.8	The International Organisation for Standardisation (ISO) (1996), 9613 Acoustics – Attenuation of sound during propagation outdoors – Part: 2 General method of calculation.
Ref. 10.9	Datakustik Cadna, A noise modelling software Version 3.72.131
Ref. 10.10	Department of Transport, Welsh Office, (1988) Calculation of Road Traffic Noise (CRTN).
Ref. 10.11	Engineering Noise Control Second Edition (2002), Bies and Hansen, Jet Noise, General Estimation Procedures, pages 444-447.

Chapter 11: Terrestrial Ecology

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Tables

Figures

11 Terrestrial Ecology

11.1 Introduction

This chapter presents an assessment of the potential impacts of the Project on terrestrial ecology. The assessment has identified sensitive ecology receptors within the Project's zone of influence and considered the potential for these receptors to be impacted upon by the Project activities. The assessment follows the recommendations and requirements of the International Finance Corporation (IFC) Performance Standards 6 (PS6): Biodiversity Conservation and Sustainable Management of Living Natural Resources and other applicable standards (see Section 11.6.5).

In order to assess potential impacts, this chapter provides a description of the approach to the study. The scoping process is detailed, during which receptors were identified through an analysis of survey data, and a review of local, national and international requirements and standards. This chapter describes the spatial and temporal boundaries used in the assessment, the baseline conditions within these areas, the assessment methodology, the mitigation measures required to avoid or minimise any significant adverse effects, and the likely residual effects after these measures have been implemented. The relevant stakeholder consultation activities on-going and undertaken for the Project are also documented. The potential for cumulative impacts with other projects in the surrounding area is addressed in **Chapter 20 Cumulative Impact Assessment**.

This Project adheres to the 'mitigation hierarchy' as defined in IFC PS6, i.e. impacts should be progressively avoided, minimised, restored or offset if necessary, with priority given to the actions which are earliest in the hierarchy. Therefore, the Project will seek to avoid impacts on biodiversity. When avoidance of impacts is not possible, measures to minimise impacts and to restore biodiversity will be implemented. Offsetting is only considered if these measures do not result in a reasonable expectation of no net loss of biodiversity (or a net gain in respect of critical habitats). Given the complexity in predicting project impacts on biodiversity over the long term, the Project will adopt a practice of adaptive management in which the implementation of mitigation and management measures are responsive to changing conditions and the results of monitoring, until the necessary management objectives have been achieved.

11.2 Scoping

The terrestrial ecology impact assessment for the Project was defined through a scoping process, which identified ecological receptors and potentially significant impacts related to the Project. An important component of the scoping process was the definition of existing baseline conditions (i.e. the prevailing ecological characteristics against which the potential impacts of the Project could be assessed). Baseline conditions were identified primarily through the review of ecological information available from studies undertaken for the Project, including extensive feasibility, engineering and environmental surveys carried out in 2011, 2012 and 2013 (detailed in Section 11.4.4). Key steps in the scoping process for terrestrial ecology comprised the following:

- The Project design was reviewed to identify activities with a potential to significantly affect ecological receptors;
- Ecological receptors within the Project's likely area of influence (see Section 11.3 for definition) were identified through a review of secondary data (see Section 11.4.2 for further detail), primary data (detailed in Section 11.4.4), and professional expertise;
- A gap analysis of the available information to identify shortfalls of ecological knowledge that would need to be addressed within the ESIA and in particular those that required additional ecological field surveys;
- Identified Project activities and receptors were examined through an Environmental Issues Identification (ENVIID) process (described in this section below);
- A review of relevant national and international legislative requirements and international standards and guidelines to ensure legislative and policy compliance (relevant requirements are detailed in Section 11.6.5 Applicable Standards and **Chapter 2 Policy, Legislation and Administrative Framework**); and
- Stakeholder consultation activities, including consultation meetings held after the scoping report was disclosed (detailed below).

11.2.1 ENVIID

An ENVIID was undertaken to assist in the identification of environmental and social issues and receptors, including those relevant to the terrestrial ecology (the ENVIID process is further described in **Chapter 3 Impact Assessment Methodology**). During the ENVIID process, each activity was examined, drawing upon the experience of the technical specialists and their understanding of the extent and nature of the Project activities and the natural environment, to understand:

- How activities were expected to interact with ecology receptors, and whether this would result in a positive or negative impact; and
- Which receptors would potentially be impacted by each activity and the potential significance of that impact.

The outcome of the ENVIID was a register which identified the various elements of the Project and their interaction or potential impact on sensitive ecological receptors.

11.2.2 Stakeholder Engagement

A number of stakeholder consultation activities were undertaken during the scoping phase (details can be found in **Chapter 6 Stakeholder Engagement**). The key issues that were raised by stakeholders related to the reinstatement of the cliff area to the west of the Study Area and general protection of the natural environment. Details of the issues raised relevant to this chapter are detailed in Table 11.1.

Table 11.1 Stakeholder Consultation Issues

Stakeholder	Document / Event	Date	Issues / Concerns Raised	Relevant ESIA Section
Local Communities	Written comments (via Comment Forms) on EIA ToR	1st – 31st August 2012	Project will adversely affect ecological system. Natural environment should not be harmed.	Chapter 11 throughout
Local Communities	Written comments (via Comment Forms) on Scoping Report	20th November 2012-31st January 2013	Sceptical about reinstatement. Who will monitor this and be responsible.	11.6.9 and 11.6.13
			Gazprom has not performed well on the issue of recultivation and environmental protection.	Chapter 11 throughout
Local communities	Comments made by telephone on ESIA Scoping Report	29th November 2012	Natural environment should not be harmed.	Chapter 11 throughout
Local communities (Supsekh)	Comments made in person in ESIA Scoping consultation meetings	10th December 2012	Will the ecosystem be restored in accordance with international standards. Are there any planned restoration activities.	Chapter 11 throughout 11.6.9 and 11.6.13
Local communities (Varvarovka and Sukko)	Comments made in person in ESIA Scoping consultation meeting	11th December 2012	Concern that juniper trees have been cut down, while representatives promised, nothing would be cut down. Will juniper be re-planted or the area recultivated. Risk of erosion.	11.6.9
Regional NGOs	Comments made in person in ESIA Scoping consultation meeting	13th December 2012	Ecosystem is in critical condition due to impact of fishing and recreation. Pipeline construction will adversely impact ecosystem.	Chapter 11 throughout

Continued...

Stakeholder	Document / Event	Date	Issues / Concerns Raised	Relevant ESIA Section
			It was declared that juniper trees would not be cut down. But juniper trees have now been cut down.	11.6.10 and 11.6.13
Local Communities	Written comments (via Comment Forms) on Draft EIA	29th April – 31st May 2013	Concerns on environmental impact from the Project appeared to be the stakeholders main concerns as high level comments on this issue were the most frequently raised. Natural environment should not be harmed.	Chapter 11 throughout

Complete.

11.2.3 Analysis of Alternatives

An important part of the ESIA process was the analysis of alternatives (see **Chapter 4 Analysis of Alternatives** for more detail). In the course of considering Project design alternatives, technical decisions were taken that resulted in avoidance of some potential impacts completely.

A comparative ecological analysis of the two alternative routes (reasoning for the two routes can be found in **Chapter 4 Analysis of Alternatives**) was conducted by Gazprom in 2010 (Ref. 11.1); reference is also made in Appendix 20.1. That study showed that the location of the Russkaya compressor station (CS) had fewer environmental impacts compared to the alternative Beregovaya location. Undertaking the Project at the Beregovaya location in close proximity to the existing compressor station of the Blue Stream Pipeline Compressor Station would have resulted in unacceptable cumulative impacts associated with the contemporaneous operation of the Blue Stream Pipeline Compressor Station and the compressor station required for the Project. On this basis, the Russkaya CS site was selected, resulting in the Anapa landfall location being selected.

11.3 Spatial and Temporal Boundaries

11.3.1 Spatial Boundaries

11.3.1.1 Landfall Section

A detailed description of the landfall, nearshore and offshore sections of the Project Area is provided in **Chapter 5 Project Description**; the landfall, nearshore and offshore sections are defined primarily in relation to the different construction activities employed in each, and are not defined in ecological terms.

The landfall section, including the landfall facilities[1], is approximately 4 km in length. In this section, the pipelines extend from the tie-in approximately 100 m upstream of the landfall facilities, in a south-westerly direction to four microtunnel entry shafts approximately 2.4 km from the landfall facilities. The pipelines will enter the microtunnels and continue in a south-westerly direction for approximately 1.4 km, to emerge from the seabed approximately 400 m offshore. According to this technical definition, the landfall section includes approximately 400 m of marine environment, which is not a focus of this chapter. (Marine receptors within the nearshore and offshore sections (including sea birds) are addressed within **Chapter 12 Marine Ecology**). Upstream and downstream of the landfall facilities, the four pipelines will be installed using open-cut construction techniques.

Study Area and Wider Study Area

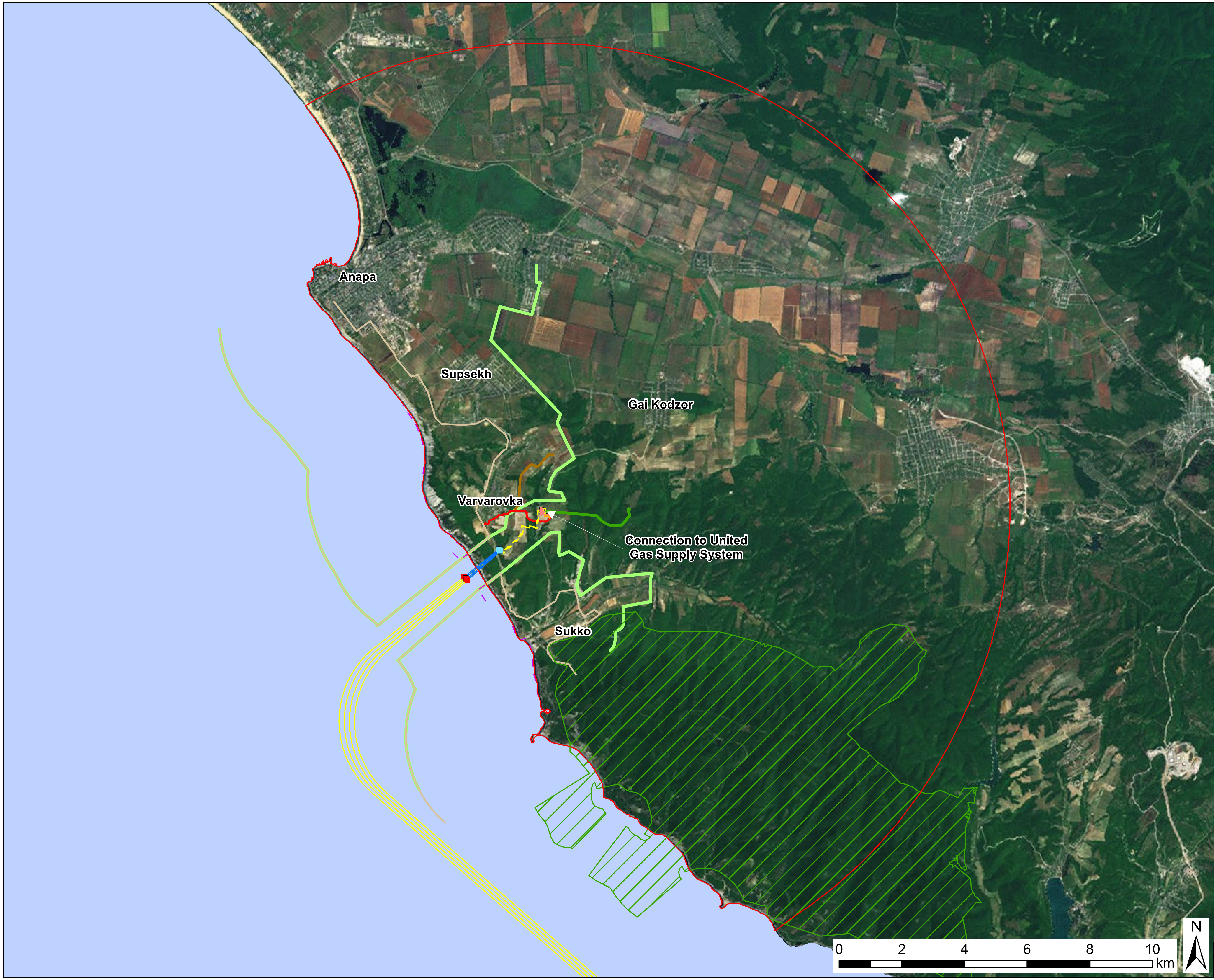
When defining study areas for terrestrial ecology, various elements of the Project were reviewed. Within the landfall section these included:

- The four pipelines that will be installed using open-cut construction techniques;
- Access roads and junction(s) for access of operations vehicles from existing roads to the Right of Way (RoW);
- The landfall facilities; and
- Microtunnel onshore entry shafts and section of microtunnelling extending as far as the shoreline.

A Wider Study Area was defined as 15 km around the centrepoint of these elements (although only extending up to the coastline, see Figure 11.1). Contextual information on the occurrence of protected or designated sites and threatened species in this area was reviewed.

The Study Area was more focused than the Wider Study Area, and covered an area of approximately 1 km surrounding the landfall section, extending to the coastline. Where access roads were located outside of this 1 km buffer, the Study Area was extended to 50 m either side of the proposed alignment (see Figure 11.2). The Study Area was subject to field survey in 2011, 2012, and 2013 (see Section 11.4).

[1] The landfall facility (approximately 4.85 ha in area) will include of metrology equipment, PIG traps, ESD valves, block and other valves, gas heating system, electrical instrumentation and other equipment; see Chapter 5 for further details.



LEGEND

- Boundary of the state nature reserve "Utrish"
- The boundary of the first area of sanitary protection zone (exclusion zone)
- The boundary of the second area of sanitary protection zone (limitation zone)
- The boundary of the third area of sanitary protection zone (monitored zone)
- Wider Study Area (15 km)

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Landfall facilities
- Proposed microtunnels
- Proposed offshore pipelines
- Microtunnel entry shaft
- Microtunnel exit pit
- Permanent access road to be constructed by SSTTBV
- Varvarovka bypass road (used by Project during construction only)

United Gas Supply System

- United Gas Supply System pipelines
- Permanent access road to be constructed by Gazprom Invest

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: For Information

Client: South Stream — Offshore Pipeline — ENERGISING EUROPE

Project Title: SOUTH STREAM OFFSHORE PIPELINE

Drawing Title: WIDER STUDY AREA

Drawn	Checked	Approved	Date
DH	DK	CP	29 May 2014

URS Internal Project No.	Scale @ A3
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Drawing Number: Figure 11.1

Rev

Plot Date: 29 May 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 11 Ecology\Figure 11-1 Landfall Wider Study Area.mxd

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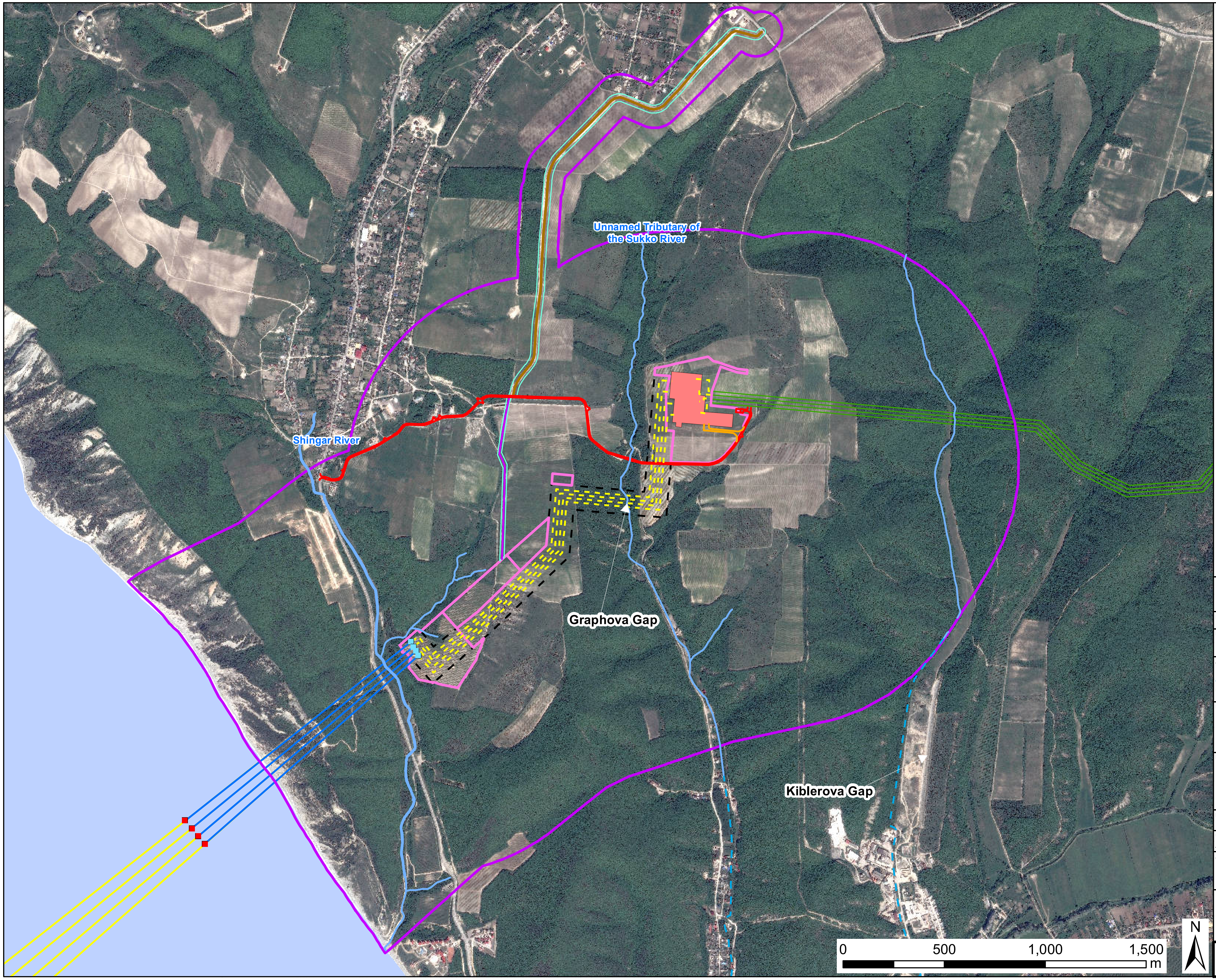

LEGEND

- Rivers
- Inferred watercourses
- Study area

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Landfall facilities
- Proposed microtunnels
- Proposed offshore pipelines
- Microtunnel entry shaft
- Microtunnel exit pit
- Construction corridor
- Temporary construction area for road construction
- Construction sites
- Permanent access road to be constructed by SSTTBV
- Temporary access road constructed by SSTTBV
- Varvarovka bypass road (used by Project during construction only)

United Gas Supply System

- United Gas Supply System pipelines
- Permanent access road to be constructed by Gazprom Invest

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue
For Information

Client
South Stream Offshore Pipeline ENERGISING EUROPE

Project Title
SOUTH STREAM OFFSHORE PIPELINE

Drawing Title
STUDY AREA

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Figure 11.2

Rev

Plot Date: 07 May 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 11 Ecology\Figure 11-2 Study Area.mxd

11.3.2 Temporal Boundaries

The assessment includes the four phases of the Project:

- Design and Development;
- Construction and Pre-Commissioning (the duration of which is approximately 18 months);
- Operational including Commissioning (an approximately 50 year period); and
- Decommissioning.

Therefore, the temporal boundary for the assessment is the end of the Decommissioning Phase, including associated demolition, removal of infrastructure and restoration works.

11.4 Baseline Data

11.4.1 Introduction

An extensive literature review and consultation with statutory bodies, interested parties and universities (see Sections 11.4.2 and 11.4.3) provided contextual information on potential terrestrial ecology receptors (habitats and species) within the Wider Study Area, and on their ecology, distribution, and pertaining threats. This information provided the contextual base upon which further field surveys were planned (see Section 11.4.4).

11.4.2 Secondary Data[2]

11.4.2.1 International, National and Regional Assessments of Extinction Risk

In order to identify the potential presence of plant and animal species of conservation importance within the Study Areas, international, national and regional assessments of extinction risk were consulted. These included:

- The RDB of the Russian Federation (RF) for plants (Ref. 11.2) and for animals (Ref. 11.3);
- The Red Data Book (RDB) of the Krasnodar Krai (KK) for plants (Ref. 11.4) and for animals (Ref. 11.5); and
- The International Union for Conservation of Nature (IUCN) Red List of Threatened Species (RL) (Ref. 11.6).

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[2] Secondary data refer to existing information that was not collected for the purpose of the Project; e.g. published literature, or reports / information held by government and non-governmental organisations. Primary data refer to information that was collected specifically for the Project; e.g. ecological surveys described in Section 11.4.4.

Table 11.2 IUCN RL, RDB RF, and RDB KK Classification System

IUCN	RDB RF	RDB KK
Extinct in the Wild (EXW)	Probably extinct (0)	Probably extinct in the region (0)
Critically Endangered (CR): Species facing an extremely high risk of extinction in the wild	Endangered (1)	Disappearing in the wild (1) Critically Endangered – (1A) Endangered – (1B)
Endangered (EN): Facing a very high risk of extinction in the wild		
Vulnerable (VU) facing a high risk of extinction in the wild	Dwindling in numbers (2)	Vulnerable – (2)
Near Threatened (NT) close to qualifying for or is likely to qualify for a threatened category in the near future	Rare (3)	Rare (3)
Data Deficient (DD) Inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and / or population status.	Undefined by status (4)	Lack of data (5)
Least Concern (LC) Widespread and abundant taxa are included in this category	Recovers and restores (5)	Recoverable (4)
N/A	N/A	Dependent on human activity (6) Specially controlled (7)

These publications provide taxonomic, conservation status and distribution information for each listed species. Table 11.2 presents the classification system used by the IUCN RL, the RDB RF and the RDB KK for representing the extinction risk of species (Ref. 11.2, Ref. 11.3, Ref. 11.4, Ref. 11.5 and Ref. 11.6).

The IUCN considers species listed as VU and above to be species of particular conservation concern due to their high risk of extinction in the wild. Species classified as VU or above on the

IUCN Red List, or two and above on the RDB RF and RDB KK are referred to as 'threatened' in this chapter.

For ease of reference, all species which are listed on the IUCN RL, RDB RF and RDB KK are referred to in this chapter as 'red list species', or as species of conservation concern / importance.

Within the Russian Federation, species assessed as categories 1-3 by the RDB RF and RDB KK, are afforded protection under Russian legislation and are therefore 'protected species' (Ref. 11.7).

11.4.2.2 Consultation

Statutory Body Consultation

The Ministry of Natural Resources of Krasnodar Krai (MNRKK) was consulted in February 2013 to provide information on the presence of threatened flora and fauna, as well as protected areas, within the Wider Study Area. The MNRKK confirmed that the landfall section of the Project Area was outside of any designated site of regional or national importance. The MNRKK also confirmed that the RDB KK and RDB RF are the official documents which contain information on the status and distribution of threatened and protected species within the Krasnodar region.

The Ministry of Natural Resources and Environment (MNRE) of the Russian Federation was consulted in February 2013 to obtain information on the Utrish Specially Protected Natural Area (SPNA) and to enquire whether the MNRERF were aware of previously conducted ecological studies within the Wider Study Area. The MNRERF returned lists of RDB species supported by the Utrish SPNA and confirmed that it has no knowledge of previously conducted ecological surveys within the Wider Study Area.

Other Interest Groups

External Experts

A meeting was held with Semon Kustov, an invertebrate specialist from the Kuban State University on 11th September 2013. The purpose of the meeting was to discuss the potential presence of threatened invertebrate species included in the RDB RF and RDB KK. Mr Kustov was able to provide information on the known distribution and ecology of these species.

A meeting was held with Dr Olga Leontyeva from Moscow State University on the 31st July 2013. Dr Leontyeva is an ecologist with more than 20 years' experience, and a recognised expert in the biology and ecology of Nikolski's tortoise, *Testudo graeca nikolskii*. The discussion with Dr Leontyeva addressed the species' population status within the Study Area, habitat requirements and biology. Taking into consideration existing data, the need for and scope of an additional population size class survey was discussed, and planned for October 2013. Dr Leontyeva also advised on a mitigation strategy in relation to Project activities proposed at the time.

Utrish Nature Reserve

An initial meeting was held in Anapa with Dr Alexandr Grigorievich Krokhmal, Director of State Nature Reserve "Utrish" on 18th April 2013. The purpose of the meeting was to understand the purpose, objectives and focus of the Utrish, which the Director explained. Potential cooperation during Construction and Operational Phase of the Project - in particular, mitigation measures for the Red Data Book species – were briefly discussed. Dr Krokhmal stated that, on the basis of information available to him, he had no concerns about the Project. A subsequent visit to the territory of the reserve was conducted on 1st June 2013 to contextualise information received from the Director.

A further meeting was held with Dr Krokhmal on 12th September 2013 to discuss potential involvement of the Utrish SPNA in providing mitigation options for Nikolski's tortoise.

11.4.3 Data Gaps

A review of secondary data provided information on the likely presence of habitats and species within the Wider Study Area. However, secondary data alone were insufficient to accurately determine habitat type and quality, as well as species presence or absence within the Study Area. Field surveys (for primary data) were therefore undertaken to obtain this information, so that potential impacts could be assessed.

11.4.4 Primary Data / Baseline Surveys

11.4.4.1 Study Area

Introduction

Baseline surveys were undertaken in 2011, 2012, and 2013 to determine the presence of terrestrial ecology receptors within the Study Area. The field surveys have been used as the primary source for characterising the terrestrial ecology baseline. The approach and methods employed for these surveys are presented below.

The surveys completed in 2011 were limited to publically accessible areas across the entire Study Area (Figure 11.3). The surveys completed in 2012 focussed primarily on the Pipeline construction corridor (Figure 11.4). The surveys completed in 2013 focussed on the access route options (Figure 11.4).

Habitats and Flora

2011 Habitats and Flora Survey

Botanical surveys were undertaken between April and July 2011 to map broad habitat types within the Study Area in accordance within generally accepted survey methodology (Voronov, 1973, as cited in Ref. 11.9). Prior to the field survey, aerial photographs were reviewed to determine the location and extent of broad habitat areas or vegetation communities. These areas were then ground-truthed to confirm or to amend the findings of the aerial photography review, as well as to gather information on the structure and composition of vegetation within the broadly identified habitat types.

Following the ground-truthing, a series of sample plots were prepared and surveyed within the Study Area (see Figure 11.3 for sample plot locations) with an exhaustive list of plant species recorded within each plot. Specimens requiring laboratory identification were stored and later examined. Species were identified with the use of local flora guides (Kosenko, 1970 and Zernov, 2002 as cited in Ref. 11.9); species of conservation concern were determined by reference to the RDB RF and RDB KK. Within each plot, abundance and projective cover were defined according to the Domin scale (Braun-Blanquet, 1965 as in Ref. 11.9). The location of each plot was recorded using a Global Positioning System (GPS) (Figure 11.3) and the plot and individual plant specimens photographed.

Surveys were undertaken at a suitable time of year for botanical survey (between April and July), when a wide range of both flowering forbs and grasses would have been visible for identification.

In addition, the freshwater habitat surveys were undertaken which included sampling both phytoplankton and zooplankton to contribute to the characterization of the waterbodies present (Ref. 11.9).

2012 Red List Flora Survey

Targeted botanical surveys were undertaken in August 2012. Surveyors focussed on recording species of conservation concern, along the proposed Pipeline construction corridor and within the landfall facilities footprint. Where encountered, red list species were recorded and mapped with the use of a GPS (see Figure 11.6). The location and extent of the area surveyed in 2012 is shown in Figure 11.4.

2013 Red List Flora Survey

Targeted botanical surveys were undertaken over a one-week period during June 2013. Surveyors focussed on recording red list species along the proposed access route options. Where encountered, red list plant species were recorded and mapped with the use of a GPS (see Figure 11.6). The location of the 2013 survey transects is depicted in Figure 11.4.

Fauna

Introduction

Extensive baseline surveys conducted for the Project in 2011 provided substantial primary data that informs this impact assessment. Surveys undertaken between April and July 2011 employed various methods to record and count animals present within the Study Area, including:

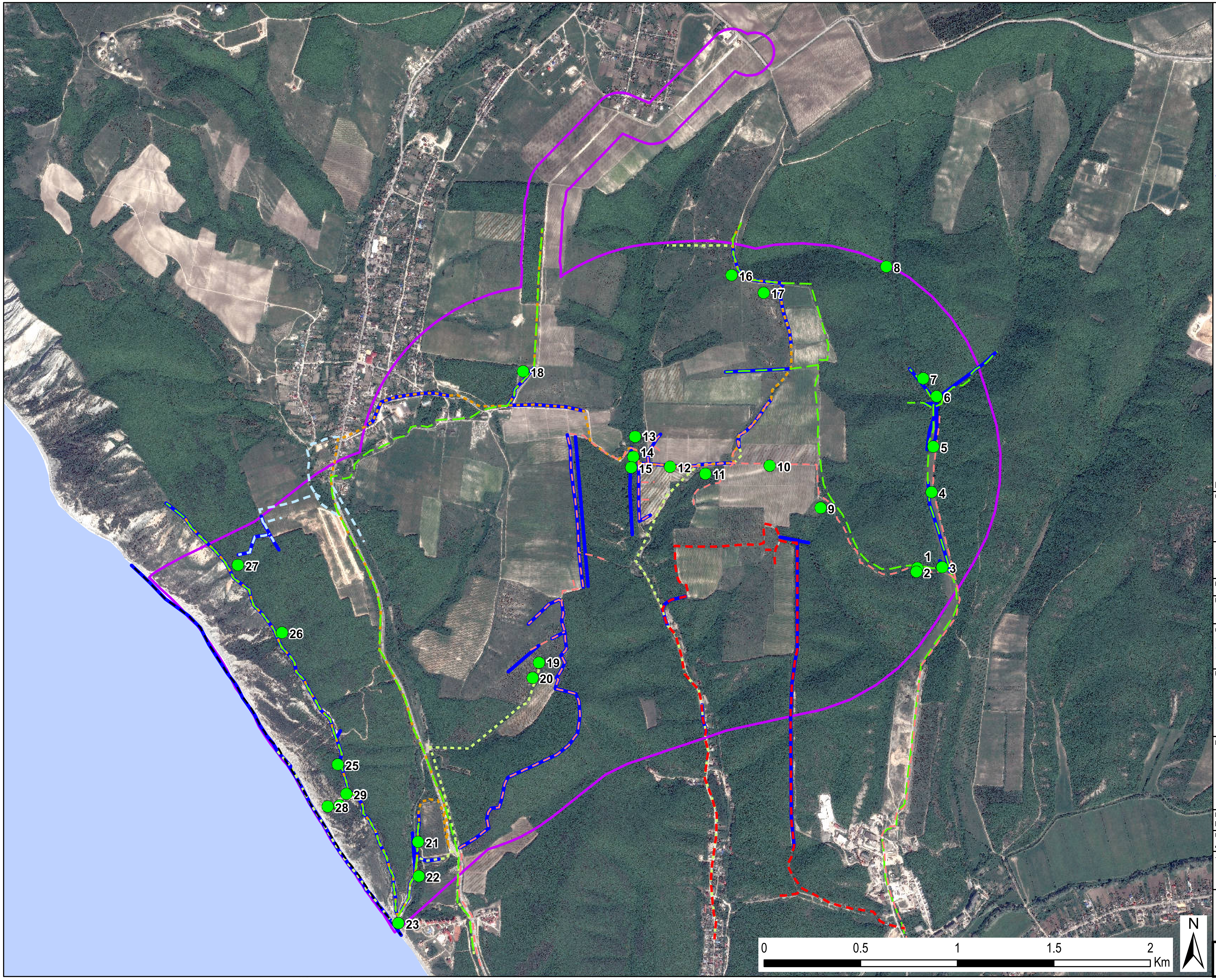
- Walked and driven transects surveys - employed to count amphibians, reptiles, birds, and larger mammals (Table 11.3);
- Traps and habitat cylinders - used to count smaller mammals such as rodents; and

- Various aquatic sampling methods – employed to determine fish, phytoplankton and zooplankton presence and populations (Ref. 11.9).

Details of the 2011 faunal survey transects are summarised in Table 11.3, and depicted in Figure 11.3 and Figure 11.5. The following sections describe the surveys for faunal groups.

Table 11.3 Faunal Survey Transect Information

Route Number	Route Type	Date	Length (km)	Faunal Surveys Completed
1	On-foot	April, 16 2011	5.8	Herpetofauna Birds Mammals
2	Vehicle and on-foot	April, 17 2011	13.1	Herpetofauna Birds Mammals
3	Vehicle and on-foot	April, 18 2011 April, 19 2011 July, 22 2011	19.9	Herpetofauna Birds Mammals
4	Vehicle and on-foot	May, 22 2011	12.8	Birds Mammals
5	Vehicle and on-foot	June, 09 2011	2.1	Herpetofauna Birds Mammals
6	On-foot	May, 22 2011 June, 09 2011 July, 22 2011	2.4	Herpetofauna Mammals
7	Vehicle and on-foot	April, 29 2011	8.8	Birds Mammals



LEGEND

- Plots of Vegetation Descriptions
- Route 1
- Route 2
- Route 3
- Route 4
- Route 5
- Route 6
- Route 7
- Census Routes
- Study area

Projection: Lambert Conformal Conic

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Revision Details	By / Check	Check Date	Suffix

Purpose of Issue

For Information

Client

South Stream Offshore Pipeline ENERGISING EUROPE

Project Title

SOUTH STREAM OFFSHORE PIPELINE PROJECT

Drawing Title

2011 SURVEY TRANSECTS AND PLOTS

Drawn	Checked	Approved	Date
DH	RW	MW	05/03/2014

URS Internal Project No.	Scale @ A3
46369084	1:18,000

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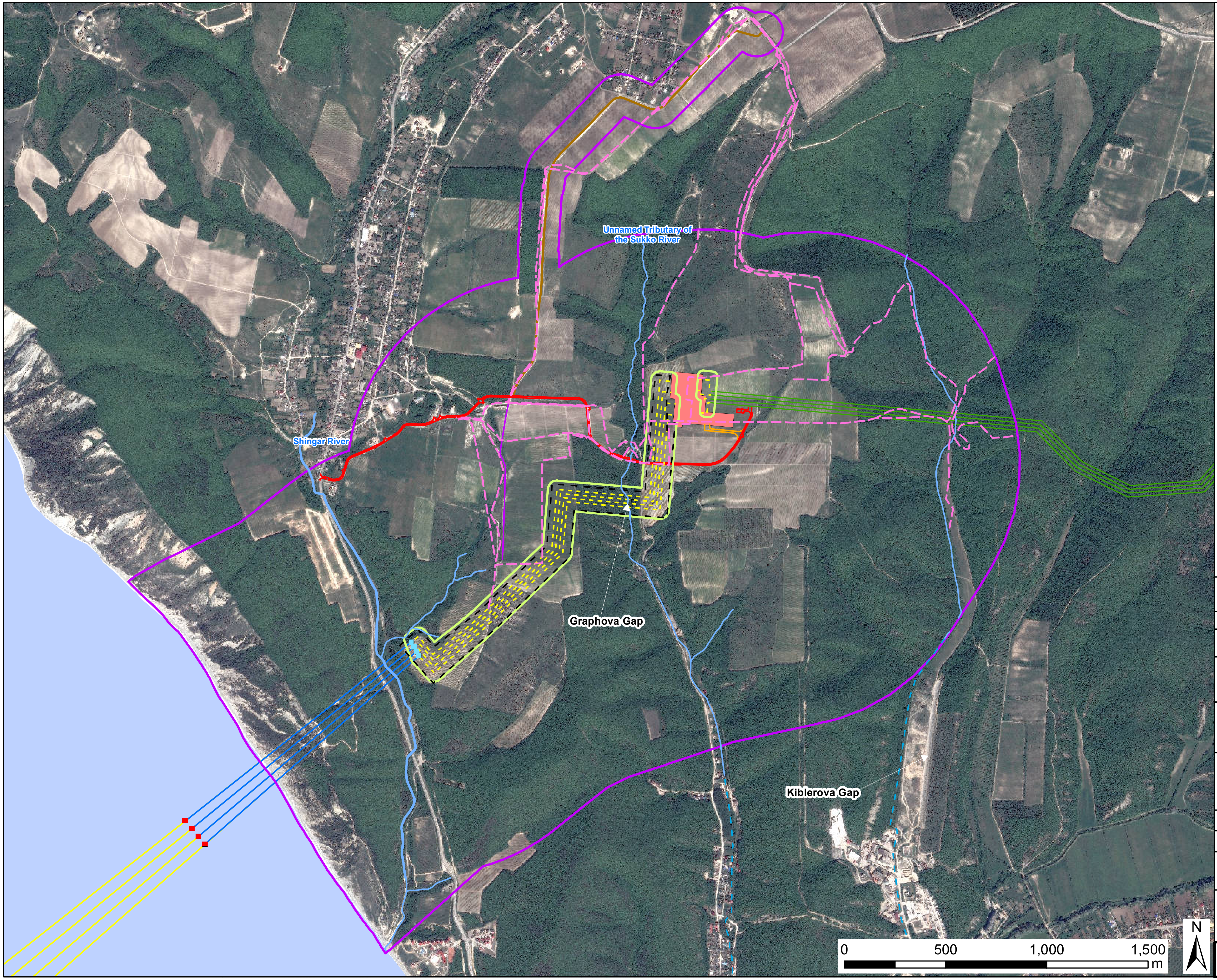
Drawing Number	Rev
Figure 11.3	

Plot Date: 05 Mar 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 11 Ecology\Figure 11-3 2011 Survey Transects and Plots.mxd



LEGEND

- Ecology 2013 Transect Routes
- Rivers
- Inferred watercourses
- 2012 survey area
- Study area

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Landfall facilities
- Proposed microtunnels
- Proposed offshore pipelines
- Construction corridor
- Microtunnel entry shaft
- Microtunnel exit pit
- Permanent access road to be constructed by SSTTBV
- Temporary access road constructed by SSTTBV
- Varvarovka bypass road (used by Project during construction only)

United Gas Supply System

- United Gas Supply System pipelines
- Permanent access road to be constructed by Gazprom Invest

Projection: Lambert Conformal Conic

Revision Details	By	Check	Check Date	Suffix

Purpose of Issue
For Information

Client
South Stream Offshore Pipeline ENERGISING EUROPE

Project Title
SOUTH STREAM OFFSHORE PIPELINE

Drawing Title
2012 AND 2013 TRANSECTS AND PLOTS

Drawn	Checked	Approved	Date
DH	RW	MW	05/03/2014

URS Internal Project No. 46369082
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Drawing Number
Figure 11.4
Rev

Plot Date: 05 Mar 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 11 Ecology\Figure 11-4 2012 and 2013 Transects and Plots.mxd

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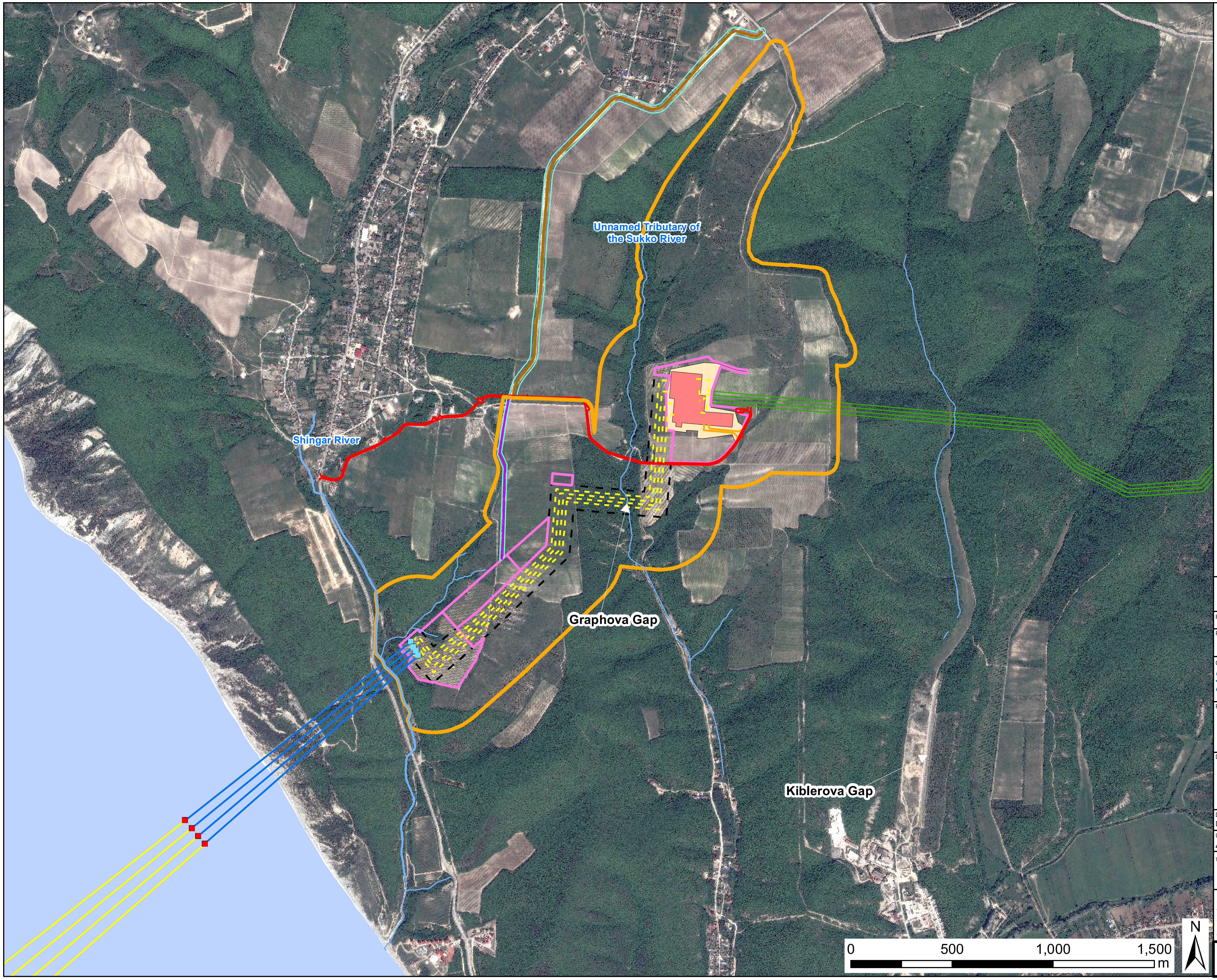

LEGEND

- Tortoise monitoring survey area
- Rivers

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Landfall facilities
- Proposed offshore pipelines
- Proposed microtunnels
- Microtunnel entry shaft
- Microtunnel exit pit
- Construction corridor
- Cut and fill side slopes
- Temporary construction area for road construction
- Construction sites
- Permanent access road to be constructed by SSTTBV
- Temporary access road constructed by SSTTBV
- Varvarovka bypass road (used by Project during construction only)

United Gas Supply System

- United Gas Supply System pipelines
- Permanent access road to be constructed by Gazprom Invest

Projection: Lambert Conformal Conic

Revision Details	By	Check	Date	Suffix

Purpose of Issue
For Information

Client
South Stream Offshore Pipeline ENERGISING EUROPE

Project Title
SOUTH STREAM OFFSHORE PIPELINE

Drawing Title
TORTOISE MONITORING SURVEY AREA

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DH	RW	MW	18 Feb 2014

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46369082	1:18,000

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Drawing Number: Figure 11.5
Rev

Plot Date: 18 Feb 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 11 Ecology\Figure 11.5 Tortoise Monitoring Survey Area.mxd

Invertebrates

2011 Surveys

Freshwater zoobenthos surveys were sampled in the two small watercourses within the Study Area. The zoobenthos were sampled, fixed in formalin and identified under a microscope using appropriate keys (e.g. Lipin, 1950, as cited in Ref. 11.9).

2012 Surveys

Invertebrate surveys were undertaken during 2012 and were largely restricted to a habitat suitability assessment, although where observed, species were recorded. Surveyors focussed on assessing the suitability of habitat along the Pipeline and landfall facilities construction footprint (excluding the micro-tunnel area) to support red list invertebrates.

Fish

Fish were sampled in 2011 in the two small watercourses within the Study Area in accordance with the best practice methods contained in Rass, Kazakova, 1966; Pravdin, 1966; Koblitskaya, 1981 (as cited in Ref. 11.9) and identified using field keys (Berg, 1948; Troiskiy and Tsunikova, 1988 as cited in Ref. 11.9). Presence or absence and where appropriate, population densities of fish were determined in accordance with these methods.

Herpetofauna

2011 Surveys

Transect surveys were employed to determine population densities of amphibian and reptile species within the Study Area. These were undertaken along transects 1, 2, 3, 5, and 6. Surveyors walked along each route with the aim of observing individual animals, as well as signs such as shed skins and droppings. Due to the relatively small size of herpetiles, the transect width was limited to two metres (one metre each side of the transect line). Where species were recorded, their location was noted with the use of a GPS. Surveys were timed to include early morning surveys, when reptile activity was likely to be at its highest. The population survey followed standard survey methodology for assessing herpetofauna populations, as is described in Novikov, 1953; Pesenko, 1982; and Scherbak, 1989 (as is cited in Ref. 11.9). This comprised the following:

- The peak count (highest number of individuals recorded on one survey across the entire survey effort) of each species was recorded per habitat type;
- The population density for each species was then calculated using a density formula which arrived at a number of species per 1 hectare (ha) (Chelintsev, 1996 as cited in Ref. 11.6); and

Relative abundance was also calculated based on the following scale of animal occurrence: 0 – species not encountered; 1- species is rare; 2 – species inconsiderable in number; 3 – species is common; and 4 – species is numerous with many encounters on the majority of routes (Pestov, 2004 as cited in Ref. 11.9).During the transect surveys potential refuges encountered, such as wood or rock piles, were checked for sheltering individuals.

Additional specific surveys for amphibians were undertaken concurrently, which included the visual inspection of water bodies for both larvae and adults. Where waterbodies were too deep or turbid for visual inspection, hand nets were used to capture animals. Potential amphibian spawning sites such as streams and ephemeral puddles were identified and mapped.

2012 Surveys

The proposed Pipeline and landfall facilities construction footprint was surveyed over six days in August 2012. The aim of the survey was to supplement the information collected during the 2011 surveys and target the proposed Pipeline construction corridor and within the landfall facilities footprint. Surveyors walked a series of transects through suitable reptile habitat with the aim of observing individuals or signs (e.g. shed skins, tracks etc.) (See Figure 11.6). In addition, surveyors conducted refugia searches, checking under fallen wood or boulders, to uncover sheltering reptiles. Care was taken to not harm or disturb any individuals where uncovered. Surveys were timed to include early morning and late afternoon surveys, when the probability of recording basking reptiles was greatest.

Amphibian surveys were undertaken concurrently with reptile surveys in 2012. Surveys involved direct observation and listening for (in the case of European tree frog *Hyla arborea schelkownikowi*) individual amphibians and their signs and refugia surveys. Areas most likely to support amphibians, including wet areas within the mesophilic forest and meadow and adjacent to streams, were targeted.

2013 Surveys

Route options for the temporary access roads were surveyed for reptiles and amphibians during June 2013. Surveyors walked a series of transects through suitable reptile habitat with the aim of observing individuals or signs (e.g. shed skins, tracks etc.) (Figure 11.4). In addition, surveyors conducted refugia searches, checking under fallen wood or boulders, to uncover sheltering reptiles. Care was taken to not harm or disturb any individuals were uncovered. Surveys were timed to include early morning and late afternoon surveys, when the probability of recording basking reptiles was greatest.

In addition to the access road survey, a targeted Nikolski's tortoise *Testudo graeca nikolskii* survey was undertaken by Dr. Leontyeva from the 8th October to the 14th November 2013. This survey had the following primary objectives:

- To determine an approximate size class estimate for the Nikolski's tortoise population within the Tortoise Survey Area (see Figure 11.5)[3]; and

[3] The Tortoise Survey Area is a subset of the Study Area and was defined based on the location of the Project's infrastructure and the known daily range of tortoise (approximately 300 m)

- To obtain information on the habitat preference and the likely distribution of the tortoise within the Study Area during its hibernation period.

The survey area covered the Pipeline footprint and associated access roads plus approximately 300 m buffer. The survey was completed by between three and five surveyors, walking transects through the Tortoise Survey Area. The total length of transects walked by the surveyors was 260 km. The visible survey width of the transects varied between four and six metres, depending on the density of the vegetation. This gives an approximate area surveyed of 130 ha (assuming an average of 5 m survey width). The location of all tortoises found during the survey was recorded using a GPS. Individual tortoises were marked with a temporary marker to avoid double counting during the survey. Furthermore, information including each individual's sex, approximate age, and size was recorded, as well as a description of the habitat within which it was observed. Photographs of each individual were also taken.

As well as recording tortoises, incidental sightings of other herpetiles species were also noted during the survey.

Birds

2011 Surveys

During 2011, both transect and point count surveys were completed. Bird surveys were undertaken within the Study Area during six days between April and June 2011. During all surveys, information including the species, habitat and signs of breeding was recorded (Ref. 11.6).

Bird transect surveys were completed along routes 1-5 and 7, which totalled 18.5 km in length (see Figure 11.3 and Table 11.3). The surveys followed 'the borderless strip' methodology described by Ravkin 1967 (as is cited in Ref 11.9). This method involved surveyors recording all birds which were heard or seen within each habitat type. Surveyors recorded the species, number of individuals, behaviour (e.g. nesting, feeding, and resting) and distance from the recorder. The census routes were representative of the habitats contained within the Study Area, with routes covering the following areas:

- Xerophilous shrub woodland (shiblyak) – 4.17 km;
- Mesophilic forest – 2 km;
- Juniper woodland and tomillyar – 3.18 km;
- Steppefied secondary meadow – 2.63 km;
- Mesophilic meadow – 0.8 km;
- Coastal shingle – 2.4 km; and
- Urban and agricultural habitats – 4.45 km.

Bird population densities were calculated according to Ravkin, 1967 (as cited in Ref. 11.9). This method calculates the density of birds encountered perched and flying separately.

Species composition within habitats with a complex structure, including the mesophilic and secondary steppefied meadow, juniper woodland and urban areas, was further investigated using point counts. Surveyors identified a typical stand of vegetation (or plot) within each habitat type subject to this survey method and recorded bird species and numbers within each plot. Surveying of each plot was repeated at each plot over the course of the three months (from April – June 2011).

2012 Surveys

During the August 2012 survey of the proposed Pipeline construction corridor and within the landfall facilities footprint, incidental sighting of birds were recorded. Information about the species, sex, age, behaviour, and habitat was recorded. The surveys included early mornings when birds are likely to be more active. A single dusk survey was also completed.

2013 Surveys

During the June 2013 survey of the access road options and landfall sites, a field ornithologist recorded all bird species observed. The following information was collected for each species recorded: sex, age, notes on behaviour and the habitat in which the species was observed. Population densities were not calculated. The surveys included early mornings when birds are likely to be more active.

Mammals

2011 Surveys

Mammal surveys were undertaken in 2011 within the Study Area, which employed both transect surveys and the use of traps (depending on the species). A summary of the methods employed for these surveys is provided below (Ref. 11.9).

Small rodents were surveyed using a trap-line methodology. This involved using baited traps arranged in a line of 25 traps, spaced 5 m apart. Fifty trapping days were undertaken within mesophilic forest and shiblyak habitats, while 25 trapping days were completed within the mesophilic meadow and steppefied meadow, juniper woodland and agricultural land. A conversion factor developed by Ravkin and Livanov, 2008 (as cited in Ref. 11.9) was used to determine population density for each species recorded.

Small insect eating mammals (excluding moles, and hedgehogs) were counted using cylinder traps. Five cylinders were installed every 50 m along a 15 cm high polyethylene fence in accordance with the method described in Ravkin and Livanov, 2008 (as cited in Ref. 11.9). Traps were placed for 10 days within both the shiblyak and mesophilic forest, whilst 5 trapping days were completed in the steppefied meadow. A conversion factor developed by Ravkin and Livanov, 2008 (as cited in Ref. 11.9) was used to determine population density for these species.

Bats were recorded through visual observation at dusk (sound detectors were not employed for survey). Additionally, structures such as trees and buildings located along the Pipeline and landfall facilities construction footprint (excluding the micro-tunnel area) assessed for their bat roost potential.

Concerning carnivores and other large mammals, information on the presence, distribution, and habitat preference of these species was gathered through sightings of individuals and recording of animal signs (e.g. burrows, snuffle holes, tracks, faeces, etc.) during the walked and driven transects. The population density of species recorded was determined using a formula based on the distance of each transect and number of interaction per species noted.

2012 Surveys

The 2012 surveys were focussed on assessing the suitability for and recording the presence and behaviour of mammals within habitats within the Pipeline and landfall facilities construction footprint (excluding the micro-tunnel area).

As well as sightings of species, surveyors searched for and recorded mammal field signs (such as footprints, mammal paths feeding remains, droppings, and burrows or holes which may have been used by mammals). A single dusk survey was completed when emerging nocturnal species (such as bats) are best recorded.

In addition, surveyors assessed potential structures, including trees and buildings (where appropriate), for their potential to support roosting bats. Trees were classified in accordance with guidance provided by the Bat Conservation Trust (UK) (Ref. 11.10).

2013 Surveys

The 2013 survey repeated the methodology of the 2012 survey, although it focused on the access road options under consideration at the time of the survey (Figure 11.4).

11.4.4.2 Habitat Characterisation according to IFC PS6

As required by IFC PS6, each habitat type is assessed as either modified or natural habitat. These are defined by IFC PS6 (Ref. 11.11) as follows:

Modified habitats are areas that may contain a large proportion of plant and / or animal species of non-native origin, and / or where human activity has substantially modified an area's primary ecological functions and species composition. Modified habitats may include areas managed for agriculture, forest plantations, reclaimed coastal zones, and reclaimed wetlands.

Natural habitats are areas composed of viable assemblages of plant and / or animal species of largely native origin, and / or where human activity has not essentially modified an area's primary ecological functions and species composition.

A subset of the above two habitat groupings represent either modified or natural habitat which is of particular ecological importance, termed 'critical habitat'. This classification is of importance in the determination of the extent and type of mitigation measures required. A separate critical habitat assessment was undertaken to identify areas of this type and is presented in Appendix 11.1, the conclusions of which are integrated into this chapter in the relevant sections.

11.4.5 Data Assumptions and Limitations

11.4.5.1 Habitats and Flora

The optimal period for habitat and botanical survey is generally between April and August, when the majority of plant species are apparent and critical identification features such as flowers and seeds are observable. The 2011 surveys, undertaken between April and July, 2012 surveys, undertaken during August and 2013 surveys, undertaken during June, are therefore likely to have captured a large proportion of the plant species present within the Study Area.

It is acknowledged that the Study Area is relatively floristically diverse and therefore contains plants with a range of flowering strategies (early or late flowering plants). While a small proportion of species may therefore not have been recorded or were under-recorded, the survey timings are not considered a limitation as sufficient information has been gathered to classify habitats and identify their dominant and indicator species.

In terms of red list plant species, secondary data has provided sufficient information to identify which species are likely to be present within the Study Area. Primary data (field surveys), have been undertaken at an appropriate time of year for identifying these species, and have covered a representative proportion of the Study Area, including the proposed Pipeline, landfall facilities, and access roads.

Sufficient data has therefore been gathered to determine the type of habitats, their distribution, and presence (or potential presence) of red list plants within the Study Area.

11.4.5.2 Fauna

Invertebrates

The invertebrates potentially present within the Study Area exhibit a variety of lifecycles, with optimum survey periods for species varying between March and September. The 2012 invertebrate survey (the only survey where invertebrates were surveyed) was undertaken during a six day period during August 2012, is therefore likely to have missed or under-recorded a large proportion of the invertebrates potentially present within the Study Area.

Therefore, species presence or likely absence from within the Study Area has largely been completed through a combination of secondary data sources and based on habitat suitability assessments. The potential presence of threatened invertebrate species was further investigated through consultation with an invertebrate specialist from Kuban State University.

In combination, the primary and secondary data has provided sufficient information to determine with confidence the presence or absence of habitats suitable to support populations of red list invertebrates within the Study Area.

Amphibians and Reptiles

Timing of Surveys

The active period for amphibians and reptiles is largely between March and October. The optimal survey period is generally during cooler months (such as March, April, May and September – mid-October). Surveys were undertaken during April and July (2011), August (2012), and June and October – November (2013). Therefore, the surveys were generally conducted during the main active period, although not always at an optimal time of year.

The 2013 targeted Nikolski's tortoise survey undertaken by Dr. Leontyeva and team, encountered cold, unseasonal weather in late September and early October. The temperatures experienced at this time were considered by Dr. Leontyeva low enough to prompt a potentially significant proportion of the local tortoise population to go in to hibernation early. This view was confirmed through survey, which revealed that a number of tortoises were already beginning to 'dig-in' for hibernation. The weather conditions are therefore likely to have reduced the number of active tortoises within the Tortoise Survey Area, and their numbers are therefore likely to have been under-recorded.

Methods Employed

The walked transect method employed for all reptile surveys, while relatively effective at recording larger reptiles such as Nikolski's tortoise, can under record smaller species and those which are highly sensitive to human presence (such as lizards and some snake species). A proportion of reptile species may therefore have been missed or under-recorded during the field survey.

Implications for the ESIA

The limitations associated with survey timing and methods have been addressed by:

- Employing a relatively high survey effort (61 days of transect surveys over the course of the three year survey period). This included 11 days in 2011, 6 days in 2012, and 40 days in 2013. The repeat visits over a three-year period increase the likelihood of presence or absence of species being confirmed; and
- Undertaking a thorough review of secondary data sources, including consultation with Dr Olga Leontyeva, a recognised national expert in herpetology from Moscow State University (see 'Herpetofauna' within Section 11.5.1.3).

The methods employed during the field surveys combined with the data gathered through the review of secondary data, are considered sufficient to determine the presence or likely absence of various species of reptile, to assess species population densities, and to assess the likely effects of the Project on these species.

Birds

Within the Study Area, birds are present throughout the year, either breeding (peak periods are between March and July inclusive), on migration (the spring migration occurs between mid-February and mid-June and the autumn migration between mid-July and mid-November), or overwintering (overwintering birds generally arrive in approximately October and leave in March). The 2011 field surveys (undertaken between April and June) would therefore have recorded a sample of breeding birds and spring migrants although they would have missed overwintering birds. The field surveys in 2012 (August) and 2013 (June) would have largely recorded middle to late season breeders and the last of the spring migrants.

The limitations inherent in the timing of the field survey have been mitigated for through the provision of secondary data which have provided context to the field survey data.

The terrestrial ecology baseline for birds presented in this chapter is therefore considered to be an accurate representation of bird species composition and habitat occupation within the Study Area.

Mammals

Mammal species potentially present within the Study Area are generally most active between March and September when mating, rearing of young, and foraging activity occur. The field surveys in 2011 (April - June), 2012 (August) and 2013 (June) were therefore undertaken at an appropriate time for recording mammals. However, due to the fact that larger mammals are highly mobile and may be transient within the Study Area at certain times, these species could potentially have been missed or under-recorded during the transect surveys.

The limitations in terms of survey timing and duration have been addressed through supplementing field survey data with a thorough literature review. The secondary data has provided additional information with which to predict species' presence or likely absence from within the Study Area throughout the year, while the field survey information has provided data to determine their likely presence or absence from the Study Area based on habitat preferences.

In terms of bats, ultra-sound detection and recording was not employed during surveys. Bats are difficult to record and identify without this equipment and individuals may therefore have been missed or under-recorded. The identification or differentiation between species of bat which were observed also could not be undertaken.

Physical data has been gathered to determine whether roosting bats are likely to be directly affected by the Project. Furthermore, sufficient information has been gathered to identify potential commuting and foraging habitat for bats. Finally, secondary data sources have allowed the determination of those species of bat which are likely to be present within the Study Area (based on their known range and habitat preferences).

11.5 Baseline Characteristics

The baseline information in this section summarises the findings of the 2011, 2012, and 2013 surveys and the secondary data reviewed for the Project. It characterises the ecology of the Study Area.

11.5.1 Study Area

11.5.1.1 Designated Sites

Special Protected Natural Areas

The Utrish SPNA is located approximately 3.8 km south-east of the Pipeline construction corridor (see Figure 11.1). It covers an area of approximately 10,800 ha and includes both onshore (9225 ha) and offshore (783 ha) areas.

Habitats and Flora

The onshore portion of the Utrish SPNA is located at the north-western extremity of the Caucasus mountain range and abuts the Black Sea along its western boundary. Two bands of vegetation predominate within the site, largely the result of the altitudinal differentiation within the area and the mountainous terrain (the influence of slope aspect and steepness). The vegetation of the lower altitudinal belt (0 – 200 m) is characterised by xerophilous (shiblyak) vegetation comprising juniper *Juniperus* sp. and pubescent oak *Quercus pubescens*. The vegetation of the upper altitudinal belt (150 m – 500 m) is characterised by mesophilic broad-leaved forests of oriental beech *Fagus orientalis*, oriental hornbeam *Carpus orientalis*, sessile oak *Quercus petraea* and ash *Fraxinus excelsior* (Ref. 11.12).

The SPNA supports a total of 117 endemic plant species, nine percent of the total number of plant species recorded within the SPNA (Ref. 11.12). The reserve does not support plant species listed as threatened (Vulnerable and above) on the IUCN RL, but it does support 72 species listed as threatened on the RDB RF or the RDB KK.

Invertebrates

The Utrish SPNA supports a large variety of invertebrate species. This includes 3 species listed as threatened on the IUCN RL and 51 species listed as threatened on either the RDB RF or RDB KK (Ref. 11.12). The juniper woodland, shiblyak and steppefied meadow contained within the reserve are of particular importance for sustaining populations of threatened insects which are dependent on the food plants contained within these habitat types.

Herpetofauna

The Utrish SPNA supports at least 14 species of reptile and eight species of amphibian. It is of particular importance to Nikolski's tortoise, a species listed as CR on the IUCN RL. It has been estimated that the SPNA supports a population of between 5000 – 6000 Nikolski's tortoise (or ca. 20 to 30 percent of the global population of this species) (Ref 11.12). It also supports two other threatened species of reptile listed on the RDB KK (the Aesculapian ratsnake *Elaphe longissima* and European glass lizard *Pseudopus apodus*) and three species of threatened amphibian listed on the RDB RF or RDB KK (southern crested newt *Triturus karelini*, smooth newt *Lissotriton vulgaris lantzi* and Caucasian toad *Bufo verrucosissimus*).

Birds

The Utrish SPNA supports approximately 157 species of bird belonging to 43 families of 19 orders (Ref. 11.12). It supports a variety of species throughout the year, including breeding, over-wintering, and transient species that use the site as a stop-over point on migration. The site supports a number of species which are listed on the IUCN RL (e.g. peregrine falcon *Falco peregrinus*) RDB RF and RDB KK (e.g. short-toed snake eagle *Circaetus gallicus*, booted eagle *Hieraaetus pennatus*, oystercatcher *Haematopus ostralegus*, gull-billed tern *Gelochelidon nilotica*, little tern *Sterna albifrons*, wood lark *Lullula arborea* and rufous-tailed rock thrush *Monticola saxatilis*).

Mammals

Utrish SPNA supports approximately 45 species of mammal (Ref. 11.12). This includes five species of bat listed as threatened on the RDB RF or RDB KK: barbastelle *Barbastella barbastellus*, lesser mouse-eared bat *Myotis blythii*, pond bat *Myotis dasycneme*, Bechstein's bat *Myotis bechsteinii*, and Leisler's bat *Nyctalus leisleri*.

Protective Forest Areas

All forest or woodland habitat within the Study Area are identified as 'protective forests', as defined within the Forest Code of the Russian Federation (Ref. 11.13). This includes all mesophilic forest, shiblyak and juniper woodland. These forests are recognised as important features within the environment, as they perform important functions, such as protection of water resources and soils, and recreational spaces for local communities. This designation is not strictly related to the forest's intrinsic 'biodiversity value', but rather is associated with the ecological function it provides.

Anapa Resort Town Sanitary Protection Area

The town of Anapa was assigned the status of a federal resort by President Decree No. 1954 dated September 22, 1994. It was given this status due to its recreational value as a 'health improving' (spa) resort area. This designated area is referred to as a Sanitary Protection Area.

The centre of the Pipeline construction corridor is located approximately 500 m from the boundary of the second and third exclusion zones of the Sanitary Protection Area of Anapa (Figure 11.1).

It is acknowledged that habitats and plant and animal species are important components of the Sanitary Protection Area and contribute to the town of Anapa's status as a resort area. The potential for the Project to affect these 'component parts' of the Sanitary Protection Area is considered in this chapter and any potential for indirect effects to the designated site will therefore be accounted for. However, as this Sanitary Protection Area is designated for its amenity and recreational value, it not considered further in this chapter.

11.5.1.2 Habitats and Flora

Introduction

The Study Area is located in the foothills between the Greater Caucasus mountain range and the Azov-Kuban lowland. It largely comprises an undulating plateau extending north-east away from a steep coastal cliff with the shoreline of the Black Sea at its base. The plateau has been eroded by streams; forming steep gullies in places (see **Chapter 7 Physical and Geophysical Environment**). The Pipeline crosses two small watercourses within the Study Area, which include the Shingar River (1.5 - 2.5 m wide) and an unnamed tributary of the Sukko River (see **Chapter 8 Soils, Groundwater and Surface Waters**).

The Study Area falls within a typically Mediterranean climatic zone, and it experiences relatively warm and moist winters and hot dry summers. On average, the warmest months are June to September with a maximum monthly average temperature of 21.0 °C. The coolest are November to March, with a minimum average temperature of 4.4 °C. The annual average precipitation is 539 millimetres (mm) (an average of 45 mm per month), mainly in the form of rain. The maximum recorded daily precipitation is 85.9 mm. There is relatively little seasonal variation in precipitation, with the greatest amount occurring during the months of November, December and January.

A diversity of soil types exists within the Study Area, which reflects the variety of bedrock and soil forming processes that underlie it (Ref. 11.9). Soils covering higher slopes and ridges are typically formed by the weathering and re-deposition of calcareous argillites and interbedded sandstones and siltstones. Soils encountered within river valley systems typically comprise weathered calcareous marls, interbedded limestones, siltstones and shales. Valley bottoms comprise variable gravel and sand deposits with occasional layers of clays and loam material interbedded in the coarser grained material (Ref. 11.9).

The topography, soil types, climate, as well as anthropogenic influence, has created relatively diverse conditions on which a range of habitat types have developed (Ref. 11.9). This has in turn created diverse conditions within which various plants and animals, including species of conservation concern, can inhabit. The following section describes these habitats and presents those species which either have been, or have the potential to be, present within the Study Area.

Habitats and Flora

The Study Area supports a range of relic arid sub-Mediterranean vegetation types that have a restricted range within Russia. Surveys undertaken in 2011 recorded a total of eight natural[4]

[4] Natural habitats are areas composed of viable assemblages of plant and/or animal species of largely native origin, and / or where human activity has not essentially modified an area's primary ecological functions and species composition. As per IFC PS 6 (Ref. 11.38).

and two modified[5] terrestrial habitat types within the Study Area (Ref. 11.9). These are: xerophilous shrub woodland (also known as shiblyak), mesophilic forest, juniper woodland, secondary steppefied meadow, mesophilic meadow, tomillyar, rocky outcrops, coastal shingle and agricultural habitats. In addition, running water habitat is present in the form of two watercourses. These habitat types are discussed in further detail, below and their location and extent mapped on Figure 11.6. Table 11.4 presents the area of each habitat type within the Study Area.

Table 11.4 Area (Ha) of Habitat Type within the Study Area.

Habitat Type	Area of Habitat Within the Study Area (ha)*
Shiblyak	431
Mesophilic forest	63
Juniper woodlands	56
Tomillyar	7
Steppefied secondary meadow	111
Mesophilic meadow	10
Rocky outcrops	8
Coastal shingle	3
Urban and Agricultural habitats	273
Running water	2

* Refer to Table 11.33 for area of loss within the project footprint

Surveys recorded approximately 340 species of plant belonging to 75 families within the Study Area (Ref. 11.9). This data revealed that species diversity is highest in the Asteraceae (39 species), Poaceae (36 species), Fabaceae (23 species), Lamiaceae (23 species), and Brassicaceae (16 species) families. The average species richness with the various plant communities within the Study Area varies between nine species per 100 m^2 on the eroded slopes to 22 species per 100 m^2 within the tomillyar habitat.

[5] Modified habitats are areas that may contain a large proportion of plant and/or animal species of non-native origin, and / or where human activity has substantially modified an area's primary ecological functions and species composition. As per IFC PS 6 (Ref. 11.38).

Shiblyak

Shiblyak woodland is the dominant woodland type in the Study Area. It comprises dwarf woodland and shrub vegetation communities 4 m – 6 m in height. Shiblyak is characterised by xerophytic species that are adapted for surviving in dry environments (Flerov 1926, Maleev 1931, Povarnitsyn 1940, as is cited in Ref. 11.9). These woodlands are diverse in structure, floristically rich and are dominated by woody species including pubescent oak *Quercus pubescens*, oriental hornbeam *Carpinus orientalis* and juniper species. Occasionally, other species such as Pitsynda pine *Pinus pityusa*, common pine *Pinus sylvestris*, field maple *Acer campestre*, European alder *Alnus glutinosa* and Mt. Atlas mastic tree *Pistacia mutica* are present. Within the understory, European cornel *Cornus mas* is dominant. Species including blood twig dogwood *Thelycrania australis* and common privet *Ligustrum vulgare* are also occasionally present. Within the ground layer, herbaceous species include wood avens *Geum urbanum*, forest violet *Viola silvestris*, Kavakh peony *Paeonia kavachensis* and common primrose *Primula vulgaris*. Grasses include heath false brome *Brachypodium pinnatum*, cocksfoot *Dactylus glomerata* and Japanese bromegrass *Bromus japonicus* (Ref. 11.9).

The shiblyak habitat within the Study Area comprises predominantly native plant species and there is little evidence of human modification of this habitat type. Shiblyak is therefore considered to be a **natural habitat** according to IFC PS 6 criteria.

Mesophilic Forest

Within the Study Area, mesophilic forest is restricted to the riverine floodplains and valleys of the Graphova and Kiblerova gaps, as well as along the floodplain of the Shingar River (refer to Figure 11.6). The woodland reaches a height of approximately 14 m – 16 m and is dominated by woody species including European alder and almond-leaved willow *Salix triandra*, with locally dominant stands of European ash *Fraxinus excelsior*, Caucasian pear *Pyrus caucasica* and field maple. The understory comprises predominantly Eurasian cornel, blood twig dogwood and common privet. Localised stands of common hazel *Corylus avellana*, European elder *Sambucus nigra* and bladdernut *Staphylea pinnata* are also present. The ground layer is relatively dense and comprises bishop's weed *Aegopodium podagraria,* common nettle *Urtica dioica*, wood avens, white dead-nettle *Lamium album* and cleavers *Gallium aparine*. In the spring, forb species include Siberian squill *Scilla sibirica*, lesser celandine *Ficaria verna*, Arum lily *Arum orientale*, common primrose and Greek corydalis *Corydalis marschalliana*, as well as orchid species such as man orchid *Orchis mascula*.

The mesophilic forest within the Study Area comprises predominantly native plant species with little evidence of human modification of this habitat type. It is therefore considered to be a **natural habitat** in accordance with IFC PS 6 criteria.

Juniper Woodland

Within the Study Area, juniper woodland mainly occurs on the coastal cliffs, although other isolated stands are present. Juniper woodland is a relatively heterogeneous community, dominated in the canopy by juniper species, with abundant pubescent oak and oriental hornbeam. Within the shrub layer, southern sumac *Rhus coppalinum*, common privet, Etruscan honeysuckle *Lonicera etrusca*, evergreen jasmine *Jasminum fruticans* and bladder fern

Cystopteris dickieana are relatively abundant. The ground-layer is diverse and comprises species including felty germander *Teucrium polium*, wall germander *Teucrium chamaedrys*, sword-leaf inula *Inula ensifolia*, goldendrop *Onosma polyphyllum*, common ephedra *Ephedra distachya* and bindweed *Convovulus cantabrica*. During the spring months, the more open areas within the juniper woodland contain species including mouse hyacinth *Muscari muscarini*, dwarf flag iris *Iris pumila* and Breckland speedwell *Veronica praecox*.

An isolated area of sparse juniper woodland is present along the Pipeline route, bordered by two areas of agricultural land (refer to Figure 11.6). This area contains species as listed for the habitat above, in addition to common pine, blackthorn *Prunus spinosa*, goat's beard *Tragopogon graminifolius* and melic grass *Melica transsilvanica*.

The juniper woodland within the Study Area comprises predominantly native plant species with little evidence of human modification of this habitat type. It is therefore considered to be a **natural habitat** in accordance with IFC PS 6 criteria.

Tomillyar

Tomillyar is relatively fragmented and scarce within the Study Area, largely confined to the coastal cliffs (Ref. 11.9). The habitat comprises herbaceous plant communities with the majority of species associated with dry and hot environments. Dominant species include felty germander, Marshall's thyme *Thymus marschallianus*, sage-leaf mullein *Phlomis tuberosa* and goldendrop. Grass species include melic grass *Melica spp.*, cocksfoot, and golden feather grass *Stipa pulcherrima*. Tomillyar is generally species-rich, containing on average 13 – 15 species per m^2. The vegetation structure is also relatively diverse, comprising three different height tiers. The first tier is generally fragmented and comprises grasses and herbs such as sage-leaf mullein and pyramidal orchid *Anacamptis pyramidalis*. The second tier is represented by medium-height herbs including felty germander and thin-leaved flax *Linum tenuifolium*, while the third tier is represented by creeping or low growing species including *Thymus helendzicus*, Marshall's thyme, and sprawling needle sunrose *Fumana procumbens*. In the spring, species including mouse hyacinth *Hyacinthus orientalis* and reticulated iris *Iris reticulata* are evident.

The tomillyar within the Study Area comprises predominantly native plant species with limited evidence of human modification. It is therefore considered to be a **natural habitat** in accordance with IFC PS 6 criteria.

Secondary Steppefied Meadow

Secondary steppefied meadow occupies a relatively large proportion of the Study Area. They are areas dominated by grasses and herbaceous species that were previously agricultural land (i.e. former vineyards, orchards and fields), which have been derelict for some time.

The dominant grasses within these areas include crested wheatgrass *Agropyron pectiniforme*, couch grass *Elytrigia repens*, Japanese brome, cock's-foot, and bushgrass *Calamagrostis epigeios*. Grasses make up approximately 75-80 percent of the sward within these areas. Abundant forbs within the meadow areas include blue daisy *Cichorium intybus,* lady's bedstraw *Galium verum* and British inula *Inula britannica*. Threatened forbs found within this habitat type include monkey orchid *Orchis simia* and pyramidal orchid. Shrub species contained within the meadow areas include common smoke tree *Cotinus coggygria*, dog rose *Rosa canina*, young specimens of Pubescent oak and juniper.

Secondary steppe meadow areas used to be agricultural land and so have been modified to a large extent. The habitat in its current condition does however contain predominantly native plant species which are representative of natural meadow communities. However, as this habitat is essentially modified from its natural (or original) state through human intervention (and was most likely modified from shiblyak woodland in the majority of areas) it is considered to be **modified habitat** in accordance with IFC PS 6 criteria.

Mesophilic meadow

Within the Study Area, mesophilic meadow is rare. Thin strips of the habitat are located along the river floodplains, predominantly within the Graphova and Kiblerova valleys. These vegetation communities are typical of periodically inundated soils which support plants favouring nutrient-rich environments. Within this habitat type, three different plant sub-communities were recorded: a grass-forb sub-community, a forb-dominant sub-community, and a sub-community comprising almost entirely of plants belonging to the family Fabiaceae (Ref. 11.9).

Approximately 85-90 percent of the vegetation within the grass-forb sub-community comprises grasses. The vegetation structure comprised roughly four tiers. The first tier contains taller grasses and forbs including velvet mullein *Verbascum Thapsus*, wild sunflower *Verbisina enclioides*, Fuller's teasel *Dipsacus fullonum* and common agrimony *Agrimonia eupatoria*. The second tier contains lower growing grasses and forbs, such as bush grass, cocksfoot, yarrow *Achillea millefolium* and common agrimony. The third tier comprises predominantly creeping forbs, including cinquefoil *Potentilla reptans* and wild strawberry *Fragaria vesca*. The fourth tier is largely comprises of moss species.

The forb-dominant sub-community comprises various forbs including blue daisy, wild carrot *Daucus carota,* Italian aster *Aster amellus* and field daisy *Leucanthemum vulgare*. Smooth-stalked meadow-grass *Poa pratensis,* field brome *Bromus arvensis*, sterile brome *Bromus sterilis* and other grass species are also present. Although rare, monkey orchid has been recorded within this sub-community type at a density of 1-2 plants per 100 m^2.

The Fabiaceae-dominant plant sub-community is present at the edges of the mesophilic meadow. The dominant species here is crown vetch *Coronilla coronata*, which in places covers 100 percent of the land surface.

The areas of mesophilic meadow within the Study Area comprise predominantly native plant species with limited evidence of human modification to this habitat type. It is therefore considered to be a **natural habitat** in accordance with IFC PS 6 criteria.

Rocky Outcrops

Fragmented areas of rock or scree habitat are restricted to areas of the coastal cliffs. Shrubs growing within these areas include southern sumac, Jerusalem thorn *Parkinsonia aculeate*, bladder fern and common smoke tree. There is a relatively high diversity of herbaceous species growing within these areas, with species including dog's parsley *Seseli ponticum*, sword-leaf inula, pyramidal orchid, thorny-head lamira *Lamyra echinocephala*, goldilocks *Linosyris vulgari*) and felty germander. Species diversity within these areas is 5 – 10 per m^2.

The areas of rocky outcrops within the Study Area comprise predominantly native plant species with limited evidence of human modification to this habitat type. It is therefore considered to be a **natural habitat** in accordance with IFC PS 6 criteria.

Coastal Shingle

Coastal shingle exists along the coastal strip to the west of the Study Area. No plant species were recorded within these areas.

These areas are subject to limited modification through human activity and are therefore considered to be a **natural habitat** in accordance with IFC PS 6 criteria.

Urban and Agricultural Habitats

Urban and agricultural habitats form a considerable part of the Study Area and include vineyards, orchards, fallows and other habitats associated with human activity (e.g. roads) (Ref. 11.9). Within these areas, fragmented grass-forb communities are present (largely adjacent to the access roads servicing the abandoned vineyards) comprising wormwood *Artemisia absinthium*, Bermuda grass *Cynodon dactylon*, yellow foxtail grass *Setaria glauca*, green foxtail grass *Setaria viridis*, bristle thistle *Carduus acanthoides*, field bindweed *Convolvulus arvensis*, common nettle, Mediterranean elder *Sambucus ebulus* and horse sorrel *Rumex confertus*.

The areas of agricultural habitats have been heavily modified through human influence. Although these areas contain pockets of semi-natural vegetation, they are considered to be a **modified habitat** in accordance with IFC PS 6.

Running Water

The landfall section of the Project crosses two small watercourses, the Shingar River and an unnamed tributary of the Sukko River (Figure 11.7). Both watercourses have the characteristics of upper course streams, being narrow (less than 3 m), occur in valleys with relatively steep gradients and exhibit short response time to rainfall events. These watercourses therefore have episodic high and low flows in response to seasonal rainfall patterns. In summer, the channels partially dry-out to leave intermittent pools along the rivers' reach. Within the Graphova gap, at least two pools have been enlarged through a combination of excavation and embankment. Both pools appear to hold water all year, even when the remainder of the watercourse has dried.

The phytoplankton communities found within the Study Area reflect the physical characteristics of the watercourses. Their low species richness and abundance are typical of watercourses in their upper courses and also possibly reflect the low water temperatures and mineral concentrations (phytoplankton and zooplankton communities tend to be generally best developed in lacustrine environments or slow flowing rivers). Species recorded include green algae, diatoms (which were dominant) and blue-green algae (which were far less prevalent).

Average phytoplankton biomass in the Shingar River was 0.41 g/m^3 and 0.37 (g/m^3) in the unnamed tributary of the Sukko River.

As many zooplankton species feed on phytoplankton, the low density of phytoplankton is reflected by low zooplankton populations within the two watercourses. The composition of the zooplankton associated with the two watercourses comprised a mixture of Rotifers (six species), Copepods and Cladocerans. Average zooplankton biomass in the Shingar River was 0.13 g/m^3 and 0.11 g/m^3 in the unnamed tributary of the Sukko.

The running water within the Study Area is subject to limited modification through human activity and is therefore considered to be a **natural habitat** in accordance with IFC PS 6 criteria.

Red List Plant Species

Secondary data indicates that the Study Area has the potential to support 28 red list plants species (Ref 11.2, Ref. 11.4). This includes 28 plant species listed in the RDB KK, 14 on the RDB RF and two on the IUCN RL (some species are listed in more than one list or book). In total, the three surveys recorded 26 different red list plant species within the Study Area (Figure 11.6). Table 11.5 presents all red list plants recorded during the 2011, 2012 and 2013 surveys, along with the habitats within which they are likely to occur.

Table 11.5 Red List Plant Species Recorded in the Study Area

Name of Species	Habitat	Conservation Status		
		IUCN	RDB RF	RDB KK
Astragalus subuliformis	Juniper scrub / woodland, shiblyak, tomillyar	Not assessed	Not listed	3
Colchicum umbrosum	Woodland	Not assessed	2	2
Fern-leaved speedwell *Veronica filifolia*	Juniper scrub / woodland, shiblyak, tomillyar	Not assessed	1	1
Siderites euxina	Juniper scrub / woodland, shiblyak, tomillyar	Not assessed	Not listed	2
Etruscan honeysuckle *Lonicera etrusca*	Juniper scrub / woodland	Not assessed	3	1
Phlomis taurica	Juniper scrub / woodland, shiblyak, tomillyar	Not assessed	Not listed	2
Dwarf flag iris *Iris pumila*	Juniper scrub / woodland, shiblyak, tomillyar	Not assessed	3	2

Continued…

Name of Species	Habitat	Conservation Status		
		IUCN	RDB RF	RDB KK
Sea kale *Crambe maritima*	Coastal	Not assessed	Not listed	2
Bladdernut *Staphylea pinnata*		Not assessed	3	2
Golden feather grass *Stipa pulcherrima*	Tomillyar	Not assessed	3	2
Campanula komarovii	Juniper scrub, steppe meadow	Not assessed	3	2
Linum hirsutum	Steppe meadow	Not assessed	Not listed	2
Stinking juniper *Juniperus foetidissima*	Juniper scrub / woodland, shiblyak, tomillyar	Least Concern	2	1
Greek juniper *Juniperus excelsa*	Juniper scrub / woodland, shiblyak, tomillyar	Least Concern	2	1
Jurinea stoechaedifolia	Juniper scrub / woodland, shiblyak, tomillyar	Not assessed	Not listed	2
Goldendrop *Onosma polyphyllum*	Tomillyar / rocky areas	Not assessed	3	2
Paeonia kavachensis *Paeonia caucasica*	Juniper scrub / woodland, shiblyak, tomillyar	Not assessed	3	2
Red helleborine *Cephalanthera rubra*	Woodland	Not assessed	3	2
Chamaecytisus wulffii	Rocky areas, steppe meadow	Not assessed	Not listed	2
Rindera tetraspis	Juniper scrub / woodland, rocky areas	Not assessed	Not listed	1
Fibigia eriocarpa	Woodland	Not assessed	Not listed	2
Mt. Atlas mastic tree *Pistacia mutica*	Juniper scrub / woodland, shiblyak, tomillyar	Not assessed	3	1

Continued…

Name of Species	Habitat	Conservation Status		
		IUCN	RDB RF	RDB KK
Salvia ringens	Coastal	Not assessed	Not listed	2
Pyramidal orchid *Anacamptis pyramidalis*	Juniper scrub / woodland, tomillyar, steppe meadow/rocky areas	Not assessed	3	2
Early purple orchid *Orchis mascula*	Mesophilic forest	Not assessed	3	2
Monkey orchid *Orchis simia*	Mesophilic forest	Not assessed	3	2

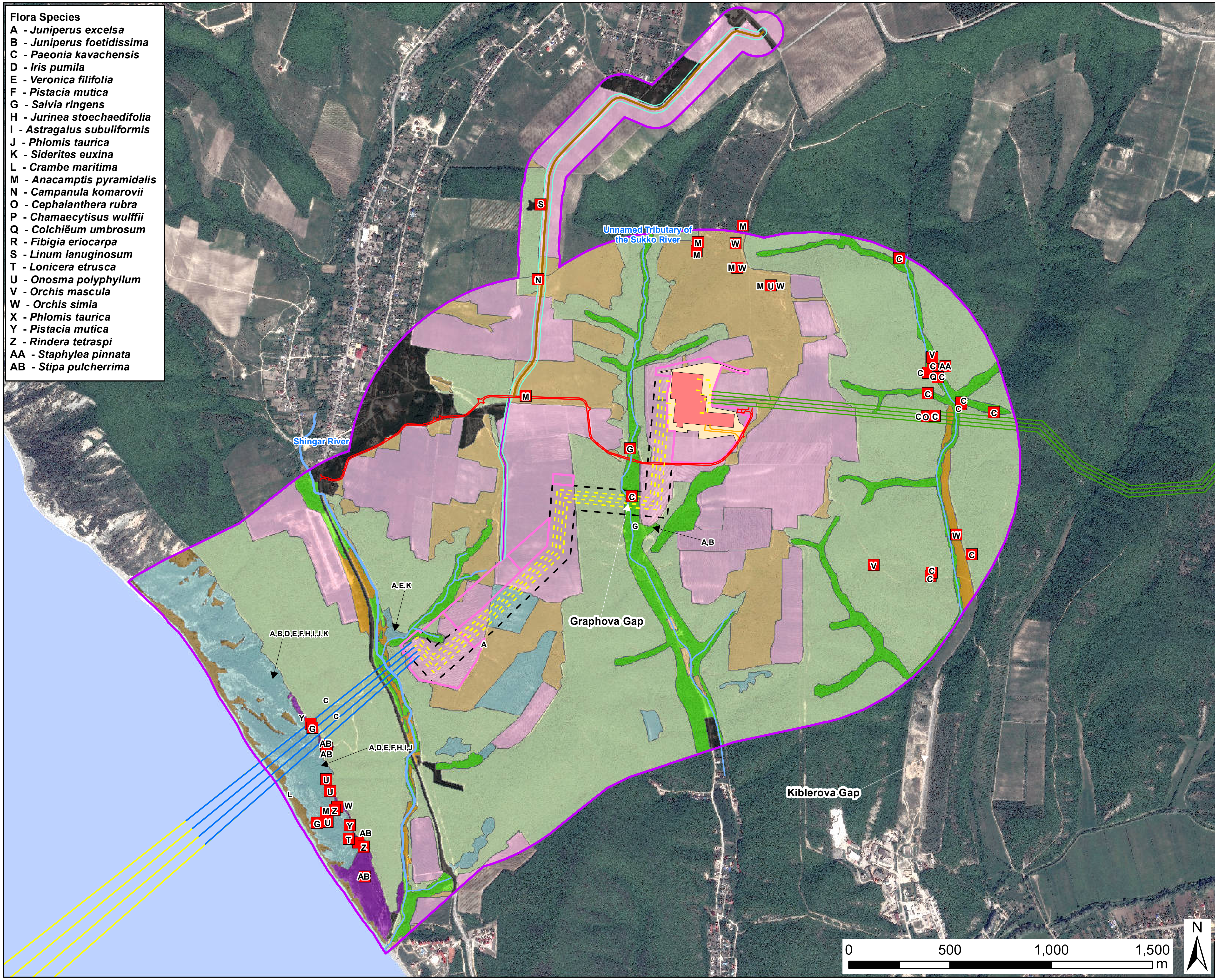
Complete.

The density of red list plant species for each habitat type was estimated during the 2011 surveys for 14 of the total 26 species; the results presented within Table 11.6 below. Red list species were recorded within all habitat types apart from the coastal shingle and agricultural habitats. The greatest diversity of red list flora was found within the juniper woodlands (8 species), tomillyar (4 species) and rocky outcrops (five species).

Table 11.6 Density of Red List Plant Species within the Study Area (individuals per Ha)

	Habitat Type						
Species	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Greek juniper	25		220				
Stinking juniper			90				
Bladdernut		1					
Paeonia caucasica	300	120					
Salvia ringens							100
Mt. Atlas mastic tree			20				
Etruscan honeysuckle			100				
Rindera tetraspis			150				80
Goldendrop						120	150
Dwarf flag iris			180			200	100
Pyramidal orchid			100	80		80	160
Early purple orchid		80					
Monkey orchid			30		60		
Golden feather grass						70	

Biotopes: 1 – shiblyak; 2 – mesophilic woodland; 3 – juniper woodland; 4 – steppefied meadow; 5 – mesophilic meadow; 6 – tomillyar; 7 – rocky outcrops.



LEGEND

- Flora survey results
- Study area
- Juniper Woodlands
- Mesophilic Forest
- Mesophilic Meadow
- Vineyards And Orchards
- Residential Area And Ruderal Habitats
- Rocky Outcrops
- Seaside Gravel
- Shiblyak (Undersized Xerophilous Forest)
- Steppefied Secondary Meadow
- Tomillyar
- Rivers

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Landfall facilities
- Proposed microtunnels
- Proposed offshore pipelines
- Construction corridor
- Cut and fill side slopes
- Temporary construction area for road construction
- Construction sites
- Permanent access road to be constructed by SSTTBV
- Temporary access road constructed by SSTTBV
- Varvarovka bypass road (used by Project during construction only)

United Gas Supply System

- United Gas Supply System pipelines
- Permanent access road to be constructed by Gazprom Invest

Projection: Lambert Conformal Conic

Purpose of Issue
For Information

Client
South Stream Offshore Pipeline ENERGISING EUROPE

Project Title
SOUTH STREAM OFFSHORE PIPELINE

Drawing Title
STUDY AREA
HABITATS AND FLORA RESULTS

Drawn	Checked	Approved	Date
DH	RW	MW	05 Mar 2014

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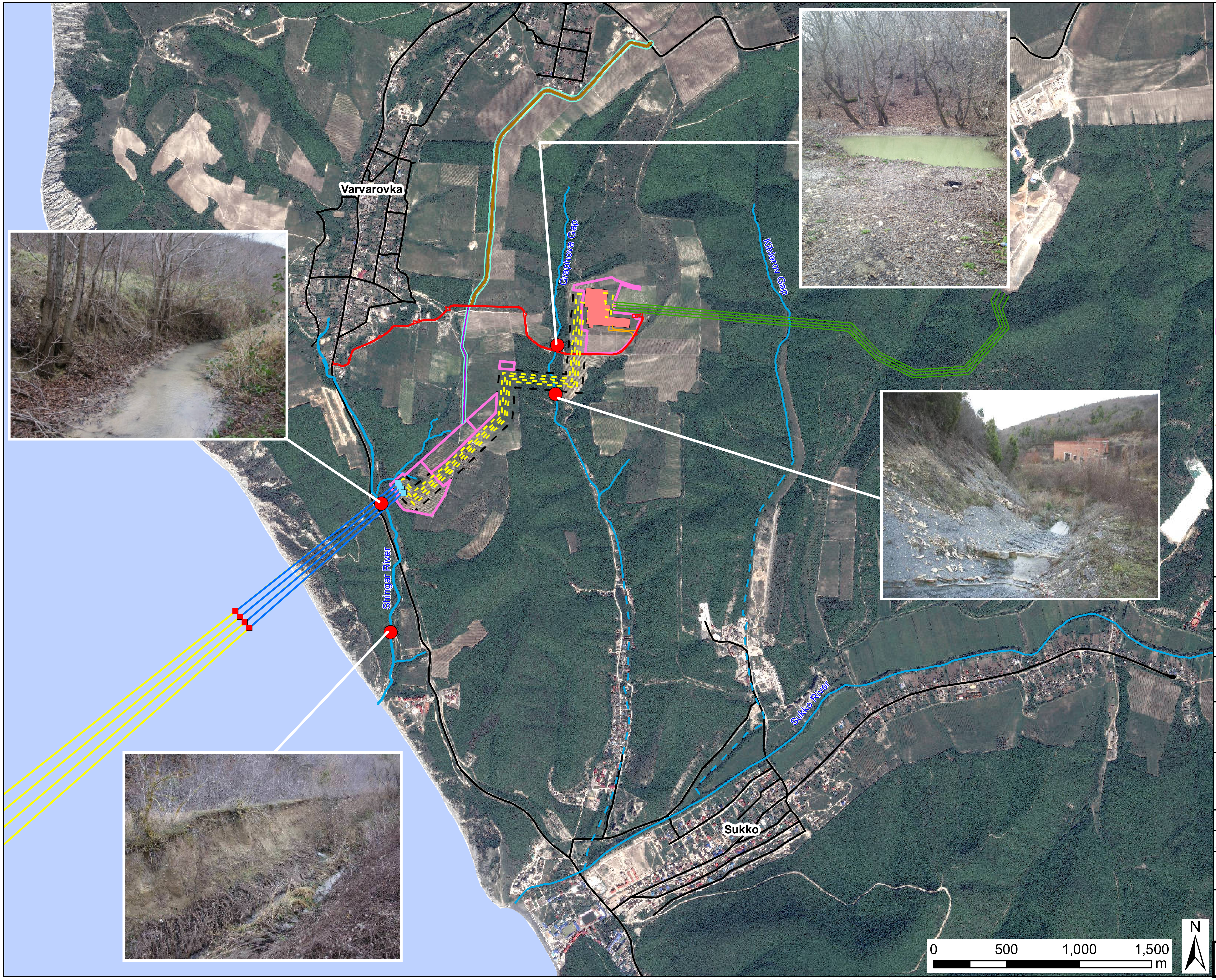
Drawing Number
Figure 11.6

Rev

Plot Date: 05 Mar 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 11 Ecology\Figure 11-6 Landfall Study Area Habitats and Flora Results.mxd



LEGEND

- Photo locations
- Rivers
- Inferred watercourses
- Existing roads

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Landfall facilities
- Proposed microtunnels
- Proposed offshore pipelines
- Microtunnel entry shaft
- Microtunnel exit pit
- Construction corridor
- Temporary construction area for road construction
- Construction sites
- Permanent access road to be constructed by SSTTBV
- Temporary access road constructed by SSTTBV
- Varvarovka bypass road (used by Project during construction only)

United Gas Supply System

- United Gas Supply System pipelines
- Permanent access road to be constructed by Gazprom Invest

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: For Information

Client: South Stream Offshore Pipeline — Stream ENERGISING EUROPE

Project Title: SOUTH STREAM OFFSHORE PIPELINE

Drawing Title: RIVER CROSSINGS AND PHOTOGRAPHS

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Drawing Number: Figure 11.7 | Rev:

Plot Date: 18 Feb 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 11 Ecology\Figure 11.7 River Crossings and Photographs.mxd

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11.5.1.3 Fauna

Introduction

The mosaic of habitats described in the previous section, as well as their relative floristic diversity, provide suitable foraging, breeding, and sheltering habitat for a range of fauna (Ref. 11.9). During surveys undertaken in 2011, 2012, and 2013, a variety of invertebrate, amphibian reptile, bird and mammal species were recorded across the habitat types present within the Study Area. The results of these surveys are detailed below.

Invertebrates

According to secondary data, 43 red list invertebrate species have the potential to be present within the Study Area. All 43 are listed on the RDB KK and nine on the RDB RF. Three species have been assessed as threatened on the IUCN RL. Table 11.7 indicates their habitat preference and conservation status.

Targeted invertebrate surveys were not undertaken in the 2011 and 2013 surveys. During the 2012 surveys, six red list invertebrate species were recorded within the Study Area. These species are highlighted in **bold** in Table 11.7 and their locations are shown in Figure 11.8.

Subsequent to the field surveys, a meeting was held with Dr Semen Kustov from the Kuban State University to discuss the known distribution and ecology of the threatened species of invertebrate listed in Table 11.7. The aim of this meeting was to obtain additional information on the likelihood of these species to be present and on their habitat requirements. Based on the information obtained during the meeting, a number of these species are considered unlikely to be present within the Study Area:

- *Cardiophorus juniperinus* - Very rare species only known from two locations within Utrish. Requires juniper deadwood habitats occurring on the ground;
- *Platypteronyx auritus* – Has only been recorded within Utrish;
- *Kretania zamotajlovi* - Very rare species which has only been recorded from 3 locations within Utrish. Populations have been reduced by collectors and possibly number less than 500 individuals;
- *Zygaena laeta* – Only known from one site near Novorossiysk and has not been recorded since the 1980s. Possibly extinct; and
- *Jordanita graeca* – RDB KK record from Utrish is considered likely to be an error as the species is otherwise restricted to lowland habitats on the Taman Peninsula.

Table 11.7 Red List Invertebrate Species Potentially Present Within the Study Area

Habitat Preference	Species	Conservation Status		
		IUCN	**RDB RF**	**RDB KK**
Beetles - Coleoptera				
Mesophilic forest	Ground beetle sp. *Carabus caucasicus*	Not assessed	2	2
	Greater capricorn beetle *Cerambyx cerdo*	VU	Not listed	7
	Cerambyx nodulosus	Not assessed	2	2
	Rosalia longicorn *Rosalia alpina*	VU	2	2
	Flower beetle *Cetonischema speciosa*	Not assessed	Not listed	2
	Jewel beetle *Capnodis cariosa*	Not assessed	Not listed	2
	Stag beetle *Lucanus cervus*	Not assessed	2	7
	Necydalis ulmi	Not assessed	Not listed	3
	Forest caterpillar hunter *Calosoma sycophanta*	Not assessed	2	7
Juniper woodland	*Cardiophorus juniperinus*	Not assessed	Not listed	1B
Meadow	*Chrysochares asiaticus*	Not assessed	Not listed	3
Other	Weevil sp. *Lixus canescens*	Not assessed	Not listed	1B
	Weevil sp. *Platypteronyx auritus*	Not assessed	Not listed	1A

Continued…

Habitat Preference	Species	Conservation Status		
		IUCN	RDB RF	RDB KK
Moths and Butterflies - Lepidoptera				
Meadow	Argus sp. *Kretania zamotajlovi*	Not assessed	Not listed	1A
	Yellow-banded skipper *Pyrgus sidae*	Not assessed	Not listed	1B
	Levantine skipper *Thymelicus hyrax*	Not assessed	Not listed	1B
	Tesselated skipper *Muschampia tessellum*	Not assessed	Not listed	2
	Southern festoon *Zerynthia polyxena*	Not assessed	Not listed	2
	Caucasian spring copper *Tomares callimachus*	Not assessed	Not listed	2
	Eastern baton blue *Pseudophilotes vicrama schiffermulleri*	Not assessed	Not listed	2
	Zephyr blue ssp *Plebejides sephirus kubanensis*	Not assessed	Not listed	2
	Dalmatian ringlet *Proterebia afra*	Not assessed	Not listed	2
	Large blue *Maculinea arion*	NT	Not listed	2
	Clouded apollo *Parnassius mnemosyne*	Not assessed	2	7
	Moth sp. *Zygaena laeta*	Not assessed	Not listed	1A
	Moth sp. *Jordanita graeca*	Not assessed	Not listed	1B
	Moth sp. *Jordanita chloros*	Not assessed	Not listed	1B

Continued...

Habitat Preference	Species	Conservation Status		
		IUCN	RDB RF	RDB KK
	Moth sp. *Lemonia ballioni*	Not assessed	Not listed	1B
	Feathered footman *Spiris striata*	Not assessed	Not listed	3
	Brown tiger moth *Hyphoraia aulica*	Not assessed	Not listed	5
Tomillyar	Purple tiger moth *Rhyparia purpurata*	Not assessed	Not listed	3
Vineyard/orchard	Death's-head hawk moth *Acherontia atropos*	Not assessed	Not listed	3
Bees and Wasps - Hymenoptera				
Meadow	Bee sp. *Bombus zonatus*	Not assessed	Not listed	2
	Carpenter bee sp. *Xylocopa valga*	Not assessed	2	7
	Solitary wasp sp. *Scolia hirta*	Not assessed	Not listed	7
	Solitary wasp sp. *Scolia maculata*	Not assessed	Not listed	7
Other: Leaf Hoppers Hemiptera, Flies Diptera, Crickets Orthoptera, Mantids Mantidae, and Dragonflies Odonta				
Mesophilic forest	Leafhopper sp. *Fieberiella lugubris*	Not assessed	Not listed	3
Meadow	**Fly sp. *Neorhynchocephalus tauscheri***	Not assessed	Not listed	2
Meadow	Predatory bush cricket *Saga pedo*	VU	2	7
Juniper	Leafhopper sp. *Liguropia juniperi*	Not assessed	Not listed	3

Continued…

Habitat Preference	Species	Conservation Status		
		IUCN	RDB RF	RDB KK
Water	Blue emperor dragonfly *Anax imperator*	LC	2	7
Other	Mantis sp. *Empusa fasciata*	Not assessed	Not listed	2
Other	**Mantis sp. *Bolivaria brachyptera***	Not assessed	Not listed	7

Complete.

Aquatic Macro-invertebrates

The taxa recorded during the 2011 surveys are found in a range of benthic freshwater habitats. The community recorded in both streams included the larvae of caddis flies (Trichoptera), dragonflies (Odonata), mayflies (Ephemeroptera), mysids (Gammaridae) and polychaetes (Polychaeta), many of which are often associated with good quality waters. No red list species were recorded.

Fish

Six species of fish were recorded within the Study Area. Southern riffle minnow was abundant in both watercourses with western transcaucasian gudgeon, colchian minnow and Rodion's river goby occurring less frequently. In downstream reaches of the Shingar River, Caucasian chub and three-spine stickleback occurred in in low numbers. One species has been assessed on the IUCN RL and none are listed on the RDB RF. Rodion's river goby *Neogobius rhodioni* and Colchis minnow *Phoxinus phoxinus colchicus* are listed on the RDB KK within appendix 3 (Table 11.8).

Table 11.8 Fish species recorded within the Study Area

Species	IUCN	RDB RF	RDB KK
Southern riffle minnow *Alburnoides bipunctatus fasciatus*	Not assessed	Not listed	Not listed
Western transcaucasian chub *Gobio gobio lepidolaemus*	Not assessed	Not listed	Not listed
Rodion's river goby *Neogobius rhodioni*	Not assessed	Not listed	App 3
Colchis minnow *Phoxinus phoxinus colchicus*	Not assessed	Not listed	App 3

Continued…

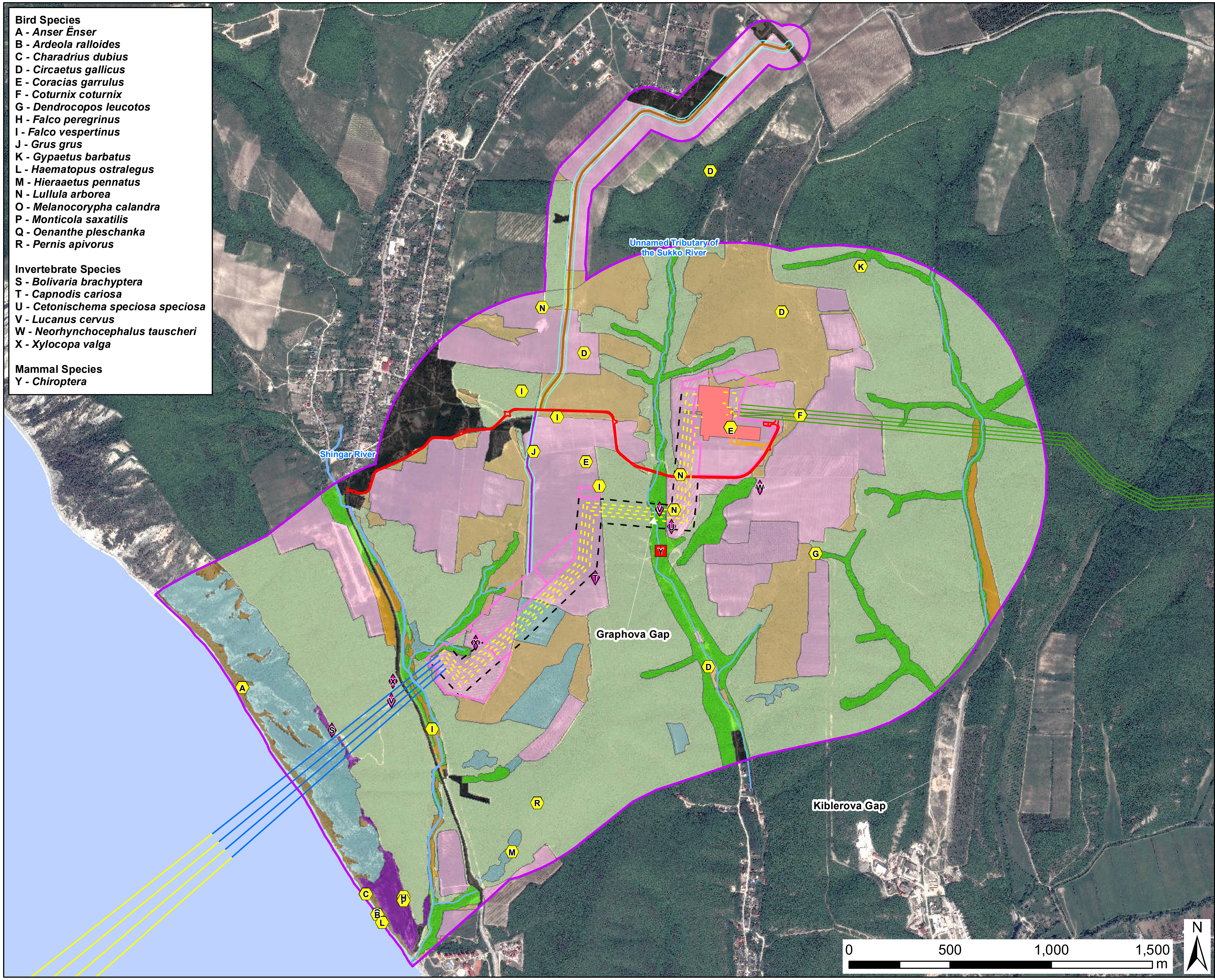
Species	IUCN	RDB RF	RDB KK
Caucasian chub *Leuciscus cephalus orientalis*	Not assessed	Not listed	Not listed
Three-spine stickleback *Gasterosteus aculeatus*	LC	Not listed	Not listed

Complete.

Herpetofauna (Amphibians and Reptiles)

The woodland, grassland, wet and open habitats, as well as the ecotones (habitat edges) between them, provide suitable habitat for amphibian and reptile species. Desk study information indicated the potential presence of five amphibian and 16 reptile species within the Study Area (Ref. 11.9, Ref. 11.3, and Ref. 11.5). During the field surveys in 2011, 2012 and 2013 a total of five amphibian and 15 species of reptile were recorded (these are shown in **bold** in Table 11.9). Table 11.9 lists all herpetofauna species potentially present within the Study Area and their conservation status.

Two amphibian species and ten reptile species recorded during the field surveys are threatened at the regional, national, and/or international level. In addition, meadow lizard is assessed as Near Threatened by the IUCN. The locations of RDB herpetiles recorded during the 2011, 2012, and 2013 are presented on Figure 11.9 and Figure 11.10.



LEGEND

Fauna survey results

- Birds
- Invertebrates
- Mammals
- Study area
- Rivers

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Landfall facilities
- Proposed microtunnels
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- Varvarovka bypass road (used by Project during construction only)

United Gas Supply System

- United Gas Supply System pipelines
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Purpose of Issue: For Information

Client: South Stream Offshore Pipeline — Stream ENERGISING EUROPE

Project Title: SOUTH STREAM OFFSHORE PIPELINE

Drawing Title: STUDY AREA FAUNA SURVEY RESULTS

Drawn	Checked	Approved	Date
DH	RW	MW	05 Mar 2014

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Plot Date: 05 Mar 2014
File Name: I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 11 Ecology\Figure 11-8 Landfall Study Area Fauna Survey Results.mxd

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Table 11.9 Herpetofauna Potentially Present within the Study Area

Species	Latin Name	Conservation Status		
		IUCN	*RDB RF*	*RDB KK*
Amphibians				
Green toad	*Pseudepidalea viridis*	LC	Not listed	Not listed
European tree frog	*Hyla arborea schelkownikowi*	LC	Not listed	Not listed
Eurasian marsh frog	*Pelophylax ridibundus*	LC	Not listed	Not listed
Caucasian toad	*Bufo verrucosissimus*	NT	2	7
Long-legged wood frog	*Rana macrocnemis*	LC	Not listed	3
Reptiles				
Nikolski's tortoise		CR	1	1B, EN
European Pond Turtle	*Emys orbicularis*	NT	Not listed	3
European glass lizard	*Pseudopus apodus*	Not assessed	Not listed	1B, EN
Slow worm	*Anguis fragilis*	Not assessed	Not listed	Not listed
Meadow lizard	*Darevskia praticola*	NT	Not listed	Not listed
Brauner's rock Lizard	*Darevskia brauneri*	LC	Not listed	3
Sand lizard	*Lacerta agilis exigua*	LC	Not listed	3
Three-lined lizard	*Lacerta media*	LC	3	3
Grass snake	*Natrix natrix*	LC	Not listed	Not listed

Continued...

Species	Latin Name	Conservation Status		
		IUCN	*RDB RF*	*RDB KK*
Tessellated water snake	*Natrix tessellata*	LC	Not listed	Not listed
Smooth snake	*Coronella austriaca*	Not assessed	Not listed	Not listed
Steppe Viper	*Pelias renardi*	Not assessed	Not listed	3
Caspian whipsnake	*Hierophis caspius*	Not assessed	Not listed	3
Pallas whipsnake	*Elaphe sauromates*	Not assessed	Not listed	3
Aesculapian ratsnake	*Zamenis longissima*	LC	2	2
Dahl's Whip Snake	*Platyceps najadum*	LC	Not listed	3

Complete.

The preferred habitat of herpetofauna recorded within the Study Area was identified through literature review (Ostrovskikh and Chuskin 1998, Ostrovskikh and Plotnikov 2006, as are cited within Ref. 11.9), through consultation with Dr. Olga Leontyeva, and through observations made during the 2011, 2012 and 2013 field surveys. These are summarised in Table 11.10.

Table 11.10 Herpetofauna habitat preferences within the Study Area

Species	Coastal Shingle	Rocky Outcrops	Juniper Woodland	Tomillyar	Shiblyak	Mesophilic Forest	Mesophilic Meadow	Steppefied Meadow	Agricultural Habitats
Amphibians									
Green toad					-	-	-	-	+
European tree frog					+	+	+	+	+
Eurasian Marsh frog						+	+		

Continued…

Species	Coastal Shingle	Rocky Outcrops	Juniper Woodland	Tomillyar	Shiblyak	Mesophilic Forest	Mesophilic Meadow	Steppefied Meadow	Agricultural Habitats
Caucasian Toad					+	+	+	+	
Long-legged wood frog						+			
Reptiles									
Nikolski's tortoise		+	+	+	+	+	-	+	-
European glass lizard		+	+	+	+	+	-	+	-
Slow worm						+	+		-
Meadow lizard			-		+	+	+	+	
Brauner's rock lizard		+			-				
Sand lizard						+	+	+	
Three-lined lizard		+	+	+					
Grass snake	+					+	+		
Tessellated Water snake	+					+			
Smooth snake				-			+		
Steppe viper								+	-
Caspian whipsnake			+	+	+	-	-	+	_

Continued...

Species	Coastal Shingle	Rocky Outcrops	Juniper Woodland	Tomillyar	Shiblyak	Mesophilic Forest	Mesophilic Meadow	Steppefied Meadow	Agricultural Habitats
Pallas whipsnake			+		+			-	
Aesculapian ratsnake			+	+	+	+		+	+
Dahl's whipsnake			+	+	+			-	

Notes: + High probability of habitat occupation; - Low probability of habitat occupations; 'blank' Occupation unlikely. *Complete.*

The coastal shingle habitats within the Study Area were shown to support grass snake and tessellated water snake, both of which prey on fish present along the coastal strip (Ref. 11.9). Brauner's rock lizard was also recorded on the coastal cliffs and rocky outcrops habitat basking and feeding on small invertebrates present within the habitat.

Within the stands of juniper woodland, three species were recorded during field surveys: Nikolski's tortoise, European glass lizard and Dahl's whipsnake. In addition to these species, other reptile species including meadow lizard, large whipsnake, and Pallas whipsnake potentially occur within this habitat (Ref. 11.9).

The structure and plant species contained within the areas of tomillyar habitat are relatively similar to that in juniper woodland. Consequently, similar species of reptile are supported by these habitats, including glass lizard, large whipsnake, Dahl's whipsnake, three-lined lizard and Nikolski's tortoise (Ref. 11.9).

Within the stands of shiblyak woodland, Nikolski's tortoise, European glass lizard, Pallas whipsnake, and meadow lizard were recorded during the 2011, 2012 and 2013 surveys. European tree frog was also recorded within this habitat. The shiblyak habitat within the Study Area is structurally and floristically relatively diverse, providing a variety of habitats for reptiles and amphibians to forage, bask, shelter, and breed (Ref. 11.9).

Conditions within the mesophilic woodlands suit reptiles and amphibians that favour moist or wetter environments, including tessellated water snake, grass snake, marsh frog and European tree frog. Meadow lizards and sand lizards were also recorded within these areas during the surveys (Ref. 11.9). Where the mesophilic forest areas grade into mesophilic meadow, species favouring these edge habitats were found. This included tessellated water snake, large whip snake, smooth snake, slow worm, sand lizard, and meadow lizard (Ref. 11.9).

The steppefied secondary meadow was shown to support Nikolski's tortoise, European glass lizard, meadow lizard, and sand lizard. Although not recorded in these habitat areas during any of the surveys large and Pallas whipsnake, may occur within these areas.

Nikolski's tortoise is known to occur within agricultural habitats early in the season (April to early May); however, none were recorded in this habitat type during the field surveys. Other species of snake and lizard may be present in agricultural habitats but were also not recorded. Two species of amphibian; green toad and Caucasian toad were recorded in or on the tracks adjacent to the vineyards in August 2013. It is considered that due to the relatively high levels of human disturbance within agricultural habitats, the occurrence of these species is, in general, short-term and episodic (Ref. 11.9). These habitats are thus not considered optimal habitat for many reptile and amphibian species. That said, for opportunistic species, such as the large whipsnake and Pallas whipsnake, the suitability of these areas increases during the orchard and vineyard fruiting periods, as numbers of prey species such as birds and rats increase within these areas at these times (Ref. 11.9).

It is important to note that the distribution of reptile and amphibians within the Study Area changes according to seasonal and climatic variability. In the spring and autumn months, when temperatures are generally cooler, reptiles prefer open habitats where they are able to bask and warm themselves. During the summer months when temperatures are very high and there is a general lack of moisture within open habitats, reptiles will move to the forest areas where it is cooler. Amphibians such as the European tree frog, Eurasian marsh frog, green toad and Caucasian toad will be present in ponds and waterbodies during the breeding season (roughly March – July), but as these ephemeral waterbodies dry up these species will move to adjacent terrestrial habitat (Ref. 11.9).

Based on the surveys undertaken in 2011, the relative abundance of each reptile and amphibian species present within the Study Area was determined. Table 11.11 below summarises this information for each species.

Table 11.11 Relative abundance of reptiles and amphibians within the Study Area

Species	Nature of the occurrence	Abundance
Green toad	Individual specimens infrequently observed along some transect routes	Rarely occurring species within the Study Area.
Slow worm		
Three-lined lizard		
Grass snake		
Smooth snake		
Large whipsnake		
Pallas whipsnake		
Dahl's whipsnake		

Continued...

Species	Nature of the occurrence	Abundance
European tree frog	Individual species regularly observed on some transect routes	Occasionally occurring species within the Study Area
Eurasian marsh frog		
Nikolski's tortoise		
Brauner's rock lizard		
Tesselated water snake		
European glass lizard	Small numbers of these species regularly observed along the transect routes	Frequently occurring species within the Study Area
Sand lizard		
Meadow lizard	Large numbers of species regularly observed along transect routes.	Abundant species within the Study Area

Complete.

Herpetile Hibernation Habitat Preference

All species of reptile and amphibian hibernate, and it is considered that this could happen in all habitat types within the Study Area, with the exception of active vineyards. However, the results of surveys undertaken by Dr. Olga Leontyeva during October – November 2013 (during which 51 individual Nikolski's tortoise were recorded), suggest that Nikolski's tortoise may favour hibernation sites near the ecotone between the forested valleys and meadows (see Figure 11.9); during the survey, Dr. Leontyeva stated that these data indicate that individuals are moving into these areas to hibernate over the winter period (Ref. 11.14).

In terms of hibernation habitat preferences for other herpetile species, they will find old animal burrows, cracks in tree roots or other suitable areas (e.g. under large logs, rubbish or under buildings) within grassland or forest areas for hibernation, but generally within areas with suitable vegetation coverage.

The hibernation season will vary slightly from species to species and according to prevailing night-time temperatures. However, in general terms is considered to last from mid-October to mid-April. Nikolski's tortoise will begin to emerge from hibernation after approximately five consecutive days where night-time temperatures have been above 10^{o}C.

Nikolski's Tortoise Population Estimate

Given the high sensitivity of Nikolski's tortoise (i.e. listed as internationally Critically Endangered), an attempt was made to determine the size of the population likely to be supported within the Study Area. An estimate was derived from a review of studies undertaken since 1985, and consideration of data obtained during the targeted Nikolski's tortoise field survey undertaken for the Project by Dr. Olga Leontyeva between October and November 2013.

Studies reviewed included the following:

- Inozemtsev and Pereshkolnik in 1985 (Ref. 11.15);
- Lukina and Sokolenko in 1991 (Ref. 11.16);
- Pestov and Leontyeva In 2011 (Ref. 11.17); and
- Leontyeva *et al*. in 2012 (Ref. 11.18).

Inozemtsev and Pereshkolnik (1985) state that the species can occur in densities of 0.2 to 0.5 per ha depending on the type and quality of the habitats present. Lukina and Sokolenko (1991) recorded 0.2/ha in Sochi National Park and in the Anapa district on the edge of agricultural land. Based on the total area of 'suitable' habitat contained within the Study Area (691 ha, a figure which excludes agricultural and urban habitats which are generally considered to be sub-optimal for supporting tortoises), this would equate to a population of between 138 – 345 individuals for the Study Area.

Pestov and Leontyeva (2011) calculated a range of population densities for different habitat types, based on data from over 300 km of transects completed during 2007-2011 on the Abrau Peninsula (Ref. 11.17). Table 11.12 presents the derived density figures / habitat type (ha).

Table 11.12 Calculated densities of Nikolski tortoise within the Study Area based on Pestov and Leontyeva (2011)

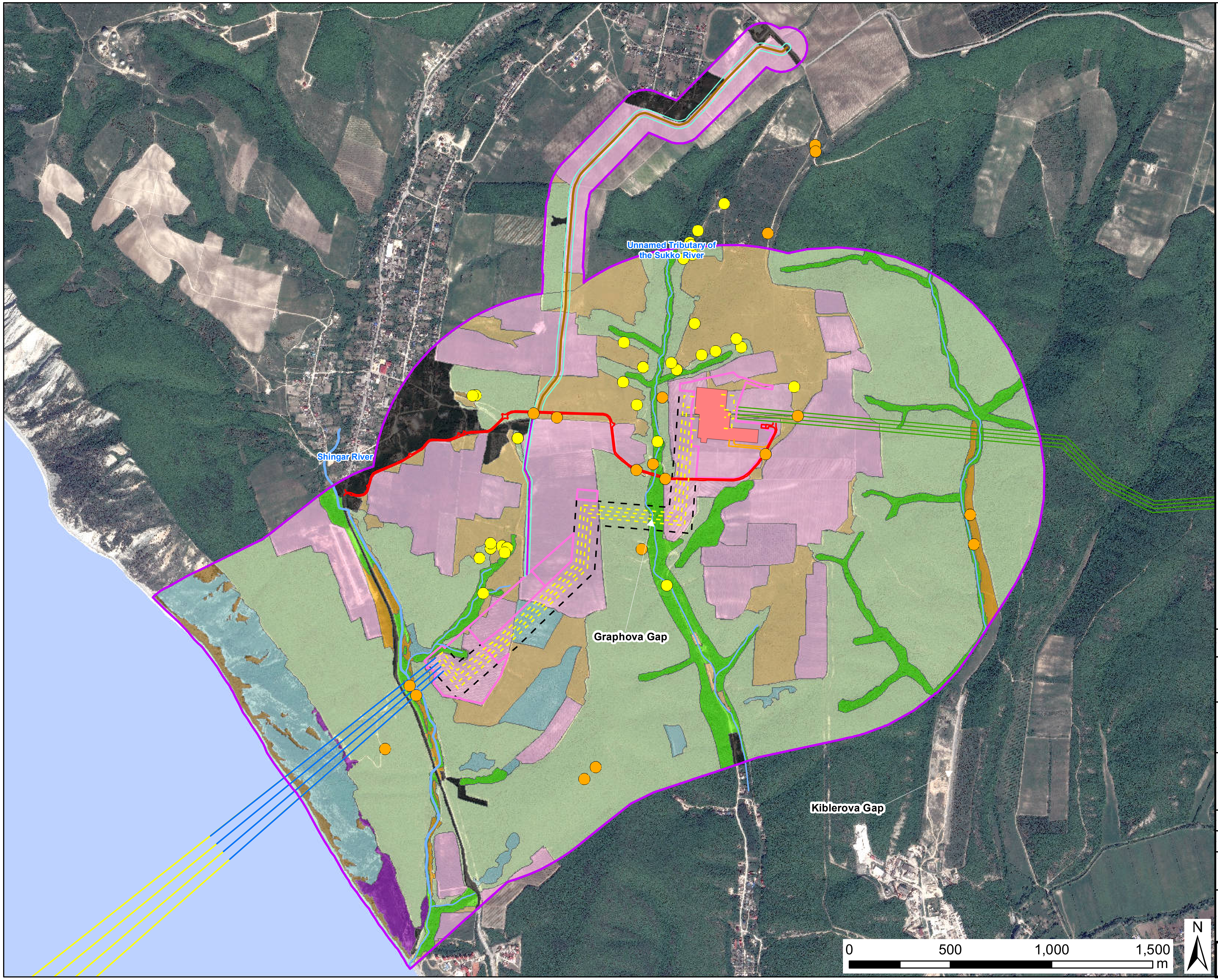
Habitat	Area of Habitat within Study Area	Published density for similar habitat type	Estimated Number of Individuals
Juniper woodlands	56	1.95 – 2.85	109.2 – 159.6
Shiblyak / mesophilic woodland	489	0.1 – 1.6	48.9 – 782.4
Open habitats (includes meadow and tomillyar)	111	2.2	279.4
Other (includes rocky outcrops and coastal shingle)	11	Unknown	Unknown
Total			**438 – 1221**

Therefore, based on the density data published by Pestov and Leontyeva (2011), the Project Study Area has the potential to support between 437 and 1220 individual tortoises.

The late autumn 2013 survey by Dr. Leontyeva was undertaken to refine the tortoise population estimate for the Study Area (see Section 11.4.4.1). This survey recorded a total of 51 individuals within the Tortoise Survey Area; taking into consideration the seasonal limitations of the survey (see Section 11.4.5.2), it is likely that larger numbers of individuals would be recorded during more suitable survey conditions.

Moreover, the vast majority of the adult individuals recorded (24 of the individuals recorded were juveniles) during the survey were female (21 of 27). Considering that the sex ratio within Nikolski's tortoise populations has generally been shown to be 1:1 (Ref. 11.19), it can be inferred that at least another 21 males are likely to be present within the Tortoise Survey Area. Therefore, the minimum density of tortoises within the Tortoise Survey Area (130 ha) is likely to be 0.55 individuals per hectare. Extrapolated to the entire Study Area (taken to include approximately 556 ha of suitable habitat) would provide an estimate population size of approximately 350 individuals. However, further survey is recommended to refine this estimate (see Section 11.6.9.4).

The population of Nikolski's tortoise within the Abrau peninsula has been estimated by Dr. Leontyeva to be in the region of 7000 individuals (Ref. 11.20). If the Study Area is assumed to support a population of 150 to 350 individuals (and potentially more), then the Study Area would support approximately 2 to 5% of total population of the Abrau peninsula; ecologically, this is considered to be a significant portion of the regional population).



LEGEND

Fauna survey results

- Pre-October 2013 Survey Records
- October 2013 Survey Records
- Study area
- Rivers

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Landfall facilities
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- Proposed offshore pipelines
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- Varvarovka bypass road (used by Project during construction only)

United Gas Supply System

- United Gas Supply System pipelines
- Permanent access road to be constructed by Gazprom Invest

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Purpose of Issue
For Information

Client
South Stream Offshore Pipeline — Energising Europe

Project Title
SOUTH STREAM OFFSHORE PIPELINE

Drawing Title
STUDY AREA
FAUNA SURVEY RESULTS
NIKOLSKI'S TORTOISE RECORDS

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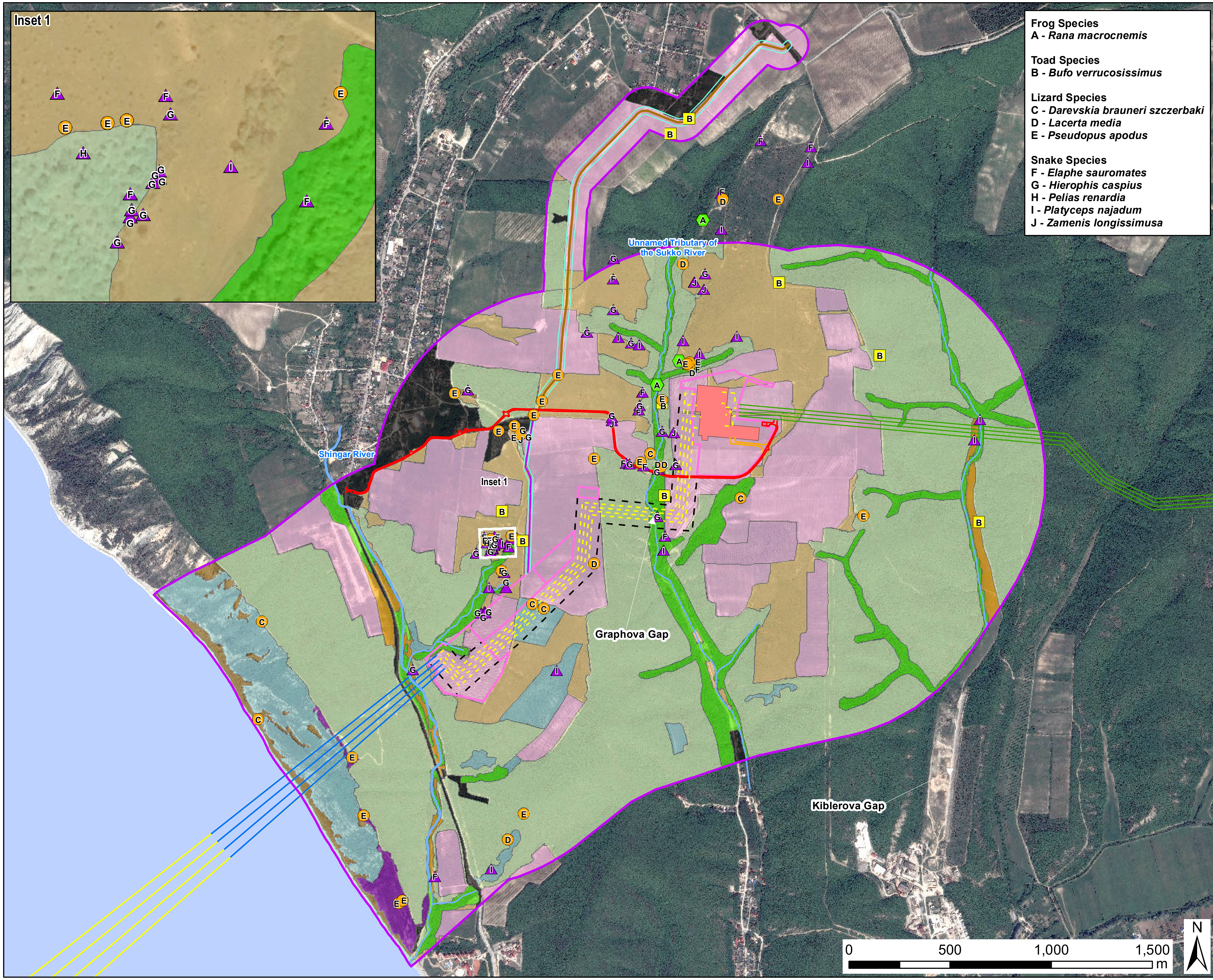

LEGEND

Fauna survey results

- Frogs
- Toads
- Lizards
- Snakes
- Study area
- Rivers

Russian Sector of South Stream Offshore Pipeline

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Purpose of Issue
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Client
South Stream
Offshore Pipeline
ENERGISING EUROPE

Project Title
SOUTH STREAM
OFFSHORE PIPELINE

Drawing Title
STUDY AREA
FAUNA SURVEY RESULTS
RED DATA BOOK HERPETILES

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Birds

The Study Area consists of a range of habitats that between them support a diverse assemblage of birds. In total, 137 species were recorded during the 2011, 2012 and 2013 bird surveys.

The species are classified by the following ecological status:

- Resident (R) – these species are present all year round and breed within the Study Area;
- Breeding Migrant (BM) – these species migrate to and breed within the Study Area during the summer months (indicatively April – September); and
- Non-breeding Migrant (NBM) – these species do not breed within the Study Area but migrate through the area. These species can be present at any point during the year but the majority would are present during spring (April / May) and autumn (July to October) passage.

None of the species recorded within the Study Area are considered likely to be present during the winter months only. A full species list of birds recorded and their ecological status is included in Table 11.13 below.

Table 11.13 Species recorded during the 2011, 2012 and 2013 survey and their ecological status on site

Species	Scientific Name	R	BM	NBM
Mute swan	*Cygnus olor*			+
Whooper swan	*Cygnus cygnus*			+
White-fronted goose	*Anser albifrons*			+
Greylag goose	*Anser anser*			+
Common quail	*Coturnix coturnix*		+	
Grey partridge	*Perdrix perdrix*	+		
Common pheasant	*Phasianus colchicus*	+		
Little bittern	*Ixobrychus minutus*			+
Black-crowned night-heron	*Nycticorax nycticorax*			+
Squacco heron	*Ardeola ralloides*			+
Great egret	*Egretta alba*			+

Continued…

Species	Scientific Name	R	BM	NBM
Little egret	*Egratta garzetta*			+
Grey heron	*Ardea cinerea*			+
Purple heron	*Ardea purpurea*			+
European honey buzzard	*Pernis apivorus*		+	+
Black kite	*Milvus migrans*			+
Egyptian vulture	*Neophron percnopterus*			+
Short-toed nnake-eagle	*Circaetus gallicus*		+	
Western marsh-harrier	*Circus aeruginosus*		?	+
Hen harrier	*Circus cyaneus*			+
Montagu's harrier	*Circus pygargus*		?	+
Northern goshawk	*Accipiter gentilis*		+	
Eurasian sparrowhawk	*Accipiter nisus*	+		
Steppe buzzard	*Buteo buteo vulpinus*		+	
Booted eagle	*Hieraaetus penatus*		+	
Common kestrel	*Falco tinnunculus*	+		
Red-footed falcon	*Falco vespertinus*		+	+
Eurasian hobby	*Falco subbuteo*		+	
Peregrine falcon	*Falco peregrinus*	+		
Common crane	*Grus grus*			+
Little bustard	*Tetrax tetrax*			+
Eurasian oystercatcher	*Haematopus ostralegus*			+
Grey plover	*Pluvialis squatarola*			+
Northern lapwing	*Vanellus vanellus*			+

Continued...

Species	Scientific Name	R	BM	NBM
Little ringed plover	*Charadrius dubius*		+	
Broad-billed sandpiper	*Limicola falcinellus*			+
Common sandpiper	*Actitis hypoleucos*		+	+
Eurasian woodcock	*Scolopax rusticola*			+
Rock pigeon	*Columba livia*	+		
Common wood-pigeon	*Columba palumbus*		+	
Eurasian collared dove	*Streptopelia decaocto*	+		
European turtle dove	*Streptopelia turtur*		+	
Common cuckoo	*Cuculus canorus*		+	
Eurasian scops owl	*Otus scops*		+	
Little owl	*Athene noctua*	+		
Tawny owl	*Strix aluco*	+		
Long-eared owl	*Asio otus*	+		
Eurasian nightjar	*Caprimulgus europaeus*		+	
Common swift	*Apus apus*		+	
Alpine swift	*Apus melba*		+	
Common kingfisher	*Alcedo atthis*			+
European bee-eater	*Merops apiaster*		+	
European roller	*Corcacias garrulous*		+	
Eurasian hoopoe	*Upapa epops*		+	
Eurasian wryneck	*Jynx torquilla*		+	
Black woodpecker	*Dryocopus martius*	+		
Eurasian green woodpecker	*Picus viridis*	+		

Continued...

Species	Scientific Name	R	BM	NBM
Great spotted woodpecker	*Dendrocopos major*	+		
Middle spotted woodpecker	*Dendrocopos medius*	+		
White-backed woodpecker	*Dendrocopos leucotos*	+		
Lesser spotted woodpecker	*Dendrocopos minor*	+		
Eurasian golden oriole	*Oriolus oriolus*		+	
Red-backed shrike	*Lanius collurio*		+	
Lesser grey shrike	*Lanius minor*		+	
Black-billed magpie	*Pica pica*	+		
Eurasian jay	*Garrulus glandarius*	+		
Rook	*Corvus frugilegus*	+		
Hooded crow	*Corvus cornix*	+		
Common raven	*Corvus corax*	+		
Goldcrest	*Regulus regulus*		+	
Blue tit	*Cyanistes caeruleus*	+		
Great tit	*Parus major*	+		
Coal tit	*Periparus ater*	+		
Marsh tit	*Parus palustris*	+		
Calandra lark	*Melanocorypha clanadra*		+	
Crested lark	*Galerida cristata*		+	
Wood lark	*Lullula arborea*		+	
Sky lark	*Alauda arvensis*		+	
Barn swallow	*Hirundo rustica*		+	
House martin	*Delichon urbica*		+	

Continued...

Species	Scientific Name	R	BM	NBM
Red-rumped swallow	*Cecropis daurica*		+	
Long-tailed tit	*Aegithalos caudatus*	+		
Green warbler	*Phylloscopus nitidus*		+	
Wood warbler	*Phylloscopus sibilatrix*		+	
Common shiffchaff	*Phylloscopus collybita*		+	
Willow warbler	*Phylloscopus trochilus*		+	
Blackcap	*Sylvia atricapilla*		+	
Garden warbler	*Sylvia borin*		+	
Barred warbler	*Sylvia nisoria*		+	
Lesser whitethroat	*Sylvia curruca*		+	
Common whitethroat	*Sylvia communis*		+	
Icterine warbler	*Hippolais icterina*		+	
Marsh warbler	*Acrocephalus palustris*		+	
Eurasian reed warbler	*Acrocephalus scirpaceus*		+	
Wood nuthatch	*Sitta europaea*	+		
Eurasian treecreeper	*Certhia familiaris*	+		
Winter wren	*Troglodytes troglodytes*	+		
Common starling	*Sternus vulgaris*		+	
Rosy starling	*Sturnus roseus*			+
Eurasian blackbird	*Turdus merula*	+		
Song thrush	*Turdus philomelos*		+	
Mistle thrush	*Turdus viscivorus*		+	
Spotted flycatcher	*Muscicapa striata*		+	

Continued…

Species	Scientific Name	R	BM	NBM
European robin	*Erithacus rubecula*		+	
Common nightingale	*Luscinia megarhynchos*		+	
Bluethroat	*Luscinia svecica*		?	+
Red-breasted flycatcher	*Ficedula parva*		+	
Collared flycatcher	*Ficedula albicollis*		+	
European pied flycatcher	*Ficedula hypoleuca*			+
Black redstart	*Phoenicurus ochruros*		+	
Common redstart	*Phoenicurus phoenicurus*		+	
Rufous-tailed rock-thrush	*Monticola saxatilis*		+	
Whinchat	*Saxicola rubetra*		+	
Common stonechat	*Saxicola torquatus*		?	+
Isabelline wheatear	*Oenanthe isabellina*			+
Northern wheatear	*Oenanthe oenanthe*		+	
Pied wheatear	*Oenanthe pleschanka*		+	
Black-eared wheatear	*Oenanthe hispanica*			+
House sparrow	*Passer domesticus*	+		
Eurasian tree sparrow	*Passer montanus*	+		
Blue-headed wagtail	*Motacilla flava flava*		?	+
Black-headed wagtail	*Motacilla flava feldegg*		?	
White wagtail	*Motacilla alba alba*		+	
Tawny pipit	*Anthus campestris*		+	
Tree pipit	*Anthus trivialis*		+	
Eurasian chaffinch	*Fringilla coelebs*		+	

Continued…

Species	Scientific Name	R	BM	NBM
European greenfinch	*Chloris chloris*		+	
European goldfinch	*Carduelis carduelis*	+		
Eurasian linnet	*Carduelis cannabina*	+		
Red crossbill	*Loxia curvirostra*		+	
Common rosefinch	*Carpodacus erythrinus*	+		
Eurasian bullfinch	*Pyrrhula pyrrhula*		+	
Hawfinch	*Coccothraustes coccothraustes*	+		
Yellowhammer	*Emberiza citrinella*	+		
Rock bunting	*Emberiza cia*	+		
Ortolan Bunting	*Emberiza hortulana*		+	
Corn bunting	*Emberiza calandra*	+		

Complete.

Breeding Birds

A total of 107 species were recorded which are considered to breed or possibly breed within the Study Area (Ref. 11.9). Of these, 39 species are thought to be present all year-round and do not migrate. The remaining 68 species breed during the spring and summer months and over-winter in other regions. Species were recorded breeding within all habitats surveyed and the large recorded assemblage is as a result of the diversity of habitats present within the Study Area.

In 2011, comprehensive bird surveys were completed which aimed to record the densities of breeding birds within each terrestrial habitat type. Those species that could be affected by the Project are shown in Table 11.14. Densities of breeding birds recorded within settlements, rocky outcrops and along the shoreline are not shown as these habitat types will not be affected by the Project, although species of conservation concern recorded within these areas are discussed.

Table 11.14 Densities of Breeding Bird by Habitat Type (pairs / km^2)

Species	MF	S	SSM	MM	JW	AH
Common quail			8.37	7.50		
Grey partridge			2.28	3.75		3.09
Common pheasant	1.50		4.94		0.94	
European honey buzzard	**					
Short-toed snake-eagle	0.50					
Western marsh-harrier			*			
Montagu's harrier			*			
Northern goshawk	1.50					
Eurasian sparrowhawk	*					
Steppe buzzard	6.50					
Booted eagle	0.50					
Common kestrel	1.50		0.76			
Common wood-pigeon	10.00	2.40			3.14	
European turtle dove	11.50	23.98			6.29	4.76
Common cuckoo	10.00	5.52	3.42			3.57
Scops owl	6.50	0.72				
Tawny owl	7.00					
Long-eared owl	6.50	2.40				3.57
Eurasian nightjar	3.00	1.44				
Eurasian wryneck	5.00					

Continued...

Species	MF	S	SSM	MM	JW	AH
Black woodpecker	6.50					
Eurasian green woodpecker	5.00					
Great spotted woodpecker	18.00	5.52			3.14	
Lesser spotted woodpecker	6.50	3.12				
Middle spotted woodpecker	5.50					
Eurasian golden oriole	5.00					
Red-backed shrike	5.00		22.81			6.19
Lesser grey shrike			3.80		12.58	
Black-billed magpie		2.40	3.80		3.14	4.76
Eurasian jay	6.50	5.52			3.14	3.57
Hooded crow	1.50					
Common raven	3.00					
Blue tit	6.50	4.80				3.57
Great tit	45.00	29.26			6.29	5.48
Coal tit	8.00	6.98				
Marsh tit	6.50					
Calandra lark			4.94			6.19
Wood lark	5.00		7.60			10.31
Sky lark			10.65	5.00		11.34
Long-tailed tit	5.00					
Green warbler	13.00	8.63				

Continued…

Species	MF	S	SSM	MM	JW	AH
Wood warbler	4.50	4.80				
Common chiffchaff	24.50	14.39			7.23	7.14
Blackcap	16.50	10.31				7.14
Garden warbler	8.00	3.84	3.80			4.76
Barred warbler	5.00	4.80	4.94			
Lesser whitethroat	3.00					
Common whitethroat			30.42	16.25		3.57
Marsh warbler			4.94	3.75		
Wood nuthatch	10.00	9.35				
Eurasian treecreeper	5.00					
Winter wren	14.50	7.19				
Common starling	3.00					
Eurasian blackbird	35.00	16.79			6.29	3.57
Song thrush	10.00	4.80				
Mistle thrush	5.00					
Spotted flycatcher	5.00					
European robin	8.00	7.19				
Common nightingale	15.00	6.24				
Red-breasted flycatcher	11.50					
Collared flycatcher	6.50					
Black redstart						6.19
Common redstart	13.00	6.24			10.38	13.40
Whinchat			4.94	3.75		

Continued...

Species	MF	S	SSM	MM	JW	AH
White wagtail						3.09
Tawny pipit	6.50		3.80			3.09
Tree pipit		5.52	6.08	5.00		9.28
Eurasian chaffinch	41.50	45.56			8.18	11.90
European greenfinch	6.50	7.19	4.94		19.81	10.71
European goldfinch	10.00	14.39	7.60		10.38	14.29
Eurasian linnet	5.00	9.59	8.75			7.14
Common rosefinch	5.00	6.24			7.23	4.76
Hawfinch	8.00					
Yellowhammer	5.00	4.80	8.75			3.57
Rock bunting			3.80			
Ortolan bunting		4.80	26.62	7.50		7.14
Corn bunting			32.70	12.50		3.09

MF – Mesophilic Forest, S – Shiblyak, SSM – Steppefied Secondary Meadow, MM – Mesphilic Meadow, JW – Juniper Woodland (with tomillares), AH – Agricultural Habitats (vineyards and orchards).* - Recorded in 2012 only – density uncertain,** - Recorded in 2013 only – density uncertain.

Complete.

Mesophilic Forest

The greatest diversity of breeding birds was recorded within the mesophilic forest. However, the assemblage consists largely of fairly widespread and ubiquitous species of woodland and woodland edge birds. Mesophilic woodland in the region is known to support seven species of breeding raptor, of which three: short-toed snake-eagle, booted eagle and red-footed falcon, are of conservation concern (Table 11.14). All three of these species are considered to have the potential to breed in this woodland habitat, although no nests of these species were confirmed on mature trees within the Study Area. All of these species have been confirmed as hunting over the Study Area. Another species of conservation concern, wood lark, breeds within the mesophilic forest. Wood larks were confirmed as breeding within this habitat and are associated with the woodland edges.

Shiblyak

Shiblyak supports the second most diverse breeding bird assemblage within the Study Area, with 34 species recorded. However, all of the species recorded are widespread and ubiquitous and are typical for this habitat type. No red list species were recorded breeding within this habitat type. The species with the greatest breeding densities were European turtle doves, thrushes and finches. This habitat also provides nesting opportunities for Eurasian nightjar, and two species of bunting: yellowhammer and ortolan bunting.

Secondary Steppefied Meadow

Twenty-six species are considered to have nested within this habitat type of which one species: wood lark is of regional conservation concern and listed on the RDB KK. The remaining breeding species are widespread and ubiquitous, typical for this habitat type. The assemblage consists of species that prefer more open habitats with associated scrub and includes: larks, pipits, shrikes, warblers, finches and four species of bunting (corn bunting, yellowhammer, rock bunting and ortolan bunting).

Two species of raptor are considered to have possibly bred within this habitat: western marsh harrier and Montagu's harrier. A female and juvenile of both species were recorded in this suitable breeding habitat in August 2012, although it is possible that all individuals seen were on migration.

Mesophilic Meadow

Out of the nine species considered to breed in this habitat type, wood lark is a red list species. The remaining species are widespread and ubiquitous.

Juniper Woodland with Tomillyar

Fifteen species were confirmed as breeding within the stands of juniper woodland within the Study Area, although none are red list species. The breeding assemblage consisted of lesser grey shrike, corvids and finches, all of which are widespread and typical for this habitat type.

Agricultural Habitats

These consist of vineyards and orchards and associated human habitation and consequently a diverse assemblage of breeding bird species is supported by these habitats. One of these species, wood lark, is listed on the RDB KK. All other birds are common species.

Other Habitats

Other habitats surveyed within the Study Area included rocky outcrops, cliff and the coastal strip. These areas supported three red list species: peregrine falcon, European roller, and rufous-tailed rock-thrush. One of these species, European roller, is listed as Near Threatened by the IUCN. All of these species are also listed on the RDB RF and RDB KK.

These habitats do not support aggregations or communities of nesting seabirds (e.g. gulls) as the cliff areas within the Study Area do not contain suitable habitat for these species. Impacts on nesting seabirds are therefore not considered further within this chapter.

Red Listed Breeding Birds

Seven of the bird species that are considered potentially to have bred within the Study Area are listed on the IUCN RL, RDB RF, and / or RDB KK. In addition, a further five species are listed on the appendix 3 of the RDB KK, which are species that are recommended for further research in the region. Table 11.15 includes a summary of their conservation status and their preferred habitats.

Table 11.15 Red list species considered potentially to have bred or potentially bred in the Study Area in 2011, 2012 and 2013.

Species	Habitat	IUCN RDL	RDB RF	RDB KK
Common quail	Mesophilic and steppefied meadow	LC	App 2	Not Listed
European honey buzzard	Tall trees within the mesophilic forest	LC	Not Listed	App 3
Short-toed snake-eagle	Tall trees within the mesophilic forest	LC	2	1A
Booted eagle	Tall trees within the mesophilic forest	LC	App 2	1B
Red-footed falcon	Trees within the mesophilic forest	NT	App 3	App 2
Peregrine falcon	Rocky outcrops and cliff habitats	LC	2	7
Little ringed plover	Coastal Shingle	LC	Not Listed	App 3
European roller	Rocky Outcrops	NT	Not listed	Not Listed
White-backed woodpecker	Mesophilic forest. Breeding status unknown	LC	Not Listed	App 3
Calandra lark	Mesophilic and steppefied meadow	LC	Not listed	App 3
Wood lark	Mesophilic forest, steppefied meadow and agricultural habitats	LC	Not Listed	1B
Rufous-tailed rock-thrush	Rocky outcrops and cliff habitats	LC	Not Listed	2
Pied wheatear	Rocky outcrops and cliff habitats	LC	Not Listed	App 3

Non-breeding Migratory and Overwintering Birds

The Black Sea coast is a major migration corridor where birds move in a north-west direction in spring and in a south-east direction during autumn. The majority of migrants follow estuarine valleys of rivers flowing into the Black Sea, where they stop to feed along the coast (Ref. 11.6).

Spring migration starts in the second or third week of February with spring migration ending in late June. Some species of birds will merely pass over the Study Area for more northerly breeding grounds whilst others migrate to the area to breed. Autumn migration begins from the second week of July and finishes in the second half of November.

A range of species were observed migrating over the Study Area in both spring and autumn. However, the Study Area is not used as a stop-over site for large numbers of birds. Migrating raptors, European bee-eaters and hirundines will feed over the site during migration and it is also probable that the site also supports migrating passerine species (e.g. warblers, thrushes, skrikes, pipits, larks and buntings). The site is not a recognised bottleneck migration site and it does not support large aggregations of staging birds. Wildfowl and wading birds, divers, grebes, gulls and terns were recorded migrating over, and over-wintering on the sea. However, these are discussed further in **Chapter 12 Marine Ecology**.

Red Listed Non-breeding Migratory and Overwintering Birds

Five non-breeding migrants of conservation concern were recorded flying over the Study Area. These are shown in Table 11.16.

Table 11.16 Red Listed Non-breeding Migrants

Species	Habitat	Conservation Status		
		IUCN RDL	RDB RF	RDB KK
Squacco heron	Non Breeding Migrant	LC	App 2	App 2
Egyptian vulture	Non Breeding Migrant	EN	3	1B
Red-footed falcon	Non Breeding Migrant	NT	App 2	App 3
Common crane	Non Breeding Migrant	LC	3	3
Little bustard	Non Breeding Migrant	NT	2	3

The Project Area does not contain habitats that would support significant aggregations of red listed migratory bird species. The Project Area is not identified as a bottleneck migration site or a significant stop over site. The wintering bird assemblages supported by the terrestrial habitats of the Study Area consist of widespread and ubiquitous species of passerine birds. The terrestrial habitats of the Study Area do not offer suitable foraging or roosting opportunities for large aggregations of wintering birds.

Terrestrial Mammals

Secondary data indicates that the Study Area has the potential to support at least 48 species of mammal (Ref. 11.9). These include species from six orders, comprising six species of insectivore, one species of lagomorph, seven species of rodent, 17 species of bat (Chiroptera), 10 species of carnivore and three species of artiodactyla (Ref. 11.9). Table 11.17 presents these species and provides their classifications on the relevant IUCN RL and RDBs.

Table 11.17 Terrestrial Mammals Potentially Present within the Study Area

Species	Latin	Conservation Status		
		IUCN	RDB RF	RDB KK
Insectivora				
Northern white-breasted Hedgehog	*Erinaceus roumanicus*	LC	Not listed	Not listed
Caucasian mole	*Talpa caucasica*	LC	Not listed	Not listed
Caucasian pygmy shrew	*Sorex volnuchini*	LC	Not listed	Not listed
Caucasian shrew	*Sorex caucasica*	LC	Not listed	Not listed
White-toothed shrew	*Crocidura leacodon*	LC	Not listed	Not listed
Lesser shrew	*Crocidura suaveolens*	LC	Not listed	Not listed
Chiroptera				
Savi's pipistrelle	*Hypsugo savii*	LC	Not listed	5
Common pipistrelle	*Pipistrellus pipistrellus*	LC	Not listed	Not listed
Nathusius’ pipistrelle	*Pipistrellus nathusii*	LC	Not listed	Not listed
Barbastelle	*Barbastella barbastellus*	NT	Not listed	2
Brown big-eared bat	*Plecotus auritus*	LC	Not listed	Not listed
Lesser horseshoe bat	*Rhinolophus hipposideros*	LC	3	3
Natterer's bat	*Myotis nattereri*	LC	Not listed	3
Whiskered bat	*Myotis mystacinus*	LC	Not listed	3
Lesser mouse-eared Myotis	*Myotis blythii*	LC	2	7

Continued…

Species	Latin	Conservation Status		
		IUCN	RDB RF	RDB KK
Steppe whiskered bat	*Myotis aurascens*	LC	Not listed	5
Daubentons' bat	*Myotis daubentonii*	LC	Not listed	Not listed
Brandt's bat	*Myotis brandtii*	LC	Not listed	7
Pond bat	*Myotis dasycneme*	NT	Not listed	2
Bechstein's bat	*Myotis bechsteinii*	NT		2
Noctule	*Nyctalus noctula*	LC	Not listed	Not listed
Giant noctule	*Nyctalus lasiopterus*	NT	Not listed	3
Lesser noctule	*Nyctalus leisleri*	LC		2
Serotine	*Eptesicus serotinus*	LC	Not listed	Not listed
Particoloured bat	*Vespertilio murinus*	LC	Not listed	Not listed
Rodentia				
Greater blind mole rat	*Spalax microphthalmus*	LC	Not listed	Not listed
Edible dormouse	*Glis glis*	LC	Not listed	Not listed
Forest dormouse	*Dryomys nitedula*	LC	Not listed	Not listed
Brown rat	*Rattus norvegicus*	LC	Not listed	Not listed
Lesser wood mouse	*Sylvaemus uralensis*	LC	Not listed	Not listed
Striped field mouse	*Apodemus agrarius*	LC	Not listed	Not listed
Common vole	*Microtus arvalis*	LC	Not listed	Not listed
House mouse	*Mus musculus*	LC	Not listed	Not listed
Lagomorpha				
European rabbit	*Oryctolagus cuniculus*	NT	Not listed	Not listed
European hare	*Lepus europaeus*	LC	Not listed	Not listed

Continued...

Species	Latin	Conservation Status		
		IUCN	RDB RF	RDB KK
Carnivora				
Gray wolf	*Canis lupus*	LC	Not listed	Not listed
Golden jackal	*Canis aureus*	LC	Not listed	Not listed
Red fox	*Vulpes vulpes*	LC	Not listed	Not listed
Raccoon dog	*Nyctereutes procyonoides*	LC	Not listed	Not listed
Northern raccoon	*Procyon lotor*	LC	Not listed	Not listed
Caucasian wildcat	*Felis silvestris*	LC	3	7
Least weasel	*Mustela nivalis*	LC	Not listed	Not listed
European pine marten	*Martes martes*	LC	Not listed	Not listed
Stone marten	*Martes foina*	LC	Not listed	Not listed
Eurasian badger	*Meles meles*	LC	Not listed	Not listed
Artiodactyla				
Wild boar	*Sus scrofa*	LC	Not listed	Not listed
European roe deer	*Capreolus capreolus*	LC	Not listed	Not listed
Red deer	*Cervus elaphus*	LC	Not listed	Not listed

Complete.

Insectivora

During the course of surveys in 2011, only the Caucasian common shrew was recorded. However during 2012, signs of both Caucasian mole and northern white-breasted hedgehog were noted.

Densities for Caucasian shrew were determined, with the species recorded within the shiblyak and mesophilic forest at densities of 20 individuals per ha, and 59 individuals per ha, respectively.

Signs of the Caucasian mole and northern white-breasted hedgehog were only recorded during the 2012 surveys. Evidence (droppings) of hedgehog was found along the cliff-top path and adjacent to shiblyak. This species is likely to occur throughout the Study Area, but at relatively low densities. Evidence (footprints and mounds) of Caucasian mole were found throughout the agricultural habitat and also along streambed within mesophilic forest.

The absence of all other insectivora from the Study Area cannot be absolutely ruled out, although considering that they have not been recorded during the 2011, 2012 and 2013 surveys, it is assumed that these species are either likely absent from the Study Area or present in low numbers.

Chiroptera

Commuting and foraging bats were observed in the evening during both the 2011 and 2012 field survey. However, as no trapping or ultra-sound survey methods were employed during the survey, the majority of bats could not be identified to genus or species level. One common pipistrelle was however caught in the hand near to the settlement of Sukko during the 2011 surveys.

Suitable foraging and commuting habitat for bats exists across the majority of the Study Area, with the mesophilic forest, shiblyak, vineyards and meadow areas providing excellent opportunity for a variety of bat species to forage. The edges of these habitats and linear features within the landscape, including rivers, tree lines, and hedgerows, provide suitable commuting routes for bats. Bats have the potential to commute up to 20 km (e.g. barbastelle) from a roost site whilst foraging and commuting (Ref. 11.23).

Suitable habitat for supporting roosting bats is present within the Study Area and includes mature trees within the areas of mesophilic forest and buildings within the areas of human settlement. During the 2012 field surveys, bat droppings were found within a disused concrete building located along the valley to the south of the Study Area (see legend labelled "Chiroptera" on Figure 11.8). In addition, other disused vineyard buildings were assessed as being suitable for roosting bats.

The 2012 surveys observed approximately nine trees present within the mesophilic forest which exhibited some, albeit relatively low potential for supporting roosting bats. The potential for these trees to support roosting bats was assessed as low as they lacked favourable features such as deep hollows, cracks, or crevices within which significant number of bats could roost. These trees were considered to be suitable as transient summer roosts, supporting individuals or low numbers of bats during the summer months. Due to the lack of favourable features, the trees were unlikely to be used as hibernation or maternity roosts by bats.

All threatened mammal species potentially present within the Project Area are bats. These include: barbastelle (RDB KK (2)), lesser noctule (RDB KK (2)), pond bat (RDB KK (2)) and Bechstein's bat (RDB KK (2)).

Rodentia

The 2011, 2012 and 2013 surveys recorded seven species of rodent within the Study Area: greater blind mole rat, forest dormouse, brown rat, house mouse, lesser wood mouse, striped field mouse and common vole. Evidence of brown rat and house mouse were recorded within the settlement areas in 2012. None of the Rodentia recorded are red list species.

The 2011 survey, which employed small mammal traps to assess species density within the Study Area, recorded and determined the density of four species of rodent. These results of presented in Table 11.18 below.

Table 11.18 Densities of Rodentia Recorded within the Study Area (Individuals / Ha)

Species	MF	S	SSM	MM	JW	AH
Lesser wood mouse	72	56	0	0	16	0
Striped field mouse	40	24	16	32	0	16
Common vole	0	0	80	48	0	8
Forest dormouse	0	8	0	0	0	0
Total	*112*	*88*	*96*	*80*	*16*	*24*

MF – Mesophilic Forest, S – Shiblyak, SSM – Steppefied Secondary Meadow, MM – Mesophilic Meadow, JW – Juniper Woodland, AH – Agricultural Habitats

The 2011 surveys recorded greater blind mole rat within the secondary steppefied meadow where, in places, individuals were recorded at densities of 1 – 1.3 individuals per m^2. Relatively large numbers of individuals were also recorded within the mesophilic meadow and steppefied agricultural habitats.

The presence of other rodents potentially present within the Study Area, but not recorded during field survey, cannot be ruled out with absolute certainty. However, as they were not recorded during the 2011, 2012 and 2013 surveys, these species are likely to be either present in low numbers or absent from the Study Area.

Lagomorpha

Evidence of European hare was recorded only during the 2012 surveys, where droppings were noted throughout the agricultural habitats. European rabbit was recorded within the 2013 Study Area with droppings and warrens noted along all of the possible access tracks as well as in the juniper woodland. Adult animals were recorded twice during the 2013 survey work.

Carnivora

None of the carnivores potentially present within the Study Area are classified as threatened by the IUCN, RDB RF, or RDB KK, although Caucasian wildcat is listed as Rare (3) on the RDB RF.

The 2011, 2012 and 2013 surveys recorded nine species of carnivore within the Study Area; grey wolf, golden jackal, red fox, raccoon dog, common racoon, least weasel, pine marten, beech marten, and Eurasian badger. Evidence of these animals was generally restricted to signs (e.g. bones, footprints and faeces).

Definitive evidence of the Caucasian wildcat was not recorded during any of the field surveys and this species is considered to be likely absent from the Study Area.

Artiodactyla

Evidence of wild boar was recorded during the 2013 surveys, with tracks of a single adult and 2 – 3 yearlings recorded within the mesophilic forest. This species is common within the forest areas on the slope of ravines and gullies located to the east of Varvarovka village.

Evidence and sightings of roe deer and red deer were recorded during the 2011 surveys. A roe deer skull was found during the 2012 survey in addition to droppings and prints in areas of the vineyards, woodlands and along the access tracks. Evidence of deer was not noted during the 2013 surveys.

11.5.2 Baseline Summary

No protected sites designated due to nature conservation interest occur within the Study Area. However, Utrish SPNA is located approximately 3.8 km to the south-east of the nearest boundary of the Pipeline construction corridor. In addition, all forest or woodland habitats in the Study Area are classified as 'protective forests' under the Forest Code of the Russian Federation.

A range of natural and modified habitats occur within the Study Area. Natural Habitats include shiblyak, mesophilic forest, juniper woodland, mesophilic meadow, tomillyar, rocky outcrops and coastal shingle. Of these, shiblyak covers the greatest land area (431 ha), whereas mesophilic meadow, tomillyar, rocky outcrops, coastal shingle are all limited in extent (all less than 10 ha). Modified habitats present include steppefied meadow (111 ha), as well as urban and agricultural habitats (273 ha). Agricultural habitats are dominated by areas of vineyards.

The habitats in the Study Area support a range of species that have been assessed by the IUCN RL as well as species included with the RDB RF and RDB KK. These include:

- Twenty six plant species listed within the RDB KK, including six assessed as Endangered within the Krasnodar Krai;
- Potentially up to 38 species of terrestrial invertebrates listed within the RDB KK, including three that have been assessed by the IUCN to be Vulnerable at an international level;
- A notable assemblage of herpetofauna, including twelve species included within the RBD KK. This includes Nikolski's tortoise, which has been assessed by the IUCN as Critically Endangered;
- Six species of bird listed within the RDB KK that may have bred within the Study Area, of which two species, European roller and red-footed falcon have been assessed by the IUCN as Near-threatened;
- Twelve species of bat listed by the RDB KK, of which four are assessed by the IUCN as Near–threatened; and

- A range of other mammal species of which one (Caucasian wildcat) is assessed by the RDB RF as rare.

Other receptors such as aquatic invertebrates, fish, phytoplankton and zooplankton are present within the Study Area, but not thought to be of notable conservation value.

Critical Habitat Summary

In addition to undertaking an evaluation of the ecological receptors present at the locations described above, for the purposes of undertaking an impact assessment, the IFC PS(6) emphasises the need for there to be particular attention to areas which qualify as 'critical habitat'. The key practical implication of the presence of critical habitat is that any proposed mitigation measures for impacts upon these areas should be designed to result in a net gain in biodiversity.

Appendix 11.1 provides an assessment of critical habitat applicable to the landfall section of the South Stream Offshore Pipeline – Russian Sector. Critical habitat is defined by IFC Performance Standard 6 (PS6) (Ref. 11.11) as areas with high biodiversity value. This includes areas that meet one or more of following criteria:

- Criterion 1: Critically Endangered (CR) and / or Endangered (EN) species;
- Criterion 2: Endemic and / or restricted-range species;
- Criterion 3: Migratory and / or congregatory species;
- Criterion 4: Highly threatened and / or unique ecosystems; and
- Criterion 5: Key evolutionary processes.

The discrete management unit (DMU) (see Appendix 11.1 for description) has been assessed against these criteria in accordance with PS6 and associated guidance notes (see Table 11.19).

The Project footprint and the Study Area are located within critical habitat defined under Criteria 1 and 2 (see Appendix 11.1 for a description of the DMU) due to the presence of four endangered and endemic species: the plants *Rindera tetraspis* and fern-leaved speedwell, the butterfly Levantine skipper and Nikolski's tortoise. The presence of two specific habitat types also triggers critical habitat under Criterion 4 (mesophilic forest and tomillyar).

Impacts on key biodiversity values of critical habitat will be afforded particular consideration with regard to mitigation and monitoring protocols, with the aim of demonstrating that there will be a net gain in biodiversity once the proposed measures have been implemented (see mitigation section).

Table 11.19 List of Critical Habitat Features within the DMU

Criterion	Feature	Rationale	Critical Habitat
Criterion 1: Critically Endangered (CR) and/or Endangered (EN) species	Rindera tetraspis	DMU represents >10 percent of the species' AOO within the Krasnodar Krai region	Yes - Tier 2
Criterion 1: Critically Endangered (CR) and/or Endangered (EN) species	Levantine Skipper	DMU represents >10 percent of the species' AOO within the Krasnodar Krai region	Yes - Tier 2
Criterion 1: Critically Endangered (CR) and/or Endangered (EN) species	Nikolski's tortoise *Testudo graeca nikolskii*	DMU supports the regular occurrence of a single individual of a CR species	Yes - Tier 2
Criterion 2: Endemic and/or restricted-range species	Fern-leaved speedwell *Veronica filifolia*	DMU supports > one percent of the global population of this endemic species	Yes - Tier 2
Criterion 2: Endemic and/or restricted-range species	Nikolski's tortoise *Testudo graeca nikolskii*	DMU supports ≥ one percent of the global population of a restricted-range species.	Yes - Tier 2
Criterion 4: Highly threatened and/or unique ecosystems	Mesophilic forest	Ecosystem structure and function unfavourable in approximately 80 percent of European range.	Yes
Criterion 4: Highly threatened and/or unique ecosystems	Tomillyar	Coastal region un-protected and under pressure from tourism and therefore at risk of significant reduction in next 50 years.	Yes

11.6 Impact Assessment

This section identifies and describes the potential impacts of the Project on terrestrial ecology receptors (see Section 11.6.6) and presents mitigation measures. The approach to the impact assessment is outlined below:

- Following the identification of potential terrestrial ecology receptors, the sensitivity of each receptor is evaluated according to their resilience and value;
- Impacts that could potentially affect receptors are identified and their nature described. The magnitude of potential impacts (negligible, low, moderate or high) resulting as a consequence of the Project is assessed. Measures that have been incorporated into the Project design to minimise or avoid impacts are described and are taken into account in the impact assessment;

- The likely significance (not significant, low, moderate or high) of these impacts on receptors are then assessed, and where possible quantified;
- Mitigation measures to avoid or reduce any moderate or high significance impacts are then described in conjunction with other elements of the design (including mitigation for other environmental disciplines). If necessary, specific measures to compensate for effects on features of nature conservation importance are identified;
- Mitigation measures for impacts to features which result in IFC critical habitat status are presented with the aim of leading to a gain in biodiversity; and
- The significance of potential residual effects is assessed.

11.6.1 Impact Assessment Criteria

The construction of the Project involves a wide range of activities that have the potential to affect the terrestrial environment, primarily during the Construction Phase. The relevant activities of the Project likely to give rise to impacts on receptors are summarised in Table 11.20.

Table 11.20 Project Activities Timings

Phase	Activity
Design and Development	Clearance of vegetation
	Creation of access tracks and surveys pads
Construction / pre-commissioning	Preparation of access roads / upgrades to junctions of existing roads
	Pipeline installation using open-cut method - from the microtunnel exit pits to the landfall facilities and from the landfall facilities to the tie-in with the United Gas Supply System approximately 100 m upstream of the landfall facilities.
	Construction of landfall facilities
	Establishment of temporary construction sites and construction of microtunnels
Operation	Maintenance of the RoW area Movement of people and machinery related to the operation of the Pipeline and its maintenance in good working condition
Decommissioning	Construction of access roads / repair of existing facilities Excavation works for taking out pipes if option of removal is selected Dismantling technical facilities accompanying the construction of the Pipeline
Unplanned Events	Possibility of accidents and accidental bursts of pollution Increased risk of fire

11.6.2 Defining Receptor Sensitivity

As noted in **Chapter 3 Impact Assessment Methodology**, receptor sensitivity is a combination of receptor 'resilience' (i.e. its vulnerability) and its 'value'. There are no universal and standardised methodologies for assigning resilience and value to ecological receptors. This is partly due to the very large number of factors that can influence any assessment. Within this chapter, the sensitivity of habitats and species has been assessed using surrogate measures of sensitivity that combine elements of both resilience and value.

For species, sensitivity has been defined according to conservation status within the IUCN RL, RDB RF and RDB KK. This is based on the assumption that a species with increased extinction risk is likely to have inherently lower resilience to a range of stressors. This is not an assessment of resilience to Project specific impacts, as these are considered within the impact assessment itself. The level of rarity of a species is a significant part of the assessment of extinction risk. Rarity is also a key factor in assigning value to a species, as partially demonstrated by its degree of protection through legal instruments, either at international, national or regional levels. This is the case in Russia, where wildlife protection legislation is driven by RDB status, either at local or national level. Table 11.22 presents the derived scale of species sensitivity.

Habitat sensitivity has been defined on the level of naturalness of a particular habitat (Table 11.21). This is based on the general relationship between naturalness and value, with natural pristine habitats valued higher than modified and artificial habitats. It can also be argued that natural habitats are less resilient than artificial habitats as they are often easier to damage and harder to restore than habitats that are already modified to some extent. This is reflected within IFC PS6 which distinguishes between natural and modified habitats. It is also partially reflected by protective legislation, which tends to apply to areas of natural habitat.

The concept of 'critical habitat' according to the IFC PS6 is not incorporated as a separate element into the determination of habitat sensitivity. This is due to the definition of critical habitat deriving from a number of different criteria that depend on both species and habitat criteria which do not fully align with the hierarchy of 'high, moderate and low' sensitivity used within this chapter. The definition of critical habitat and compliance with IFC PS6 is therefore considered as a separate, but parallel, procedure. A separate critical habitat assessment has been undertaken and is presented in Appendix 11.1. Notwithstanding this, where relevant, individual receptors are identified as being component of critical habitat within the chapter. Impacts on such receptors are also highlighted in relation to IFC PS6. For such receptors, mitigation proposals have been formulated in the context of IFC PS6 requirements. The chapter also presents a summary that demonstrates to what extent IFC PS6 requirements are complied with, following the implementation of appropriate mitigation measures.

Table 11.21 Defining Habitat Receptor Sensitivity

Sensitivity and Value	Description	Applicable Standards
High (D)	An area which has designated conservation status categories Ia to IV under the IUCN Classification. Sites designated as Specially Protected Natural Areas (SPNAs).	Russian: Habitats designated under Russian law on "On Specially Protected Natural Areas" No. 33-FZ
Moderate (C)	A site or habitat that has designated conservation status at a National scale. Undesignated habitats which are unmodified by human activity and comprise native species forming assemblages consistent with the prevailing environmental conditions (Natural habitats according to IFC PS6)	None applicable
Low (B)	Habitats occurring outside of any designation which are subject to active management or alteration through human activity, but with an assemblage of species which is predominantly native in origin (Modified Habitats according to IFC PS6).	None applicable
Negligible (A)	Habitats which are either appreciably degraded/disturbed by human activity or have high proportions of invasive/non-native species (Modified Habitats according to IFC PS6).	None applicable

Table 11.22 Defining Species Receptor Sensitivity

Sensitivity and Value	Description	Applicable Standards
High (D)	A species assessed as Endangered or Critically Endangered either at an international or national level.	Russian: Government Enactment 'On the Red Data Book of the Russian Federation' (Ref. 11.26)
Moderate (C)	A species assessed as Vulnerable either at an international or national level. A species assessed as Vulnerable or Endangered at a regional level	Russian: Government Enactment 'On the Red Data Book of the Russian Federation' (Ref. 11.26) The Decree of the Head of the Administration for Krasnodar Krai, 'On the Red Data Book of Krasnodar Krai', dated 21.12.2010 No.1202 (Ref. 11.30)
Low (B)	A species assessed at 'Near Threatened' internationally. A species assessed as rare at a National or Regional level.	Government Enactment 'On the Red Data Book of the Russian Federation' (Ref. 11.26) The Decree of the Head of the Administration for Krasnodar Krai, 'On the Red Data Book of Krasnodar Krai', dated 21.12.2010 No.1202 (Ref. 11.26)
Negligible (A)	Non- red list species	None applicable

11.6.3 Defining Impact Magnitude

The key potential impacts associated with the Project that have been considered in this chapter are:

- Direct land take, temporary (during Construction Phase) and permanent (during Construction and Operational Phases), resulting in loss or fragmentation of habitats;
- Direct impacts on protected species;
- Indirect noise, vibration and visual disturbance;
- Changes in air quality due to dust generation, site plant emissions and road traffic;
- Changes in hydrology due to changes in drainage regime;
- Increased risk of pollution; and
- Changes in floristic assemblages following completion of construction.

The frameworks for defining the magnitude of impacts on habitats and species are presented in Table 11.23 and Table 11.24 respectively.

Table 11.23 Impact Magnitude - Habitats

Magnitude	Description
High (4)	The impact has the potential to adversely affect the integrity of an area/region, by substantially changing in the long term its ecological features, structures and functions, across its whole area, that enable it to sustain the habitat, complex of habitats and/or population levels of species that makes it important.
Moderate (3)	The area/region's integrity is predicted to not be adversely affected in the long term, but the project is likely to affect some, if not all, of the area's ecological features, structures and functions in the short or medium term. The area/region may be able to recover through natural regeneration and restoration.
Low (2)	Neither of the above applies, but some minor impacts of limited extent, or to some elements of the area, are evident but easy to recover through natural regeneration.
Negligible (1)	Indiscernible from natural variability.

Table 11.24 Impact Magnitude – Species

Magnitude	Description
High (4)	Impact on a species that affects an entire population to cause a decline in abundance and/or change in distribution beyond which natural recruitment (reproduction, immigration from unaffected areas) would not return that population or species, or any population or species dependent upon it, to its former level within several generations6, or when there is no possibility of recovery.
Moderate (3)	Impact affects a portion of a population and may bring about a change in abundance and/or a reduction in the distribution over one or more generations*, but does not threaten the long-term integrity of that population or any population dependent on it. The size and cumulative character of the consequence is also important. A moderate magnitude impact multiplied over a wide area would be regarded as a high magnitude impact.
Low (2)	A low magnitude impact on a species affects a specific group of localized individuals within a population over a short time period (one generation or less), but does not affect other tropic levels or the population itself.
Negligible (1)	Indiscernible from natural variability.

[6] These are generations of the animal / plant species under consideration not human generations

11.6.4 Determining Impact Significance

As outlined in **Chapter 3 Impact Assessment Methodology** of this ESIA Report, the significance of an impact on a receptor is determined as a relationship between the sensitivity of the receptor and the magnitude of the predicted impact. The relationship between receptor sensitivity and impact magnitude, along with the resultant significance of an impact (beneficial or adverse) is presented in Table 11.25 below.

Table 11.25 Impacts Significance Matrix

		Receptor Sensitivity (Vulnerability and Value)			
		Negligible	***Low***	***Moderate***	***High***
Impact Magnitude (Extent, Frequency, Reversibility, Duration)	***Negligible***	Not significant	Not significant	Not significant	Not significant/Low*
	Low	Not significant	Low	Low/Moderate†	Moderate
	Moderate	Not significant	Low/Moderate	Moderate	High
	High	Low	Moderate	High	High

* Allows technical discipline author to decide if impact significance is Not Significant or Low.
† Allows technical discipline author to decide if impact significance is Low or Moderate.

11.6.5 Applicable Standards

The terrestrial ecology assessment has considered relevant Russian federal (national) and regional legislation, applicable standards and guidelines for international finance, and international agreements to which the Russian Federation is a signatory. All applicable standards relevant to the ESIA are presented in **Chapter 2 Policy, Regulatory, and Administrative Framework**, with those of particular relevance to ecology and biodiversity summarised below.

Federal and Regional Legislation

Table 11.26 presents the federal laws of the Russian Federation which are applicable to biodiversity and conservation.

Table 11.26 Russian Federal Legislation Relevant to Biodiversity and Conservation

Legislation	Date and Reference Number	Relevance to Project
Federal Law 'On Environmental Protection' (Ref. 11.24)	10.01.2002, No. 7-FZ	This is the overarching law on environmental protection. This law states that an environmental review will be undertaken to verify that Project documentation complies with environmental requirements set by the technical regulations and environmental legislation preventing activities that could cause adverse environmental impact.
Federal Law 'On Wildlife' (Ref. 11.7)	24.04.1995, no. 52-FZ	This law regulates wildlife protection, as well as, conservation and restoration of wild habitats. It promotes the conservation of biodiversity, sustainable use of all the wildlife components, creation of conditions for sustainable livelihood, conservation of generic resources of wild animals and other protection of wildlife as an integral element of the natural environment.
Federal Law 'On Specially Protected Natural Areas' (Ref. 11.25)	14.03.1995, no. 33-FZ	This law establishes a system of specially protected natural areas, specifies conditions of their use and protection of natural resources. The protected area 'Utrish' is located approximately 4 km south-east of the landfall and offshore section of the Project.
Forest Code of the Russian Federation (Ref. 11.13)	04.12.2006, No. 200-FZ	The Forest Code establishes the regulatory basis of efficient use, protection, security and reproduction of forests, as well as increasing their environmental and resource potential.

Other national legislation relevant to biodiversity and the ESIA includes:

- Government Enactment 'On the Red Data Book of the Russian Federation' (Ref. 11.26);
- Government Enactment 'On measures for enforcement of obligations arising from the Conservation on the Wetlands of International Importance (Especially as Wildlife Habitats dated 02.02.1971)' (No. 1050 of 13.09.1994) (Ref. 11.27);
- Government Enactment 'On the adoption of requirements for the prevention of wildlife loss' (No.997 of 13.08.1996) (Ref. 11.28) This enactment sets out requirements to regulate operating activities in order to manage and prevent loss of wildlife species and habitats (as a result of changing habitat and migration paths). It covers: water intake facilities; production equipment units; mobile transport and agricultural machines; construction of production and other facilities; extraction, processing and transportation of raw materials; and technological processes of cattle breeding and plant growing; and
- Order 'On the adoption of rules of using forests for construction, upgrade and operation of line facilities' (Ref. 11.29).

The ESIA takes account of Krasnodar regional legislation, including Krasnodar Region Laws such as the Decree of the Head of the Administration for Krasnodar Krai, 'On the Red Data Book of Krasnodar Krai', dated 21.12.2010 No.1202 (Ref. 11.30) which outlines protection principles for the Red Data Book of Krasnodar Krai, as well as, its contents, the procedure for keeping records and the protection categories of the listed species.

International Financial Institution standards and guidance

The Project is undertaken in accordance with the standards and guidelines of relevant International Financial Institutions, including the IFC Performance Standards (PS) (Ref. 11.11), Equator Principles (Ref. 11.31) and OECD Common Approaches (Ref. 11.32). However the IFC PS, including IFC PS6 Biodiversity Conservation and Sustainable Management of Living Natural Resources, sets out an approach to protect and conserve biodiversity including habitats, species and communities, ecosystem diversity, and genes and genomes, all of which have potential social, economic, cultural and scientific importance. It also sets out definitions of natural, modified and critical habitat types, stating that there should be no net loss of biodiversity in natural habitats. In critical habitat, mitigation measures should result in a net gain of those biodiversity values for which the critical habitat was designated. Such measures should be described in a Biodiversity Action Plan (BAP).

International Agreements

The Russian Federation is a signatory of the following conventions of relevance to biodiversity and conservation:

- Convention on Biological Diversity, 1992 (Ref. 11.33) - The Convention promotes conservation of biological diversity and sustainable use of its components, and the Project Pipeline corridor and temporary facilities will affect habitats; and
- Convention on Wetlands of International Importance, especially as Waterfowl Habitat (Ramsar), 1971 (Ref. 11.34) - The Ramsar Convention promotes the importance of the ecological functions of wetlands, and the Project onshore facilities may impact on wetlands.

11.6.6 Ecology Receptor Identification and Sensitivity

The section below identifies the receptors within the Wider Study Area to be included in the impact assessment and discusses their sensitivity in line with the criteria presented in Section 11.6.2 above.

11.6.6.1 Designated Sites

Utrish SPNA

Utrish is a statutory protected site which is designated for its conservation and biodiversity value. The site is known to contain a wide range of red list species and habitats which are notable at the regional, national, and international level. It is also considered to be of particular importance to Nikolski's tortoise. The site is therefore assessed as being of high sensitivity.

Protective Forest Areas

The areas designated as 'protective forest' include areas of shiblyak woodland, mesophilic forest, and juniper woodland. These areas of habitat have been assigned sensitivity individually in Table 11.27 below.

11.6.6.2 Habitats and Flora

Habitats

Table 11.27 describes each habitat type in relation to the criteria used to determine sensitivity for habitats.

Table 11.27 Habitat Sensitivity Appraisal

Habitat Type	Evaluation
Shiblyak Juniper woodland	Designation These habitats are defined as a 'Protective Forest' under the Forest Code of Russia. Naturalness The habitat is largely natural with relatively little evidence of artificial disturbance or anthropogenic transformation. Sensitivity This habitat is assessed as being of moderate sensitivity.
Mesophilic forest	Designation These habitats are defined as a 'Protective Forest' under the Forest Code of Russia. Naturalness The habitat is largely natural with relatively little evidence of artificial disturbance or anthropogenic transformation. Sensitivity This habitat is assessed as being of moderate sensitivity. This habitat fulfils critical habitat criteria (see Appendix 11.1).

Continued...

Habitat Type	Evaluation
Steppefied secondary meadow	Designations This habitat type receives no formal designation or statutory protection. Naturalness The habitat has been subject to modification in the past although the habitat is now reverting to a more natural state. Sensitivity The habitat receives no formal designation and has been subject to a degree of human modification in the past, although it is recovering. It is however not considered pristine habitat. The habitat is therefore assessed as being of low sensitivity.
Mesophilic meadow	Designation This habitat type receives no formal designation or statutory protection. Naturalness The habitat is largely natural with relatively little evidence of artificial disturbance or anthropogenic transformation. Sensitivity This habitat is assessed as being of moderate sensitivity.
Tomillyar	Designation This habitat type receives no formal designation or statutory protection. Naturalness The habitat is largely natural with relatively little evidence of artificial disturbance or anthropogenic transformation. Sensitivity This habitat is assessed as being of moderate sensitivity. This habitat fulfils critical habitat criteria (see Appendix 11.1).
Rocky outcrops	Designation This habitat type receives no formal designation or statutory protection. Naturalness The habitat is largely natural with relatively little evidence of artificial disturbance or anthropogenic transformation. Sensitivity This habitat is assessed as being of moderate sensitivity.

Continued…

Habitat Type	Evaluation
Coastal shingle	Designation This habitat type receives no formal designation or statutory protection. Naturalness The habitat is largely natural with relatively little evidence of artificial disturbance or anthropogenic transformation. Sensitivity This habitat is assessed as being of moderate sensitivity.
Urban and agricultural habitats	Designation This habitat type receives no formal designation or statutory protection. Naturalness These habitats have been altered through human activity and are considered to be significantly altered from their original state. Sensitivity This habitat is assessed as being of negligible sensitivity.
Running Water	Designation This habitat type receives no formal designation or statutory protection. Naturalness The habitat is largely natural with relatively little evidence of artificial disturbance or anthropogenic transformation. Sensitivity This habitat is assessed as being of moderate sensitivity.

Complete.

Urban and agricultural habitats are assessed as being of negligible sensitivity. These habitats are therefore considered to be of insufficient ecological value to warrant further consideration in the impact assessment. These habitat types are therefore not discussed further within this assessment.

Flora

The species listed below have been recorded within the Study Area during field survey (Table 11.28).

Table 11.28 Flora Sensitivity Appraisal

Name of Species	Conservation Status			Sensitivity
	IUCN	*RDB RF*	*RDB KK*	
Fern-leaved speedwell	Not assessed	1	1	High and fulfils critical habitat criteria (Appendix 11.1)
Pyramidal orchid	Not assessed	3	2	Moderate
Colchicum umbrosum	Not assessed	2	2	Moderate
Siderites euxina	Not assessed	Not listed	2	Moderate
Etruscan honeysuckle	Not assessed	3	1	Moderate
Phlomis taurica	Not assessed	Not listed	2	Moderate
Dwarf flag iris	Not assessed	3	2	Moderate
Sea kale	Not assessed	Not listed	2	Moderate
Bladdernut	Not assessed	3	2	Moderate
Golden feather grass	Not assessed	3	2	Moderate
Campanula komarovii	Not assessed	3	2	Moderate
Linum hirsutum	Not assessed	Not listed	2	Moderate
Stinking juniper	Least Concern	2	1	Moderate
Greek juniper	Least Concern	2	1	Moderate
Jurinea stoechaedifolia	Not assessed	Not listed	2	Moderate
Goldendrop	Not assessed	3	2	Moderate
Paeonia caucasica	Not assessed	3	2	Moderate
Red helleborine	Not assessed	3	2	Moderate
Chamaecytisus wulffii	Not assessed	Not listed	2	Moderate

Continued…

Name of Species	Conservation Status			Sensitivity
Rindera tetraspis	Not assessed	Not listed	1	Moderate and fulfils critical habitat criteria (Appendix 11.1)
Fibigia eriocarpa	Not assessed	Not listed	2	Moderate
Mt. Atlas mastic tree	Not assessed	3	1	Moderate
Salvia ringens	Not assessed	Not listed	2	Moderate
Early purple orchid	Not assessed	3	2	Moderate
Monkey orchid	Not assessed	3	2	Moderate
Astragalus subuliformis	Not assessed	Not listed	3	Low
All other plants	LC / Not assessed	Not listed	Not listed	Low

Complete.

11.6.6.3 Fauna

Invertebrates

A notable assemblage of red list invertebrate species is potentially present within the Study Area. This includes 10 species likely to occur within the mesophilic forest, 20 within the areas of meadow habitat and one near riparian and aquatic environments (Table 11.28 above and Table 11.29 below for further detail).

Table 11.29 Invertebrate Sensitivity Appraisal

Species	IUCN	RDB RF	RDB KK	Sensitivity
Beetles – Coleoptera				
Ground beetle sp. *Carabus caucasicus*	Not assessed	2	2	Moderate
Greater capricorn beetle	VU	Not listed	7	Moderate
Cerambyx nodulosus	Not assessed	2	2	Moderate

Continued...

Species	IUCN	RDB RF	RDB KK	Sensitivity
Rosalia longicorn	VU	2	2	Moderate
Flower beetle	Not assessed	Not listed	2	Moderate
Jewel beetle	Not assessed	Not listed	2	Moderate
Stag beetle	Not assessed	2	7	Moderate
Necydalis ulmi	Not assessed	Not listed	3	Low
Forest caterpillar hunter	Not assessed	2	7	Moderate
Chrysochares asiaticus	Not assessed	Not listed	3	Low
Weevil sp. *Lixus canescens*	Not assessed	Not listed	1B	Moderate
Moths and Butterflies – Lepidoptera				
Yellow-banded skipper	Not assessed	Not listed	1B	Moderate
Levantine skipper	Not assessed	Not listed	1B	Moderate and fulfils critical habitat criteria (Appendix 11.1)
Tesselated skipper	Not assessed	Not listed	2	Moderate
Southern festoon	Not assessed	Not listed	2	Moderate
Caucasian spring copper	Not assessed	Not listed	2	Moderate
Eastern baton blue	Not assessed	Not listed	2	Moderate

Continued...

Species	IUCN	RDB RF	RDB KK	Sensitivity
Zephyr blue ssp	Not assessed	Not listed	2	Moderate
Dalmatian ringlet	Not assessed	Not listed	2	Moderate
Large blue	NT	Not listed	2	Moderate
Clouded Apollo	Not assessed	2	7	Moderate
Moth sp. *Jordanita chloros*	Not assessed	Not listed	1B	Moderate
Moth sp. *Lemonia ballioni*	Not assessed	Not listed	1B	Moderate
Feathered footman	Not assessed	Not listed	3	Low
Brown tiger moth	Not assessed	Not listed	5	Low
Purple tiger moth	Not assessed	Not listed	3	Low
Death's-head hawkmoth	Not assessed	Not listed	3	Low
Bees and Wasps – Hymenoptera				
Bee sp. *Bombus zonatus*	Not assessed	Not listed	2	Moderate
Carpenter bee sp. *Xylocopa valga*	Not assessed	2	7	Moderate
Solitary wasp sp. *Scolia hirta*	Not assessed	Not listed	7	Low
Solitary wasp sp. *Scolia maculate*	Not assessed	Not listed	7	Low

Continued...

Species	IUCN	RDB RF	RDB KK	Sensitivity
Other: Leaf Hoppers Hemiptera, Flies Diptera, Crickets Orthoptera, Mantids Mantidae, and Dragonflies Odonta				
Leafhopper sp. *Fieberiella lugubris*	Not assessed	Not listed	3	Low
Fly sp. *Neorhynchocephalus tauscheri*	Not assessed	Not listed	2	Moderate
Predatory bush cricket	VU	2	7	Moderate
Leafhopper sp. *Liguropia juniper*	Not assessed	Not listed	3	Low
Blue emperor dragonfly	LC	2	7	Moderate
Mantis sp. *Empusa fasciata*	Not assessed	Not listed	2	Moderate
Mantis sp. *Bolivaria brachyptera*	Not assessed	Not listed	7	Low

Complete.

Herpetofauna

Five amphibian and seventeen species of reptile have been recorded or are potentially present within the Study Area. This includes four species which are listed as threatened on the IUCN RL, RDB RF and / or RDB KK (Table 11.30).

Table 11.30 Sensitivity of Herpetofauna

Name of Species	Conservation Status			Sensitivity
	IUCN	RDB RF	RDB KK	
Caucasian toad	NT	2	7	Moderate
Nikolski's tortoise	VU	1	1B, EN	High and fulfils critical habitat criteria (Appendix 11.1)
European glass Lizard	Not assessed	Not listed	1B, EN	Moderate
Aesculapian ratsnake	LC	2	2	Moderate

Continued…

Name of Species	Conservation Status			Sensitivity
	IUCN	RDB RF	RDB KK	
Combined reptile and amphibian assemblage (all other species)	Not Listed			Low

Complete.

Fish

None of the fish present within the Study Area are listed as species of conservation concern on the IUCN RL, RDB RF, or RDB KK. Individuals and the freshwater fish assemblage present within the Study Area are therefore assessed as being of negligible sensitivity and are considered to be of insufficient ecological value to warrant further consideration in the impact assessment.

Birds

Breeding Birds

Seven of the bird species that are considered to have bred within the Study Area are red list species (Table 11.31). In addition, a further five species are listed on appendix 3 of the RDBKK, which are species that are recommended for further research in the region. The sensitivity of the latter species are not assessed individually, but included as part of the breeding bird assemblage. The combined breeding bird assemblage largely consists of a wide range of common and ubiquitous species which are typical for the habitats present in the Project Area. This combined assemblage is assessed as being of low sensitivity.

Non-breeding Migratory and Overwintering Birds

Five non-breeding migrants of conservation concern were recorded flying over the Study Area; however, the Project Area does not contain habitats that would support significant aggregations of red list migratory bird species. In addition, the Project Area is not identified as a bottleneck migration site or a significant stop over site. It is not anticipated that the Project will result in a direct or indirect impact on migratory bird species of ecological importance and these are not considered further in this assessment.

The wintering bird assemblage supported by the terrestrial habitats of the Study Area consists of widespread and ubiquitous species of passerine birds. The terrestrial habitats of the Study Area does not offer suitable foraging or nesting opportunities for large aggregations of wintering birds and therefore impacts on wintering bird species within the Study Area are not considered further.

Table 11.31 Sensitivities of Birds

Name of Species	Conservation Status			Sensitivity
	IUCN	RDB RF	RDB KK	
Breeding				
Wood lark	LC	Not Listed	1B	Moderate
Short-toed snake-eagle	LC	2	1A	Moderate
Booted eagle	LC	App 2	1B	Moderate
Red-footed falcon	NT	App 2	App 3	Low
Rufous-tailed rock-thrush	LC	Not Listed	2	Moderate
Peregrine falcon	LC	2	7	Moderate
European roller	NT	Not listed	Not Listed	Low
Combined breeding bird assemblage	LC / Not assessed	Not listed	Not listed	Low
Migratory				
Negligible				
Wintering				
Negligible				

Terrestrial Mammals

Thirteen species of red list mammal species are potentially present within the Study Area. This includes five species which are listed as threatened on the IUCN RL, RDB RF and / or RDB KK (Table 11.32).

Table 11.32 Sensitivity of Mammals

Species	Conservation Status			Sensitivity
	IUCN	RDB RF	RDB KK	
Lesser mouse-eared bat	LC	2	7	Moderate
Barbastelle	NT	Not listed	2	Moderate
Pond bat	NT	Not listed	2	Moderate
Bechstein's bat	NT		2	Moderate
Lesser noctule	LC		2	Moderate
Lesser horseshoe bat	LC	3	3	Low
Natterer's bat	LC	Not listed	3	Low
Whiskered bat	LC	Not listed	3	Low
Steppe whiskered bat	LC	Not listed	5	Low
Brandt's bat	LC	Not listed	7	Low
Savi's pipistrelle	LC	Not listed	5	Low
Giant noctule	NT	Not listed	3	Low
Caucasian wildcat	LC	3	7	Low
All other mammals	LC / Not assessed	Not listed	Not listed	Low

11.6.7 Assessment of Potential Impacts: Design and Development

Geotechnical surveys were undertaken in 2012 to inform the design and layout of the Project. Some geotechnical surveys were undertaken along a section of the sea cliff, located to the west of the proposed microtunnel entry shafts. The surveys were undertaken in compliance with Russian regulations.

To facilitate the geotechnical surveys, four strips, each approximately 4 m wide and 120 m long, were cleared of vegetation from the top of the cliff, down the western face and to the shoreline. Various access roads and drill pads were also constructed to facilitate access for the geotechnical surveys.

The drill pads and their associated access roads were constructed within areas of shiblyak (largely within the drill pad access road areas), juniper woodland and tomillyar habitats (located along the top of the cliff).

The impact of the site preparation works for the design and development works resulted in loss of natural terrestrial habitat along the cliff tops as well as down the cliff itself. Additional habitats were removed to accommodate the drill pads and associated roads. The total area of habitat lost was approximately 0.39 ha of shiblyak, 0.03 ha of tomillyar and 0.32 ha of juniper woodland. In addition to the loss of habitat, the access track is being used by people to access the area. During a site visit made in September 2013, signs of fly tipping and fire lighting were evident. Increased access could also lead to increased disturbance of threatened species.

It was agreed with the Forestry Department that the main access track up to the cliff top will not be reinstated as this track will be used by the Forestry Department for forestry maintenance works. Due to the presence of habitats of a moderate sensitivity, and presence of flora species of up to high sensitivity (including fern-leaved speedwell and *Rindera tetrapsis*), the impact within this area could be of up to high adverse significance in the absence of any mitigation or successful reinstatement of lost or damaged habitats.

In order to mitigate for these impacts, a re-instatement plan has been devised to mitigate for the impact of the geotechnical works. This mitigation has been incorporated in to a Cliff Area Habitat Reinstatement Plan which is included in Appendix 11.2. All works stipulated in this plan will be completed by the client and the works will result in the re-establishment of a significant proportion of the original habitats, both through planting and natural re-colonisation. The Cliff Area Habitat Reinstatement Plan will be implemented as part of the BAP.

As tomillyar, fern-leaved speedwell and *Rindera tetrapsis* confer critical habitat status, a BAP will be developed to deliver net gains in these biodiversity features. The BAP will provide a robust long-term biodiversity monitoring and evaluation programme as well as engagement with relevant stakeholders.

Taking in to consideration the planned reinstatement works and monitoring plan (refer to Appendix 11.2) it is likely that the residual impacts of the design and development works within the cliff area will be of no more than **Low** adverse significance. Any impact on tomillyar or the populations of fern-leaved speedwell and Rindera tetrapsis would constitute an effect on critical habitat (see Appendix 11.1). However, following implementation of the Cliff Area Habitat Reinstatement Plan, it is considered that there would be no net loss of these components.

11.6.8 Assessment of Potential Impacts: Construction and Pre-Commissioning

This section presents and discusses the impacts and mitigation measures of the Construction and Pre-Commissioning Phase of the Project on the identified terrestrial ecology receptors within the Study Area (see Section 11.6.6). The Project has been designed to reduce a number of impacts at source. Design measures have been incorporated to reduce the potential impacts from a given Project activity. Potential Construction and Pre-Commissioning Phase impacts are assessed on this basis. Additional mitigation and monitoring measures are then identified that can further reduce impacts, and the residual impact is identified.

Design measures are presented in **Chapter 5 Project Description.** Those of particular relevance to terrestrial ecology include the following:

- Microtunnelling below the Shingar River;
- Drainage to manage surface run-off, which will be constructed along access roads and at the landfall facilities;
- The use of geotextiles in the construction of permanent and temporary access roads;
- Stripping and stockpiling topsoil (stockpiles will normally be less than 2 m in height) for later use during reinstatement;
- Backfilling of trenches, which will normally occur immediately after the Pipeline has been lowered;
- Reinstatement of the Pipeline corridor, which will include restoration of original land contours as closely as possible, except grading of slopes at the Graphova Gap to manage slope stability;
- Dedicated mobile plant and refuelling areas. Fuel storage tanks will be double-walled. Secondary containment by bunding will surround the tanks;
- Provision of wastewater collection systems and offsite disposal by licensed waste management operators; and
- Chemical storage areas, which will be constructed on hard standing with bunding.

11.6.8.1 Designated Sites

Project activities have the potential to affect designated sites directly (through land-take, whether temporary or permanent) and / or indirectly (through degradation due to changes in air quality, introduction of pollutants (aerial or otherwise), invasive species and potentially damage due to fire).

Utrish SPNA

Utrish SPNA is located approximately 3.8 km to the south of the landfall section. Land-take within the SPNA will therefore not occur. Due to the distance between the site and construction activities, damage or degradation to the SPNA due to dust is not anticipated. The potential for NOx and SO_2 to degrade the habitats contained within the Utrish (predominantly the forest habitats) has been considered. Air quality modelling has determined that, during the course of construction, the change in the atmospheric concentrations of NOx and SO_2 within the vicinity of the SPNA will be minimal (a change of less than approximately two percent, when compared to the relevant criteria / standards) (see **Chapter 9 Air Quality**). Furthermore, considering that the impact will last only for the duration of construction (approximately 1 year), and will cease following completion of construction, changes in NOx and SO_2 concentrations are unlikely to affect the habitats contained within the Utrish SPNA. In the absence of mitigation, the impact is assessed as being of negligible magnitude resulting in a **Not Significant** effect.

In the absence of appropriate controls, there is the potential for the introduction of invasive fauna and flora during construction. Invasive species have the potential to significantly alter the ecology of the SPNA and affect its overall integrity in the long term. Although of a relatively low probability, it is potentially a high magnitude impact on a receptor of high sensitivity resulting in an effect of **High** significance.

Protective Forests

The assessment for the areas of habitat within the Study Area designated as 'protective forest' are considered in the relevant habitat sections below (see assessments for shiblyak, mesophilic forest and juniper woodland).

11.6.8.2 Habitats and Flora

Habitats

Direct impacts due to landtake will occur within the juniper woodland, mesophilic forest, shiblyak, and secondary steppefied meadow all of which fall within the Project's construction corridor. Table 11.33 presents the area of each habitat that will be removed during construction.

In addition to the above, there is the potential for indirect effects due to changes in air quality, introduction of pollutants (aerial or otherwise) and invasive species.

Table 11.33 Direct Habitat loss within the Study Area

Habitat Type	Area of Habitat Within the Study Area Subject to Habitat Loss (ha)
Juniper woodlands	2.6
Mesophilic forest	1.4
Steppefied secondary meadow	4.1
Shiblyak	3.5
Rocky outcrops	0
Mesophilic meadow	0
Tomillyar	0
Coastal shingle	0

Juniper Woodland

Approximately 2.6 ha of juniper woodland will be cleared during construction. Approximately 1.9 ha of this loss will be permanent due to the requirement for a permanent RoW along the Pipeline route. The remaining 0.7 ha has the potential to be reinstated post-construction although the habitat would be likely to only return to its pre-clearance state in the long term (20 years or more).

The loss of 2.6 ha constitutes approximately 4.6 percent of the juniper woodland within the Study Area. The loss of this woodland is unlikely to affect the ability of this habitat type to persist within the region. The impact is assessed as being of a moderate adverse magnitude on a receptor of moderate sensitivity resulting in **Moderate** significance effect.

There is the potential for degradation to juniper woodland (which has not already been affected by land take) due to dust and adverse changes in air quality. The impact on vegetation will be temporary (lasting for approximately one year) and for this reason is unlikely to alter the structure or composition of affected juniper woodland in the long term (see **Chapter 9 Air Quality**). The impact is assessed as a low magnitude impact resulting in an effect of **Low** significance.

There is the potential for the introduction of invasive fauna and / or flora during construction. Invasive species have the potential to significantly alter the ecology of juniper woodland and affect its overall integrity in the long term. Although of a relatively low probability, it is potentially a high magnitude impact on a receptor of moderate sensitivity resulting in an effect of **High** significance.

Mesophilic Forest

Approximately 1.4 ha of mesophilic forest will be cleared during construction. Approximately 0.8 ha of this loss will be permanent while the remaining 0.7 ha has the potential to be reinstated post-construction. As with juniper woodland, this would likely only occur in the long term. The loss of this habitat is also likely to fragment remaining mesophilic woodland habitat to the north and south within the Graphova Gap.

The proportion of mesophilic forest directly affected is approximately 2.2 percent of this habitat type recorded within the Study Area. The loss of a relatively small proportion of this woodland is unlikely to affect the ability of this habitat type to persist within the region.

In the absence of mitigation, the impact is assessed as being of a moderate adverse magnitude on a receptor of moderate sensitivity resulting in an effect of **Moderate** significance.

There is the potential for degradation to mesophilic woodland (which has not already been affected by land take) due to dust and adverse changes in air quality. The impact on vegetation will be temporary (lasting for approximately one year) and for this reason is unlikely to alter the structure or composition of affected mesophilic forest in the long term (see **Chapter 9 Air Quality**). The impact is assessed as a low magnitude impact resulting in an effect of **Low** significance.

There is the potential for the introduction of invasive fauna and / or flora during construction. Invasive species have the potential to significantly alter the ecology of mesophilic forest and affect its overall integrity in the long term. Although of a relatively low probability, it is potentially a high magnitude impact on a receptor of moderate sensitivity resulting in an effect of **High** significance.

The impact on mesophilic forest constitutes an effect on critical habitat (see Appendix 11.1)

Shiblyak

Approximately 3.5 ha of shiblyak will be cleared during construction. Approximately 2.4 ha of this loss will be permanent due to the requirement for a permanent RoW. The remaining 1.1 ha has the potential to be reinstated post-construction although, as with juniper woodland, the habitat would only return to its pre-clearance state in the long term.

The proportion of shiblyak directly affected is approximately 0.8 percent of the habitat type recorded within the Study Area. The relatively small loss of this woodland is unlikely to affect the ability of this habitat type to persist within the region. In the absence of mitigation, the impact is assessed as being of a moderate adverse magnitude on a receptor of moderate sensitivity resulting in an effect of **Moderate** significance.

There is the potential for degradation to shiblyak (which has not already been affected by land take) due to dust and adverse changes in air quality. The impact on vegetation will be temporary (lasting for approximately one year) and for this reason is unlikely to alter the structure or composition of affected shiblyak in the long term (see **Chapter 9 Air Quality**). The impact is assessed as a low magnitude impact resulting in an effect of **Low** significance.

There is the potential for the introduction of invasive fauna and / or flora during construction. Invasive species have the potential to significantly alter the ecology of shiblyak and affect its overall integrity in the long term. Although of a relatively low probability, it is potentially a high magnitude impact on a receptor of moderate sensitivity resulting in an effect of **High** significance.

Secondary Steppefied Meadow

Approximately 4.1 ha of secondary steppefied meadow will be cleared during construction. This includes permanent habitat loss along the Pipeline RoW, and temporary loss associated with the construction of the temporary access roads. There is therefore the potential for the majority of this habitat to be reinstated and a large proportion of the loss (up to 90% of the cleared habitat) is therefore considered to be in the short term (within 1 – 2 years following completion of construction).

The loss of approximately 3.7 percent of the habitat within the Study Area is therefore assessed as being an impact of low adverse magnitude on a receptor of low sensitivity. This equates to an effect of **Low** significance.

There is the potential for degradation to other habitats due to dust and adverse changes in air quality. The impact on vegetation will be temporary (lasting only for the duration of construction). It is therefore unlikely that the structure or composition of these habitats will be affected in the long term. The impact is assessed as a low magnitude impact resulting in an effect of **Low** adverse significance.

There is the potential for the introduction of invasive fauna and / or flora during construction. Although of a relatively low probability, it is potentially a high magnitude impact on a receptor of low sensitivity resulting in an effect of moderate significance.

Tomillyar and Mesophilic Meadow

There is the potential for degradation to other habitats due to dust and adverse changes in air quality. The impact on vegetation will be temporary (lasting only for the duration of construction). It is therefore unlikely that the structure or composition of these habitats will be affected in the long term. The impact is assessed as a low magnitude impact resulting in an effect of **Low** adverse significance.

There is the potential for the introduction of invasive fauna and / or fauna during construction. Although of a relatively low probability, it is potentially a high magnitude impact on a receptor of moderate sensitivity resulting in an effect of **High** significance.

Running Water

The Pipeline crosses two watercourses (the Shingar River and an unnamed tributary of the Sukko) on one occasion each (please see Figure 11.7 for further detail). The effect of the Project on the soils and hydrological regime of these watercourses is discussed in **Chapter 8 Soil, Groundwater and Surface Water**.

The Shingar River will be crossed with the use of micro-tunnelling (see **Chapter 5 Project Description**) and impacts to this watercourse during its crossing are therefore anticipated to be limited. However, there is the potential for other construction activities within the RoW and at the microtunnel construction site to cause runoff and increased sediment to enter the watercourse. The impacts associated with construction in the catchments of the Shingar River are likely to be medium term and of moderate magnitude and **Moderate** significance prior to mitigation.

With regards the crossing of the unnamed tributary in the Graphova Gap, open cut trenching is proposed at this location. Open cut trenching across the river will temporarily alter the flow during the works at the crossing and potentially result in flows during a flood event being diverted onto the surrounding floodplain. Given the nature of the topography at the crossing site with relatively steep valley sides, the impacts on the flow regime are likely to be local to the crossing. The crossing may also affect the sediment load and quality of the water at the crossing and along the downstream stretch of the watercourse. It is anticipated that the construction be undertaken in the low rainfall season when there is little to no flow in the ephemeral watercourse, which will reduce the likelihood of impacts. However, based on the worst case assumption that there are flows in the watercourse due to rainfall at the time of crossing construction, the impacts on the tributary in the Graphova Gap are medium term and is of moderate magnitude and **Moderate** significance (see **Chapter 8 Soils, Groundwater and Surface Water**).

The proposed Gazprom Invest permanent access road route crosses the Graphova Gap. Depending on the timing of the construction works, there could be impacts on the surfacewater flow regime, water quality and the hydromorphology of the river channel. Construction details are not currently available; however, construction of the stream crossing could temporarily alter the flow route during the works and potentially result in flood flows being diverted onto the surrounding floodplain. Given the nature of the topography at the crossing site with relatively steep valley sides, the impacts on the flow regime are likely to be local to the crossing. The crossing may also affect the sediment load and quality of the river at the crossing and along the downstream stretch of the watercourse. The impacts of the construction works will be temporary and the watercourse will recover through natural processes. It is recommended that the construction be undertaken in low rainfall season when there is little to no flow in the ephemeral watercourse. Based on the worst case assumption that there are flows in the watercourse due to rainfall at the time of crossing construction, the impact on the tributary in the Graphova Gap is medium term and is of moderate magnitude and **Moderate** significance.

Flora

There is the potential for the direct loss and damage of flora of ecological value during the Construction Phase of the Project. There is also potential for indirect effects on to flora located adjacent to the construction corridor due to dust and other construction related emissions.

Of the 26 notable plant species recorded within the Study Area, four have been recorded within the Pipeline construction corridor: Greek juniper, stinking juniper, pyramidal orchid and Kavakh peony. These species have the potential to be directly affected during construction.

Greek and Stinking Juniper

Greek and stinking juniper have been recorded within the juniper woodland and shiblyak habitats that will be directly affected during construction. Approximately 2.6 ha of juniper woodland and 3.5 ha of shiblyak will be cleared, resulting in the loss of specimens within these areas.

As is discussed above, the proportion of juniper woodland and shiblyak habitat lost is approximately 4.6 percent and 0.8 percent of each resource within the Study Area, respectively. The loss of this amount of habitat is not considered of sufficient magnitude to significantly affect the persistence of these species within the local area (within the Wider Study Area).

Construction is therefore expected to have a localised direct long term impact on Greek and stinking juniper. This is assessed as an impact of moderate adverse magnitude on a receptor of moderate sensitivity resulting in an effect of **Moderate** significance.

There is potential for dust and adverse changes in air quality to damage or degrade Greek and stinking juniper (see **Chapter 9 Air Quality**). Based on the temporary nature of construction activities (approximately 1 year), it is not anticipated that dust and air quality impacts would significantly affect the ability of these species to persist within the affected habitats. The degraded habitats would also be likely to recover to their original state in the short term (1 - 2 years) following cessation of the impact. It is assessed as an impact of low adverse magnitude on receptors of moderate sensitivity resulting in an effect of **Low** significance.

Pyramidal Orchid, Campanula komorovii, Salvia ringens, and Linum hirsutum

Four RDB plant species have been recorded in meadow habitats either within or in close proximity to the construction area for the Varvarovka bypass road. Clearance of this habitat during construction could therefore result in the loss of individuals or possibly a sub-population of these species within the construction area. As discussed above, approximately 4.1 ha of secondary steppefied meadow will be temporarily lost during construction; approximately 3.7

percent of the resource within the Study Area. The loss of this amount of habitat is not considered of sufficient magnitude to significantly affect the persistence of this species within the local area (within approximately 15 km of the Pipeline).

In the absence of mitigation, construction is therefore expected to have a localised, direct impact on these species. The impact is however considered reversible within the short – medium term (2 – 3 years) as the secondary steppefied meadow habitats are reinstated. The impact is therefore assessed as being of up to moderate adverse magnitude on receptors of moderate sensitivity resulting in an effect of **Moderate** significance.

The species may also be affected by dust and changes in air quality (discussed above for Greek and stinking juniper). The impact is assessed as an impact of low adverse magnitude on receptors of moderate sensitivity resulting in an effect of **Low** significance.

Kavakh Peony

Kalakh peony was recorded within the mesophilic forest within the construction corridor of the Pipeline. Clearance of this habitat during construction will result in the loss of all specimens within the construction corridor.

The proportion of mesophilic forest which will be cleared is approximately 2.2 percent of the resource within the Study Area. The loss of this amount of habitat is not considered of sufficient magnitude to significantly affect the persistence of this species within the local area (within approximately 15 km of the Pipeline).

Construction is therefore expected to have a localised direct long term impact on Kavakh peony. This is assessed as an impact of moderate adverse magnitude on a receptor of moderate sensitivity resulting in an effect of **Moderate** significance.

The species may also be affected by dust and changes in air quality (discussed above for Greek and stinking juniper). The impact is assessed as an impact of low adverse magnitude on receptors of moderate sensitivity resulting in an effect of **Low** significance.

All Other Notable Flora

No other notable plant species were recorded within the construction corridor and they are therefore considered to be either absent from the zone of direct impact of the Project or present in very low numbers. It is therefore very unlikely that the Project would affect the integrity of the local population of these species.

Therefore, as a worst case assessment, construction could potentially have direct and long term impact on a small population of these species. This is assessed as an impact of low adverse magnitude on receptors of low to moderate sensitivity resulting in an effect of no more than **Moderate** significance.

These species may also be affected by dust and changes in air quality (discussed above for Greek and stinking juniper). The impact is assessed as an impact of low adverse magnitude on receptors of up to moderate sensitivity resulting in an effect of **Low** significance.

Any impact on fern-leaved speedwell and *Rindira tetraspis* would constitute an effect on critical habitat (see Appendix 11.1). However neither species have been recorded within the construction corridor. Both species appear to be restricted to the coastal cliffs which will be micro-tunneled and therefore no impacts to either species would occur.

11.6.8.3 Fauna

Invertebrates

The potential impact pathways to invertebrates may be direct or indirect. Direct impacts may occur due to loss and fragmentation of habitats, as well as changes in the character of habitats. Indirect impacts may occur due to a decrease in floral species diversity resulting in a decrease in food availability, light pollution from construction works or changes in air quality.

Invertebrates of ecological importance are potentially relatively abundant within the Study Area, comprising beetles (nine species), weevils (one species), moths and butterflies (14 species), bees and wasps (two species), leaf hoppers, flies (one species), crickets (one species), mantids (one species) and dragonflies (one species). The majority of these species are most likely to be found within areas of meadow and woodland habitats (including the steppefied and mesophilic meadow, mesophilic forest, juniper woodland, and shiblyak).

The loss of relatively small proportions of suitable invertebrate habitat contained within the Study Area (mesophilic forest (2.2 percent), shiblyak (0.9 percent), steppefied meadow (4.1 percent), juniper woods (4.6 percent) and no loss from within the mesophilic meadow, tomillyar, coastal shingle or residential / ruderal habitats) will be partially mitigated by the availability of similar habitat adjacent to the Pipeline route where land take will occur.

Degradation to adjacent habitats may occur as a result of light, dust and emission of air pollutants during construction. If left unmitigated, this could potentially result in larger areas of suitable invertebrate habitat being affected. However, this impact would be of short duration (restricted to approximately one year).

Considering the relatively limited extent of habitat loss, availability of other suitable habitat within the local area, the impact on invertebrates is assessed as being of low adverse magnitude. The effect of construction on invertebrates is assessed as considered to be of up to **Moderate** significance, due to the sensitivity of the receptor (up to moderate) and magnitude of the impact (adverse moderate).

Any impact on Levantine skipper populations would constitute an effect on critical habitat (see Appendix 11.1). This species is associated with dry open grassland habitats. The loss of such habitat as a result of the Project is limited in extent and unlikely to adversely affect the population of this species. Due to the operational requirement for open habitats to replace lost woodland, the likely available habitat for this species will increase in extent as a result of the Project.

Herpetofauna

Potential impacts on reptiles during the Construction and Pre-Commissioning Phase include the loss and fragmentation of habitats, direct mortality or injury to individuals, disturbance to individuals during the breeding and hibernation period, and obstruction of movement.

Nikolski's tortoise

Habitat loss: Works occurring during the species' active period will affect areas of shiblyak (3.5 ha), juniper woodland (2.6 ha), mesophilic forest (1.4), and secondary steppefied meadow (4.1 ha); all of which are important to the tortoise for foraging, shelter and breeding. Areas of agricultural habitat which are less important, but are a potential foraging resource for the species, will also be cleared.

A proportion of this loss will be reversible, as the cleared habitats will be reinstated following completion of construction. However recovery of these habitats could take from 2-5 years (in the case of the steppefied secondary meadow and vineyard) to over 20 years (in the case of the woodland habitats) (see the Habitats assessment above for further detail).

Disturbance impacts: In addition to direct habitat loss during construction, tortoises could also be impacted through disturbance. A number of studies have recorded disturbance effects on tortoises from roads. Both Nafus et al., (2013) and Boarman and Sazaki, (2006) recorded declines in the apparent densities of tortoises within 400 m of roads; Nafus et al., (2013) reported a decline in tortoise signs of over 40% between low and medium/high traffic roads, although a large proportion of this may have been due to road kill (Ref. 11.21 and Ref. 11.22).

Direct mortality impacts: In the absence of mitigation, direct mortality to tortoises could occur due to plant or vehicle collisions, damage during trenching activities, harm by humans or introduced animals (e.g. dogs). Tortoises hibernating in the ground could be directly affected by works undertaken during the hibernation period.

Habitat severance and fragmentation: Construction of the Pipeline and of the access roads, could affect seasonal migrations of the tortoise (i.e. from the hill areas or open habitats (shiblyak and juniper woodland and meadow) to the valley floors within the mesophilic woodland). In particular, the route of the Pipeline crosses the Graphova Gap, fragmenting two significant areas of habitat located to the north and south. This would affect the species during the construction period (for approximately 24 months), with the impact within the Pipeline route ceasing on completion of construction.

The effect of habitat loss and fragmentation, as well as the potential for direct mortality and disturbance of tortoises, has the potential to affect not only the population of tortoises within the Study Area (currently estimated 150 - 350 individuals) (Ref. 11.14), but potentially may also affect the population beyond the Study Area due to the effects of reduced fecundity and population fragmentation. The Project therefore has the potential to affect the integrity of a significant[7] population of tortoises (150 – 350 individuals or approximately 2 - 5% of population of the Abrau peninsula).

In the absence of mitigation, the impacts arising at the Construction Phase therefore have the potential to affect the integrity of a globally significant population of a critically endangered species of tortoise in the medium – long term. The impact magnitude is assessed as being moderate adverse on a receptor of high sensitivity, resulting in an effect of **High** significance.

Any impact on Nikolski's tortoise would constitute an effect on critical habitat (see Appendix 11.1).

European Glass Lizard and Aescalupean Ratsnake

European glass lizards were recorded at various locations within the Study Area and are considered a frequently occurring species. Aesculapean ratsnake was also recorded at various locations within the Study Area although at lower densities. The species is therefore considered either likely absent or present in relatively low numbers within the Study Area.

Both species forage, shelter, breed and hibernate within habitats that will be directly impacted during construction: including shiblyak, juniper woodland, mesophilic forest and steppefied secondary meadow. They are also potentially present foraging within the agricultural habitats although these areas are considered sub-optimal. When viewed within the context of the local area (within the Wider Study Area), the proportion of habitat lost and fragmented is not anticipated to be sufficient to significantly affect the ability of the local species populations to survive in the long term. It is also likely that the majority of habitat which will be directly affected during construction will be reinstated post-construction (see Habitats assessment above). The impact is therefore assessed as being of low adverse magnitude on a receptor of moderate sensitivity resulting in an effect of **Low** significance.

As discussed above, the construction of the Varvarovka bypass access road will occur when reptile species are potentially hibernating. There is the potential for both European glass lizard and Aescalupean ratsnake to be present within the open habitats (such as the secondary steppefied meadow). Therefore, habitat removal during the hibernation period could result in the direct mortality of a number of these species.

There is also the potential for the killing and injury of these species outside of the hibernation period (as discussed above for Nikolski's tortoise). The deaths of individuals will reduce the size of the local population and potentially the pool of breeding adults. This could have a long term adverse impact on the local population of these species. The impact is assessed as being of up to moderate adverse magnitude resulting in an effect of **Moderate** significance.

There is some potential for construction activities to restrict the movement of these species. European glass lizards generally have a relatively limited range and the severance effect is unlikely to be of a magnitude which would affect the population within the Study Area.

[7] Significant in this context refers to greater than 1% of a regionally important population (i.e. the Abrau peninsula population).

Construction related severance may restrict the movement of Aesculapean snake slightly, although it is unlikely to stop the species from accessing sufficient foraging, sheltering hibernation or breeding habitat within the Study Area. It will also only persist for the duration of the construction period. The impact is assessed as being of low magnitude resulting in an effect of **Low** significance.

All Other Common Reptiles

The effects on common reptiles are anticipated to be the same as for glass lizard and Aesculapean snake, discussed above. This includes habitat loss, killing of individuals (including during the hibernation period) and creation of barriers to the dispersal of species.

The Project is anticipated to have a medium term localised impact on terrestrial habitats used by reptiles during the Construction Phase, resulting in a temporary loss of habitat and biota along the alignment. It is assessed that this is a negative impact of low to moderate magnitude on species of low sensitivity resulting in an effect of up to **Moderate** significance.

Amphibians

Amphibians are potentially sheltering and foraging within habitats which will be directly impacted during construction, including the shiblyak, juniper woodland, mesophilic forest, secondary steppefied meadow and agricultural habitats. Suitable breeding habitat, adjacent to watercourses within the mesophilic forest, and within ephemeral waterbodies which are not location specific, are also likely to be subject to direct loss. This loss is not anticipated to be sufficient to significantly affect the ability of the local amphibian population to survive in the long term as sufficient habitat remains within the Study Area to support these species. The impact is therefore assessed as being of low adverse magnitude on a receptor of low to moderate sensitivity resulting in an effect of up to **Moderate** significance.

Construction activities also have the potential to kill and injure species potentially present within the aforementioned habitats (including during the hibernation period, as discussed above for reptiles). This has the potential to affect the amphibian population, including the RDB listed Caucasian toad, within the Study Area in the medium term. This impact is assessed as being of up to moderate magnitude, as it will affect the local amphibian population in the medium term. It is therefore assessed as an effect of **Moderate** significance.

Construction activities may restrict the movement of amphibians, particularly during the breeding season when these species need to access waterbodies for breeding. This has the potential to fragment and interrupt the breeding of the population of amphibians within the Study Area. This impact is likely to persist for only one breeding season as construction is predicted to last for 16 months. The impact is assessed as being of moderate magnitude resulting in an effect of up to **Moderate** significance.

Birds

Potential impacts on birds during the Construction Phase include the direct loss of breeding habitat. Breeding bird habitat with the potential to be directly affected during construction includes shiblyak (3.5 ha will be lost), juniper woodland (2.6 ha will be lost), mesophilic forest (1.4 ha will be lost), and steppefied secondary meadow (4.1 ha will be lost). There is also the potential for individual birds which are nesting within these habitats to be killed or injured and for their nests to be damaged.

Breeding birds may also be affected by noise and visual disturbance from construction activity. Noise modelling has been undertaken at four locations to predict the likely noise levels associated with construction experienced at various locations within the Study Area (see **Chapter 10 Noise and Vibration**). The noise modelling predicts that within woodland, grassland, and vineyard areas close to the Pipeline route, during construction, noise levels will be experienced of between 39 - 59 dB depending on the activities being undertaken, compared to an ambient background levels of between 43 - 53.2 dB (noise modelling locations 9 to 12).

Short-toed Snake-eagle and Booted Eagle

Short-toed snake-eagle and booted eagle do not breed within areas of woodland which are likely to be directly or indirectly affected by the Project. Loss of potential breeding habitat, killing or injury of individuals, and damage to nests is therefore not anticipated.

Impacts on these species of raptor will therefore be limited to loss of suitable foraging habitat. Given the large amount of suitable hunting habitat for all species outside the Project area and as the population of breeding raptors is limited to one pair of each species this impact is considered to be of **Low** significance.

Wood Lark

Wood lark have been recorded breeding within the mesophilic woodland, steppefied secondary meadow, and agricultural habitats. Based on the population density surveys completed in 2011 the potential reduction in the number of wood lark in the Project Area is shown in Table 11.34.

Table 11.34 Potential Reduction in Breeding Pairs of Species of Ecological Importance as a Result of Habitat Loss

Species	Habitat Preference	Population Density (breeding pairs/km^2)	Amount of Habitat Loss (km^2)	Potential Reduction of Breeding Pairs
Wood lark	Mesophilic Woodland	5	0.0739	0.37
	Steppefied secondary meadow	7.6	0.0372	0.28
	Agricultural habitats	10.31	0.2268	2.34
			Total	**3 pairs**

In addition to the loss of breeding habitat and potential for the killing or injury of individual wood lark, impacts will occur in a wider area due to increases in noise and visual disturbance so the ‘loss’ of breeding pairs is likely to be slightly higher. However, there are large areas of natural habitat that should be able to support some of these displaced breeding birds.

Therefore, the loss of 3 pairs is probably a reasonable estimate. The temporary loss of 3 breeding pairs would represent 1-1.5 percent of the total estimated breeding population of wood larks in the Krasnodar Krai (200-300 pairs), which would represent an impact of low magnitude. Post construction, the Pipeline route will be allowed to periodically re-vegetate (allowed to grow for 2 to 3 years and then cut). This area will therefore develop in to a more open edge type habitat which is favoured by wood larks as well as many of the commoner breeding bird species breeding in the Project Area. In the long-term, this will allow all these species to breed in this area and it is therefore predicted that the Project will not result in a long-term decrease in breeding species.

In absence of mitigation, the impact on woodlark is therefore assessed as being of **Moderate** significance.

Breeding Bird Assemblage

As has been discussed above for the threatened breeding bird species, construction activities will result in the loss of potential breeding bird habitat, potential killing, injury and disturbance to individuals, potential damage to nests, and potential loss of foraging habitat. The proportion of habitat affected when compared to the amount of available habitat within the Study Area is unlikely to be sufficient to affect the ability of the breeding bird assemblage to breed and survive within the local area, either during construction or in the long term. The impact is therefore considered to be temporary and of a relatively low magnitude resulting in an impact of **Low** significance.

Mammals

Potential impacts on mammals during the Construction Phase include the loss and fragmentation of habitats and direct mortality or injury to individuals. Mammals may also be affected by noise and temporary lighting, which may result in disruption to foraging, breeding and migration.

Bats

Twelve species of bat are potentially present within the Study Area. This includes species assessed as being of low to moderate sensitivity.

Within the construction corridor, there are limited roosting opportunities for bats. Potential roost sites are restricted to 9 trees assessed as having low roost potential. These trees will be removed during construction and there is therefore potential for a small proportion of relatively low quality roosting habitat for bats to be lost. This is assessed as a low magnitude impact on a receptor of low to moderate sensitivity resulting in an effect of no more than **Moderate** significance.

There is potential for construction noise, vibration and construction related light pollution to disturb roosting bats (see **Chapter 10 Noise and Vibration** and 'Birds' Section above for further detail). This impact is likely to be restricted to works within the vicinity of the mesophilic woodland where potential roosting habitat exists. Construction activities within this area will be of a relatively short duration (approximately 1 year) and restricted in extent. Furthermore, other roosting habitat is available (including buildings and other trees) within the Study Area which bats could use to roost. Temporary disturbance within areas of low roost potential is a low magnitude impact on a receptor of low to moderate sensitivity resulting in an effect of no more than **Moderate** significance.

In terms of foraging bats, habitats within the Study Area, including the woodland, meadow, rivers and agricultural habitats are likely to support foraging bats. The loss of these habitats and potential disturbance to foraging bats are unlikely to affect the ability of the local bat population to persist within the Study Area, as sufficient habitat of a similar quality remains. The impact is assessed as a low magnitude resulting in an effect of no more than **Moderate** significance.

Bats favour linear features such as rivers, forest edges and tree lines, which they use for navigation when commuting. The Graphova Gap which contains the unnamed tributary of the Sukko River flows is a potentially important commuting corridor for bats. Works within this area, if undertaken at night and during the bat activity season, have the potential to disturb bats commuting along this flight line. Light and noise disturbance are not anticipated to be of a scale which would result in the total severance of this route, although some disturbance to bats is possible. Low numbers of commuting bats have the potential to be temporarily disturbed although no commuting routes are likely to be completely severed during the Construction Phase. The impact is therefore assessed as a low magnitude impact of no more than **Moderate** significance.

Other Mammals

The following may be present both within the Study Area and along the Pipeline route: insectivores (confirmed sightings of hedgehog, Caucasian mole-rat, Caucasian common shrew); rodents (confirmed sightings of greater mole-rat, forest dormouse, field mouse); lagomorphs (sightings of brown hare and European rabbit); carnivores (including sightings of wolf, common jackal, red fox, common racoon, common marten, rock marten, and badger) and artiodactyls (including sightings of roe deer). Thus, construction of the Project has the potential to result in the loss of foraging and breeding habitat for these species, as well as to disturb them at various stages in their lifecycle (e.g. breeding and hibernation).

Construction will result in the loss of suitable foraging, sheltering, and breeding habitat for mammals. This includes areas of shiblyak, juniper woodland, mesophilic forest, secondary steppefied meadow, and vineyard. When viewed within the context of the local area (within approximately 5 km of the Project), the proportion of habitat lost is not anticipated to be sufficient to affect the ability of mammals supported within the Study Area to survive. Habitat loss is therefore a low magnitude impact on receptors of low sensitivity resulting in an effect of **Low** significance.

There is the potential for killing and injury of individuals during construction (particularly the subterranean dwelling species such as mole-rats and smaller burrowing rodents). The other mammal species are have greater mobility and are likely to be able to quickly leave affected areas of habitat during the Construction Phase. In the absence of mitigation, construction activities could result in the deaths of relatively low numbers of mammals within the Study Area. The impact is potentially of moderate adverse magnitude resulting in an effect of **Low** significance.

Mammals are likely to be indirectly affected by noise (see **Chapter 10 Noise and Vibration**) and / or light disturbance during the Construction Phase. The impact is likely to be short term and reversible i.e. mammals will return to affected areas once construction ceases. This could affect a relatively small number of mammals within the vicinity of the construction corridor. It is assessed as an impact of low magnitude on a receptor of low sensitivity resulting in an effect of **Low** significance.

11.6.9 Mitigation and Monitoring: Construction and Pre-Commissioning

Where the likely impacts on ecological receptors are assessed to be of high or moderate significance, mitigation measures are proposed to lower the overall magnitude of impact on a particular receptor and to avoid or reduce significant impacts on habitats and protected species. Additional mitigation measures are required where there are potential impacts to component features of critical habitats so that the requirements of IFC PS6 are met.

The mitigation approach comprises a number of elements:

- General mitigation measures, including provision for an Ecological Clerk of Works (ECoW), training of construction personnel and implementation of a Construction Management Plan (CMP);
- Herpetile Mitigation Strategy that covers: firstly the construction period and details the measures to be undertaken to protect key ecological receptors such as the Nikolski's tortoise, particularly during initial site clearance works (Appendix 11.3);
- A Habitat Reinstatement Plan (RP) (also referred to in the Proekt as the 'Technical and Biological Recultivation Plan') will provide detailed specifications for the restoration of habitats post-construction. Management and monitoring requirements for an appropriate length of time for each activity will also be specified; and
- A BAP will be developed to describe how the Project will meet IFC PS requirements for no net loss of biodiversity within natural habitats, and net gain requirements for components of critical habitat. Therefore, the BAP will provide a framework for a long-term biodiversity monitoring and evaluation programme. Development of the BAP will take into consideration relevant industry guidance, and will allow for adaptive management and consultation with stakeholders on topics of conservation related to the Project's biodiversity interests.

The implementation of the management plans will be monitored by the Environmental and Social Monitoring Programme for the South Stream Offshore Pipeline.

11.6.9.1 General Mitigation Measures

Ecological Clerk of Works

A suitably qualified ECoW will be appointed by South Stream Transport, independent of the construction site contractor, for the duration of the onshore Construction Phase of the Project. The ECoW will be tasked with overseeing onshore construction activity and with ensuring that all mitigation measures are implemented in accordance with the CMP and associated documentation. Furthermore, the ECoW will be given the responsibility of compiling weekly /

monthly reports on issues such as non-compliance and on modification or supplementation of the CMP, and these reports will be submitted to South Stream Transport and to the construction contractor.

Due to the scale of the Project, the ECoW will be supported by specialists (e.g. botanists, zoologists) as necessary to assist with monitoring the implementation of the CMP and assisting with mitigation where necessary.

Site Personnel Training

Information on the ecological sensitivity of the habitats and species within the construction corridor will be included within a site induction package for all site personnel. This will ensure that all personnel working on site are aware of the sensitivities of the protected sites, habitats and species and are aware of the mitigation measures that need to be employed to minimise any adverse effects of the Project. These measures are described below in respect of terrestrial ecological receptors.

Construction Management Plan

A CMP will detail general mitigation measures to be applied for the Project during construction, and will include the following:

- Strict limitation of construction workers, materials and machinery to the defined construction areas to avoid impacts to surrounding habitats;
- Project workers will not be allowed to bring any live animals or plants into the construction site to avoid the risk of pest or invasive species establishing in the Project Area;
- Once quarries and disposal sites are confirmed by the contractor, South Stream Transport will conduct an invasive species risk assessment. If the findings indicate there is a significant risk of introducing alien invasive species then appropriate mitigation will be implemented. Such measures may include the washing or spraying of all incoming machinery at a demarcated 'washing site' to ensure that any mud or soil which may be carrying seeds is removed;
- The construction site will be monitored by the ECoW for the presence of alien invasive species. Where stands of alien invasive weeds that are known habitat transformers are found to occur within the construction site, such stands should be demarcated so that vehicles do not pass through these stands (and thus potentially spread seeds and other propagules of these species) and that the soils associated with these stands are not transported. An appropriate remediation strategy for alien invasive species will be implemented on-site, where these species are found to occur;
- In-line with GIIP, all construction sites will have appropriate sediment and erosion control practices applied. This will minimise the potential for seed dispersal and noxious weed establishment potentially associated with disturbance at construction areas and limit the likelihood of any effects on receptors remote from the immediate vicinity of the works;
- Storage areas shall only be placed in areas of low ecological importance (e.g. cultivated agricultural land);

- Project workers will be trained in litter / waste control procedures and fire emergency response procedures. This will aim to minimise the risk of accidental fires in surrounding vegetation. Suitable equipment will be made available on site. Emergency response plans will be developed and coordinated with the relevant national authorities;
- Waste management (see **Chapter 18 Waste Management**) includes recycling activities, for example vegetation removed from site will be used where possible for habitat improvement or composted;
- The lighting of fires will be strictly prohibited at all times during construction;
- Project workers will be forbidden from hunting or collecting wild plants and animals;
- The use of herbicides will be forbidden on-site;
- Any artificial lighting will be carefully located and directed to avoid light spill into adjacent areas;
- A detailed soil management strategy to ensure that topsoil from cultivated areas is not mixed with topsoil from non-cultivated areas. In addition, topsoil and subsoil will be stored separately. This is to retain integrity of seed banks and soil microbial composition;
- Measures to reduce the potential for soil run-off and scouring of bare soil following vegetation clearance; and
- Only the designated access roads shall be used to access the landfall section construction areas. Machinery shall not be allowed to move outside these access roads and construction areas. Traffic during the Operational Phase shall travel along designated routes, marked with clear and lasting markings.

The CMP will cross reference relevant measures contained within Appendix 11.3 Herpetile Mitigation Strategy that will require implementation throughout the construction period such as maintenance and protection of reptile exclusion fencing.

11.6.9.2 Designated Sites

The general mitigation measures (see Section 11.6.9.1) should be adhered to in order to avoid significant effects on designated sites (as described in Section 11.5.1.1).

11.6.9.3 Habitats and Flora

Habitats

The general mitigation measures shall be implemented to avoid significant effects on habitats during construction. This section on terrestrial habitats should be read in conjunction with Section 11.6.9.4 on fauna and Nikolski's tortoise in particular.

Within areas of shiblyak, juniper woodland, mesophilic forest, and secondary steppefied meadow, habitats will, where possible, be reinstated to their pre-construction condition, with mitigation weighted in favour of 'like for like or better' habitat reinstatement. A habitat Reinstatement Plan will detail specifications for the restoration of different habitat types within the construction footprint. It will also include provisions for post-construction monitoring of habitats, and will include adaptive mechanisms that allow modification of practices to ensure the objectives of the plan are met.

It will not be possible to allow deep-rooted trees and shrubs to establish over the Right of Way (RoW). The de-forested construction corridor will therefore be seeded with a native grass species, with the aim of creating a habitat similar to the existing steppefied meadows. It may be feasible to propagate and establish red-list species of plant within the area.

Consequently, it will not be possible to reinstate all shiblyak, juniper woodland, and mesophilic forest habitat subject to direct loss during construction. Table 11.35 below presents the areas of residual habitat loss (permanent loss) following implementation of the restoration and reinstatement mitigation measures presented above.

Table 11.35 Areas of Residual Habitat Loss After Implementation of Mitigation

Habitat Type	Temporary Loss (ha)[8]	Permanent loss (residual loss) (ha)	Total
Juniper woodlands	0.52	1.87	2.39
Mesophilic forest	0.64	0.78	1.42
Shiblyak	1.1	2.36	3.46
Total	**2.26**	**5.01**	

Relevant IFC PS Requirements

Paragraph 15 of IFC PS6 states that '*In areas of **natural habitat**, mitigation measures will be designed to achieve no net loss of biodiversity where feasible'*. It has been established that natural habitats within the Project Area include shiblyak and juniper woodland.

Paragraph 17 of IFC PS6 states that no project activities will be implemented in areas of **critical habitat** unless *inter alia* '*The project does not lead to measurable adverse impacts on those biodiversity values for which the critical habitat was designated'*. It has been established that, in terms of ecosystems within the Project Area, mesophilic forest is a threatened habitat type that confers critical habitat status under Criterion 4 (see Appendix 11.1). Based on the residual effect of habitat loss presented in Table 11.35 above, it is apparent that, despite the implementation of avoidance, minimisation, restoration, and reinstatement mitigation measures, the Project would not initially meet the requirements for no-net loss within the natural and critical habitats impacted. Additional mitigation is therefore proposed to comply with the requirements of IFC PS6.

[8] Temporary loss in this context refers to areas of habitat where it will be possible to reinstate habitat following completion of construction. It is recognised that it could take these habitats many years (more than 20 in the case of woodland) following reinstatement to reach their pre-construction condition.

Indeed, further to this under Paragraph 18 of PS6, a net gain in mesophilic forest is needed as the mitigation measures listed above are not expected to result in net gains. Options to mitigate residual loss of natural habitat and critical habitat will be explored and detailed in a BAP (which is specifically required by IFC PS6 Paragraph 18 when critical habitat is being considered).

Freshwater Habitats

Direct impacts to the Shingar River during construction will be avoided as the pipelines will be installed by micro-tunneling under the watercourse. It is also anticipated that significant impacts to the watercourse in the Graphova Gap will be avoided during construction by completing the works during the dry season. Despite this, unplanned incidents of pollution or an increase in silt or run-off within the river channels could potentially result in adverse impacts within the aquatic environment. Strict pollution control measures will therefore be employed at both locations; re-fueling operations shall be restricted to dedicated areas located at a distance greater than 50 m away from the watercourse. Spill kits, including floating booms will be available adjacent to the working area and all spills will be cleared up immediately. In addition to spill kits, silt trapping kits will be stored and available for use at the tributary location should rainfall occur during the construction period. Silt traps will be employed to ensure that the scheme does not result in an increase of greater than 20% above up-stream levels in suspended solids within the water column down-stream of the works area resulting in an adverse impact.

Further measures for the protection of watercourses are detailed in **Chapter 8 Terrestrial Soils, Groundwater and Surface Water**.

Flora

Where necessary, prior to the commencement of construction, RDB plant species within the construction area will be identified, and their location recorded using GPS. RDB species that have been recorded in the area include:

- Greek and stinking juniper;
- Pyramidal orchid;
- *Campanula komorovii*;
- *Salvia ringens*;
- *Linum hirsutum*; and
- Kavach peony.

In line with Russian statutory requirements, all protected plant species within the construction footprint will be moved to suitable alternative habitat outside the construction corridor and away from any potential effects. Translocation will be undertaken in accordance with measures to be contained within a detailed flora layout plan (to be produced). This document will be produced in association with local botanical experts.

Preservation of the seed bank through appropriate topsoil and subsoil storage during the Construction Phase will facilitate natural regeneration of the native species. Translocation of individuals back into the restored area will also be undertaken where appropriate, supplemented by propagation of seeds and cuttings.

Monitoring of the regeneration of these species will be included in the monitoring plan for the Project.

Rehabilitation of vegetation following completion of construction will be undertaken with due consideration to the existing natural vegetative assemblages in the wider local area. Native species of local provenance will be sourced as appropriate. The Habitat Reinstatement Plan will detail the appropriate restoration of the construction site.

11.6.9.4 Fauna

Invertebrates

The ESIA Report has identified potential negative effects of moderate significance on invertebrates resulting from the construction of the Project. Although it will be difficult to avoid impacts during construction, measures to reduce degradation to habitats adjacent to the construction sites will be employed to safeguard invertebrates supported within these areas (including Levantine skipper, which is a component of critical habitat). This will include:

- Restriction of the working corridor to limit the loss of invertebrate habitat; and
- Measures detailed within the CMP should be adhered to in order to avoid loss and / or degradation to invertebrate habitat adjacent to the construction corridor.

Furthermore, upon completion of the construction of the Project, continued implementation of the BAP to replace lost habitat and provide biodiversity enhancements to benefit invertebrates will be implemented. In particular, measures to address potential impacts to Levantine skipper will be incorporated to include a baseline survey to confirm presence or absence in the Study Area, provision of suitable habitats and a post-construction monitoring programme.

Nikolski's Tortoise and All Other Amphibian and Reptile Species

This ESIA has identified the potential for the Project to result in negative impacts of high significance on Nikolski's tortoise, and up to moderate significance on other species of herpetiles. Mitigation is therefore proposed to avoid impacts on these species. The mitigation measures described are incorporated into a detailed mitigation strategy (see Appendix 11.3) which provides a specification for mitigation measures to ensure that the Project does not result in a significant adverse impact on Nikolski's tortoise, as well as on all other species of amphibians and reptiles. A summary of the mitigation strategy is given below:

Construction Activity Prior to a Programme of Translocation Being Undertaken (the Varvarovka bypass road, only)

- Should any construction activities to be undertaken during the herpetiles hibernation period dependent on annual climatic variation), such activities will be restricted to essential areas only;
- Prior to the commencement of construction of the temporary access roads, all areas of habitat which will be directly affected by construction will be fenced off using one way permanent reptile proof fencing; and

- All clearance activities within areas to be constructed during the hibernation period will be undertaken under a watching brief of the ECoW to maintain the strict observance to the working corridor.

Construction Activity after a Programme of Translocation Has Been Undertaken

- Prior to the commencement of construction, all areas of habitat which will be directly affected by construction and the habitat reinstatement areas will be fenced off using one way permanent reptile proof fencing;
- Pit-fall traps, artificial refuges and temporary internal fences will also be installed at this stage and all non-protected plant species, shrubs and trees will be removed by hand to a height of approximately 100 mm. All works will be completed under an ecological watching brief;
- On completion of the fencing works, a period of translocation will be completed in which the fenced area, traps and artificial refuges will be checked twice a day by ecologists and all reptiles and amphibians caught will be placed in areas of suitable alternative habitat outside the fenced areas. Any tortoises caught will be subject to full bio-metric measurement and all or a proportion of the population will be marked using a radio transmitter to assist with further population monitoring. The exact type of tag will be determined over the winter 2013 / 2014 to ensure the chosen technology will generate the most useful monitoring data as well as ensure that any system used will not have any adverse effect on the ecology or behaviour (including mating behavior) of the tortoise. All other animals caught during the translocation period will be recorded; and
- At the end of the movement, all internal fences, pit-fall traps and artificial refuges will be removed and the permanent fence maintained to ensure that no animals can enter the working area during the construction period. On completion of construction and all post-works and habitat reinstatement, all permanent fencing will be removed. Post-construction monitoring of the tortoise population will be undertaken as part of the ecological monitoring plan for the Project.

Under-road Tunnels

In order to mitigate against the impact of habitat severance and fragmentation, under-road tunnels will be constructed at appropriate locations along the alignment of both access roads to allow for the movement of tortoises and other herpetiles. The precise location and specification of these tunnels will be discussed and agreed with the Project's contractors, but will conform to the following general principles:

- In accordance with good industry practice and published guidelines, the tunnels will be spaced at an appropriate distance and location (adjacent to suitable habitat along the Varvarovka bypass road) to ensure that there is a sufficient number and that they meet conservation objectives; and
- There will be fencing or barriers along the road to exclude tortoises from the working area.

No additional mitigation measures are expected, but would be subject to tunnel use which will be included as part of the tortoise monitoring programme.

Mitigation

The mitigation measures described above for Nikolski's tortoise, a critically endangered species and component of critical habitat, are anticipated to substantially reduce the effect of the Project on this species. However, the long term effect remains uncertain. There is the potential for Project related mortality, disturbance (including to the breeding and hibernation cycle), long-term habitat loss (see impacts to shiblyak, juniper woodland, and mesophilic forest), and habitat severance, to affect the integrity of the local tortoise population (estimated to be in region of 2% – 5% of the population within the Abrau Peninsula). Furthermore, there is a risk that, if the integrity of the local tortoise population is affected, then this could also affect the regional (i.e. Abrau Peninsula) population.

Paragraph 17 of IFC PS6 requires a project to meet the following requirements before it can be implemented:

- '*The project does not lead to measurable adverse impacts on those biodiversity values for which the critical habitat was designated*"; and
- '*The project does not lead to a net reduction*[9] *in the global and/or national/regional population of any Critically Endangered or Endangered species over a reasonable period of time*'.

Paragraph 18 of IFC PS6 goes on to state (in relation to critical habitat) that a project's mitigation strategy must be designed to achieve net gains[10] for the values which it has been designated (in this case, Nikolski's tortoise).

Given the anticipated residual impacts, and high sensitivity of Nikolski's tortoise, the Project would not be able to meet the requirement under paragraph 17 (i.e. the project will have an adverse impact which needs to be addressed), which would then lead to following paragraph 18 under which a net-gain would be required. A programme of biodiversity offsets may need to be proposed to ensure that the Project meets the requirements of paragraph 17 and paragraph 18 of IFC PS6 and would be determined through the BAP and after results of further studies as described below.

A population survey for Nikolski's tortoise will therefore be undertaken in spring 2014. This survey will be a continuation of the study undertaken between October and November 2013 and will be undertaken in conjunction with local species specialists (this is likely to include Dr. Olga Leontyeva).

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[9] Net reduction defined as a singular or cumulative loss of individuals that impacts on the species' ability to persist at the global and / or regional / national scales for many generations or over a long period of time. The scale (i.e. global and / or regional / national) of the potential net reduction is determined based on the species' listing on either the (global) IUCN Red List and/or on regional/national lists. For species listed on both the (global) IUCN Red List and the national/regional lists, the net reduction will be based on the national/regional population.

[10] Net gains are additional conservation outcomes that can be achieved for the biodiversity values for which the critical habitat was designated.

The requirement is provided below in two interlinked parts primarily to ensure 'no net reduction' and a monitoring research and conservation programme designed to ensure 'net gain'. Based on the monitoring and knowledge requirements outlined above and in Appendix 11.3 Herpetile Mitigation Strategy, a potential strategy is outlined below:

- A BAP will be produced, with a significant component concerning the conservation of Nikolski's tortoise. The BAP will be subject to periodic change based on monitoring and research results and the success of habitat management actions. The BAP will be independently peer reviewed;
- In order to demonstrate 'net gain' to the species, a monitoring programme of will be applied (i.e. have practical and research value). It is expected that the continuity in the management of this monitoring programme be maintained so that its data can be collated and applied to the activities described within the BAP;
- Research into the ecology and behaviour is crucial for any offset design and habitat management, especially in relation to hibernation, breeding, dispersal and mortality;
- Surveys of tortoise populations in adjacent habitats will be undertaken to gather further data on population density and define habitat suitability parameters;
- A robust, appropriately designed, and long-term biodiversity monitoring and evaluation programme will be integrated into the client's environmental and social management plan. This will include key performance indicators on a higher level to ensure that the mitigation strategy and BAP is achieving its targets; and
- The longer-term monitoring and research programme should be designed in consultation with relevant international, national and local expertise, e.g. IUCN Species Survival Group, or an academic institute with relevant expertise.

Birds

This ESIA has identified potential negative impacts of low/moderate significance on breeding birds resulting from the construction of the Project. Mitigation is therefore proposed to minimize the magnitude of impact on breeding birds. The mitigation measures described will be incorporated into a detailed method statement for breeding birds prior to the commencement of construction, with advice from statutory nature conservation bodies as appropriate:

- Removal of nesting habitat will be undertaken prior to the breeding bird season (which is considered to be between March and September) to minimize the risk to breeding species. If this is not possible, a suitably experienced ecologist will check vegetation prior to removal for evidence of nests. If active nests of species of ecological importance are identified, an appropriate exclusion zone (approximately 5 to 10 m) will be established around the nest site until any young have fledged;
- Post-construction monitoring for the presence/ absence of nesting birds within the working area should be undertaken as part of the ecological monitoring plan for the Project. These surveys would be robust enough to calculate population densities;
- Adherence to the CMP for Biodiversity and associated working method statements to avoid loss and degradation to habitats adjacent to the working corridor; and

- Development of a post-construction habitat management plan which will include timings for management operations along the Pipeline route (i.e. vegetation management will only be completed outside of the breeding bird season).

Mammals

Bats

The following measures are recommended to safeguard bats potentially roosting within the trees present within the mesophilic woodland:

- Construction-related lighting should be minimised as far as is possible and directed to avoid illumination of adjacent habitat;
- If the trees within the mesophilic forest are to be removed during the bat activity season (March – October), clearance works will be preceded by bat roost survey to determine bat presence / likely absence of roosting bats. If bats are found to be present, a soft felling process will be implemented where the trees are felled carefully under supervision of a suitably qualified ecologist. The section of tree containing the bat roost would be left in-situ over-night to enable bats to leave of their own accord; and
- A post construction plan will be implemented to replace lost habitat and provide biodiversity enhancements for bats.

11.6.10 Residual Impacts: Construction and Pre-Commissioning

11.6.10.1 Designated Sites

Assuming the general mitigation measures described above are implemented, the residual effect of the Project on designated sites will be **Not Significant**.

11.6.10.2 Habitats and Flora

Habitats

It is not possible to restore the lost habitat in its entirety post-construction given the requirement for the maintenance of a permanent de-forested way leave along the entire Pipeline route. However, where appropriate, the reinstatement of habitats and provision of compensatory planting is likely to reduce the magnitude of the impact on habitats from low to negligible in the medium to long term. Assuming these mitigation measures are successful, the residual effect of land take on habitats is assessed as being of no more than **Not Significant** significance due to a negligible impact on a receptor of up to moderate sensitivity.

Flora

Mitigation to implement targeted movement of red list plants will lower the magnitude of the impact to negligible. The sensitive storage of topsoil, subsoil and coastal sand to preserve the natural seed bank will also maximize opportunities for natural recolonization by notable flora. It is assessed that the residual impact on notable species is **Not Significant**.

11.6.10.3 Fauna

Invertebrates

Mitigation measures aimed at reducing impacts on invertebrate habitat, as well as the proposed habitat reinstatement plan (aimed at benefiting invertebrates), are likely to reduce the impact of land take on invertebrates to negligible in the medium to long term. It is therefore considered that the residual effect of the Project on invertebrates will be **Not Significant**.

Herpetofauna

Mitigation measures will safeguard the tortoise during its active (non-hibernating) phase and reduce the impact magnitude of the Project activities on Nikolski's tortoise (and other herpetiles) during this period from high to negligible.

Works undertaken during the hibernation period will potentially result in the mortality of a small number of tortoises and other herpetiles. In order to compensate for this loss and enhance the overall population in the long term, offsetting may be required. Assuming that monitoring demonstrates that mitigation measures undertaken are successful, it is assessed that the Project will result in a **Not Significant** residual impact on Nikolski's tortoise and other herpetiles species in the long term.

Mammals

Bats

Mitigation measures will reduce the impact magnitude of the Project on roosting and foraging bats from low to negligible. It is therefore assessed that the Project will result in residual impacts on roosting bats of **Not Significant**.

All Other Mammals

Adherence to the general mitigation measures described above is likely to be sufficient to avoid significant effects on other mammals present within the Study Area. No additional mitigation for impacts on other mammals is considered necessary and the residual impact is assessed to be **Not Significant**.

Birds

Breeding Birds and Spring / Summer Migratory Birds

Habitat manipulation and sensitive timing of works to avoid breeding and migratory periods will reduce the impact magnitude of the Project on breeding birds from low to negligible. It is therefore anticipated that that the Project will result in residual effects on breeding birds of no more than **Low**.

Migratory and Over-wintering Birds

No mitigation for impacts on migratory and over-wintering birds is considered necessary and therefore the residual impact on these species is, as previously assessed, **Low**.

11.6.11 Assessment of Potential Impacts: Commissioning and Operational Phase

11.6.11.1 Designated Site, Habitats and Flora

Operational impacts resulting from the Project are limited given that all of the significant impacts on habitats will have occurred at the Construction Phase. During the Commissioning and Operational Phase many of the mitigation measures for the impacts of construction (such as vegetation replanting) will occur. The overall impact of the Commissioning and Operational Phase will therefore be considerably lower than those during construction.

The overall impact on habitats during operation will be **Not Significant** due to the lack of any significant ground-works or other major works. The only activities that will be undertaken during this Project phase will be related to land remediation and maintenance of the RoW.

There is some potential for impacts on flora (including potentially red list species) as a result of maintenance to keep the RoW free of large trees and deep-rooted shrubs for the lifespan of the Project. However, considering that the worst case scenario of habitat and species loss for flora of conservation importance has been assessed for construction, the effect of operational activities is likely to be **Not Significant** (Table 11.36).

Table 11.36 Assessment Summary Table of Potential Impacts: Construction and Pre-Commissioning

Activity	Potential Impact	Receptor(s)	Receptor Sensitivity	Pre-mitigation Impact Magnitude	Pre-mitigation impact significance	Mitigation measures	Residual impact significance
Preparation of access roads / upgrades to junctions of existing roads Open trench pipe laying activities Construction of landfall facilities Establishment of microtunnel construction site Establishment of microtunnel construction site Increased construction related traffic Increased site population	Habitat degradation Introduction of invasive species	Designated Sites	High	Up to high	Up to High Adverse	Adherence to general mitigation measures and CMP.	Not Significant

Continued…

Activity	Potential Impact	Receptor(s)	Receptor Sensitivity	Pre-mitigation Impact Magnitude	Pre-mitigation impact significance	Mitigation measures	Residual impact significance
Preparation of access roads / upgrades to junctions of existing roads Open trench pipe laying activities Construction of landfall facilities Establishment of temporary construction sites Increased construction related traffic Increased site population	Habitat loss Habitat degradation Damage to flora	Habitats and flora	Up to high	Up to moderate	Up to Moderate Adverse	Adherence to general mitigation measures and CMP. Pre-construction surveys to identify the presence of rare plants within construction areas. Species of ecological importance will be moved to suitable receptor sites. Production of a BAP. Production and implementation of a post construction BAP.	Not Significant

Continued…

Activity	Potential Impact	Receptor(s)	Receptor Sensitivity	Pre-mitigation Impact Magnitude	Pre-mitigation impact significance	Mitigation measures	Residual impact significance
Preparation of access roads / upgrades to junctions of existing roads Open trench pipe laying activities Construction of landfall facilities Establishment of temporary construction sites Increased construction related traffic Increased site population	Killing and injury to species Disturbance to species Loss of species habitat Habitat severance / fragmentation	Invertebrates	Up to high	Up to moderate	Up to Moderate Adverse	Adherence to general mitigation measures and CMP. Restriction of the working corridor (where possible) to reduce loss of invertebrate habitat. Production and implementation of a post construction BAP.	Not Significant

Continued…

Activity	Potential Impact	Receptor(s)	Receptor Sensitivity	Pre-mitigation Impact Magnitude	Pre-mitigation impact significance	Mitigation measures	Residual impact significance
Preparation of access roads / upgrades to junctions of existing roads Open trench pipe laying activities Construction of landfall facilities Establishment of temporary construction sites Increased construction related traffic Increased site population	Killing and injury to species Disturbance to species Loss and degradation of species habitat Habitat severance / fragmentation	Herpetiles	Up to high	Up to moderate adverse	Up to High Adverse	Adherence to general mitigation measures and CMP. Exclusion of herpetiles from construction areas with the use of herpetile fencing. Production of a BAP with a strategy to determine measures for loss of habitat caused by construction. Movement of species from construction areas into undisturbed habitats. Installation of under-road tunnels to allow for animal movement within the local environment. Post-construction monitoring. Implementation of a post construction BAP.	Not Significant

Continued…

Activity	Potential Impact	Receptor(s)	Receptor Sensitivity	Pre-mitigation Impact Magnitude	Pre-mitigation impact significance	Mitigation measures	Residual impact significance
Preparation of access roads / upgrades to junctions of existing roads Open trench pipe laying activities Construction of landfall facilities Establishment of temporary construction sites Increased construction related traffic Increased site population	Killing and injury to species Disturbance to species Loss and degradation of species habitat Habitat severance / fragmentation	Mammals (including bats)	Up to moderate	Low	Up to Moderate Adverse	Adherence to general mitigation measures and CMP. Trees with the potential to support roosting bats will be surveyed prior to removal to determine roosting bat presence / likely absence. Implementation of a post construction BAP.	Not Significant

Continued…

Activity	Potential Impact	Receptor(s)	Receptor Sensitivity	Pre-mitigation Impact Magnitude	Pre-mitigation impact significance	Mitigation measures	Residual impact significance
Preparation of access roads / upgrades to junctions of existing roads Open trench pipe laying activities Construction of landfall facilities Establishment of temporary construction sites Increased construction related traffic Increased site population	Killing, injury and disturbance of nesting birds during construction if undertaken during the breeding season (typically between March and September). Loss of breeding and foraging habitat	Birds	Up to moderate	Low	Up to Moderate Adverse	Adherence to general mitigation measures and CMP. Removal of nesting habitat (trees, scrub, tall grassland areas) outside of the breeding bird season (therefore removal between October and February inclusive). Implementation of a post construction BAP.	Low

Continued…

Activity	Potential Impact	Receptor(s)	Receptor Sensitivity	Pre-mitigation Impact Magnitude	Pre-mitigation impact significance	Mitigation measures	Residual impact significance
Preparation of access roads / upgrades to junctions of existing roads Open trench pipe laying activities Construction of landfall facilities Establishment of temporary construction sites Increased construction related traffic Increased site population	Killing and injury to species Disturbance to species Loss and degradation of species habitat Habitat severance / fragmentation	Freshwater ecology receptors	Moderate	Moderate	Moderate	Adherence to general mitigation measures and CMP. Implementation of a post construction BAP.	Not Significant

Complete.

11.6.11.2 Fauna

Invertebrates

During maintenance activities small scale works, machinery movements will occur. However, the location and scale of such disturbance will have no effect on invertebrates. The overall impact on invertebrates during operation will therefore be **Not Significant**.

Herpetiles

During maintenance activities small scale works and machinery movements will occur. There is potential for herpetiles, including Nikolski's tortoise, to be present within habitats along the RoW during the Operational Phase. There is therefore some potential for killing and injury to these species during routine maintenance and inspection works. In the absence of mitigation, this could result in the death of individuals. This is assessed as a low magnitude impact on receptors of up to high sensitivity (Nikolski's tortoise) resulting in an effect of **Moderate** significance.

Several species of herpetile will benefit from the creation of new open habitats (grassland) and habitat mosaics (interactions between open habitats and the woodland edges). For these species, replacement of woodland and forest with grassland at the Pipeline easement and its maintenance by removal of shrubs and trees is a creation of new suitable habitat and an ecological corridor for connection between patches of other open habitats.

Mammals

During maintenance activities small scale works, machinery movements and noise will occur. However, due to the localised nature and scale of activity the disturbance effects on mammals (including bats) are considered to be of a negligible magnitude, resulting in a **Not Significant** effect.

During operation, there will be some illumination during the hours of darkness. Lighting controls to minimize light spillage will be implemented. Any additional impacts of lighting are considered to be of negligible magnitude resulting in **Not Significant** effect.

Birds

There is some potential for breeding birds to be affected if vegetation clearance along the RoW is undertaken during the bird breeding season. Impacts would however be limited given that all of the significant impacts on species of conservation importance as a result of habitat loss will have occurred at the Construction Phase. The loss of this habitat and / or disturbance to these species would therefore be of no more than **Low** significance.

During operation, disturbance to birds will be limited due to the lack of any significant groundwork or other major construction works. There will be limited lighting at the landfall facilities which may disturb surrounding local habitat areas at night. Noise pollution will be limited to that generated by the presence of workers, vehicles and equipment during Pipeline inspection and RoW maintenance. Such impacts will be temporary and localised in nature.

The impacts will be limited to the Project footprint and are not predicted to result in disturbance to any additional areas. As a result, disturbance will occur in less than one percent of the available habitat within the local area and is considered to be of negligible magnitude. As a result, disturbance impacts during operation are considered to be **Not Significant**.

11.6.12 Mitigation and Monitoring: Commissioning and Operational Phase

11.6.12.1 Designated Sites, Habitats and Flora

As no significant effects are anticipated at the Operational Phase, no mitigation or monitoring is recommended.

11.6.12.2 Fauna

Herpetiles

Any Operation Phase vegetation management works (i.e. periodic cutting of vegetation along the Pipeline corridor) will be undertaken in the winter period only (between November and February) when the tortoises (and other amphibian / reptile species) are hibernating. Low-impact hand-held machinery will be used to complete this vegetation management. Vegetation will be cut to no lower than 100 mm and no ground should be broken during these works.

During the operation of the Pipeline, any maintenance / project vehicles will adhere to a strict on-site speed limit of 10 km/h and drivers must be mindful that tortoises could be present along any of the access tracks. For good practice, if an animal is observed and in immediate danger, it should be moved off the track. Any casualties observed will need to be recorded and reported to the project manager.

Birds

Vegetation clearance along the RoW should be undertaken outside of the breeding bird season (which is approximately between March and September) to avoid impacts on breeding birds.

All Other Fauna

As no significant effects are anticipated at the Operational Phase, no mitigation or monitoring is recommended.

11.6.13 Residual Impacts: Commissioning and Operational Phase

Assuming the mitigation measures described above for herpetiles and birds are implemented, residual impacts (Table 11.37) at the Commissioning and Operational Phase are expected to be **Not Significant**.

Table 11.37 Assessment Summary Table of Potential Impacts: Commissioning and Operation

Activity	Potential Impact	Receptor(s)	Receptor Sensitivity	Pre-mitigation impact significance	Mitigation measures	Residual impact type and significance
Maintenance of the RoW area Movement of people and machinery related to the operation of the Pipeline and its maintenance in good working condition.	Habitat loss Habitat degradation Damage to flora	Designated sites, habitats, and flora.	Up to high	Not significant / low	None Required	Not significant
Maintenance of the RoW area Movement of people and machinery related to the operation of the Pipeline and its maintenance in good working condition.	No impacts anticipated	Invertebrates	Up to high	Not significant / low	None required	Not significant

Continued…

Activity	Potential Impact	Receptor(s)	Receptor Sensitivity	Pre-mitigation impact significance	Mitigation measures	Residual impact type and significance
Maintenance of the RoW area Movement of people and machinery related to the operation of the Pipeline and its maintenance in good working condition.	Killing or injury of species	Herpetiles	Up to high	Up to moderate adverse	Sensitive timing of works during operational phase. Vegetation clearance should be undertaken outside the herpetile active period (undertaken between November and February) Low-impact machines will be used to complete this vegetation management. Vegetation will be cut to no lower than 100 mm and no ground should be broken during these works A site speed limit of no more than 10 km/hour should be enforced to avoid collisions with species (particularly Nikolski's tortoise	Not significant

Continued…

Activity	Potential Impact	Receptor(s)	Receptor Sensitivity	Pre-mitigation impact significance	Mitigation measures	Residual impact type and significance
Maintenance of the RoW area Movement of people and machinery related to the operation of the Pipeline and its maintenance in good working condition	No impacts anticipated	Mammals (including bats)	Low - Moderate	Negligible	None required	Not significant
Maintenance of the RoW area Movement of people and machinery related to the operation of the Pipeline and its maintenance in good working condition	Potential damage / disturbance to nesting birds	Birds	Moderate	Negligible	Sensitive timing of works. Vegetation clearance should be undertaken outside the herpetile active period (undertaken between November and February)	Not significant
Maintenance of the RoW area Movement of people and machinery related to the operation of the Pipeline and its maintenance in good working condition	No impacts anticipated	Aquatic receptors	Low	Negligible	None required	Not significant

Complete.

11.6.14 Assessment of Potential Impacts: Decommissioning

The South Stream transportation system is designed to operate for 50 years, although its life may be extended subject to close monitoring. The decommissioning program will be developed during the Operational Phase, and it is likely that the technological options and preferred methods for decommissioning of such transportation systems will be different in 50 years' time.

Under the worst case scenario, whereby the Pipeline is removed from the ground (as opposed to being left in place), and activities associated with the Decommissioning Phase are likely to include the following:

- Construction of access roads / repair of existing facilities;
- Excavation works for the removal of pipes; and
- Dismantling and removal of the landfall facilities.

It is anticipated that the impacts associated with these activities; including habitat damage or degradation, killing, injury or disturbance to species, are unlikely to be of a magnitude greater than those reported for the Construction Phase (assessed and presented in Section 11.6.13 above). The significance of effects on ecological receptors is therefore not anticipated to be greater than those which have been reported for the Construction Phase.

11.6.15 Mitigation and Monitoring – Decommissioning Phase

As the impacts and effects are anticipated to be similar to those identified during the Construction Phase, the mitigation proposed for decommissioning will be the same as is proposed for the Construction Phase.

11.6.16 Residual Impacts: Decommissioning

Assuming the mitigation measures as are described in Section 11.6.3 are implemented appropriately no significant adverse effects are anticipated on terrestrial ecology receptors during construction. Impacts are therefore not anticipated to be of greater than **Not Significant** or **Low** adverse significance.

11.7 Demonstrating Compliance with IFC Performance Standard 6

The above sections have presented the baseline ecology present within the Landfall Project Area which has identified certain ecological receptors as contributing to the determination of critical habitat. These receptors are further discussed in Appendix 11.1. The assessment of residual impacts of construction, operation and decommissioning the Project on valued ecological receptors has taken in to consideration likely adverse impacts of the Project as well committed mitigation measures to avoid, reduce or mitigate for these impacts. The residual impact assessment has concluded that construction, operation and decommissioning of the Project will result in low / negligible adverse impacts on all ecological receptors, including those which are components of critical habitats. Accordingly, it has been demonstrated that the Project will fulfil the requirement of Paragraph 17 of Performance Standard 6, which states the client will not implement any Project activities unless the following are demonstrated:

Test 1 – no other viable alternatives within the region exist for development of the project on modified or natural habitats that are not critical

Reasons for site selection and consideration of the alternative are presented and discussed in full in **Chapter 4 Analysis of Alternatives** of this document where it is clearly demonstrated that there are no viable alternative sites for this facility.

Test 2 – the project does not lead to measurable impacts on those biodiversity values for which the critical habitat was designated, and on the ecological processes supporting those biodiversity values

The residual impact assessment, which takes in to consideration all committed mitigation, has concluded that the Project will not result in any measureable impact on all identified and valued ecological receptors including those which are components of critical habitat. Mitigation including translocation of valued receptors, habitat reinstatement and development of areas of natural habitat as well as a long-term monitoring plan will ensure the Project will not result in impacts on valued receptors or ecological processes.

Test 3 – the project does not lead to a net reduction in the global and / or national / regional population of any Critically Endangered or Endangered species over a reasonable period of time

A robust monitoring plan will be developed by the client that will detail long-term monitoring ecological receptors, including those identified as components of critical habitat. The monitoring and management plan will also detail further measures to be completed if the monitoring demonstrates that targets set within this document are not being met (e.g. if the rate of establishment of planted trees is not met additional supplementary planting or additional aftercare will be completed to ensure robust reinstatement of habitats).

Test 4 – a robust, appropriately designed, and long-term biodiversity monitoring and evaluation programme is integrated in to the client management programme

As detailed in Test 3 this document will be developed and will detail long-term monitoring and management that will also include measurable targets against which to assess the mitigation and habitat reinstatement works. This plan will also include committed measures should the monitoring programme indicate that these targets are not being met.

11.8 Unplanned Events

The potential impacts associated with unplanned events are discussed in **Chapter 19 Unplanned Events**.

Unplanned events in the landfall section may occur during the Construction Phase from the use of construction plant, power generation equipment and from vehicular traffic in conjunction with equipment malfunction or human error. The resultant effects of these unplanned events will be limited to accidental pollution incidents involving fuel and oils, which could result in a significant (major) adverse ecological impact especially if these pollutants enter watercourses. Fire is also a potential hazard and this could result in a significant (major) adverse impact on areas of terrestrial habitat outside the working area; especially in the forest areas. The design controls that will be in place to reduce the risk of occurrence of the above potential events, as well as the mitigation measures that will be enforced to minimise the consequences associated with the events, are discussed in **Chapter 19 Unplanned Events**.

During the Operations Phase, unplanned events are similar to those listed above for construction and would therefore be limited to isolated pollution risks associated with site inspection vehicles or maintenance tasks. Control measure for possible pollution incidents will be as detailed for construction. It is not anticipated that operational inspections, maintenance or habitat management will pose a significant fire risk.

11.9 Cumulative Impacts

The cumulative impacts associated with the Project relating to terrestrial ecology are assessed in **Chapter 20 Cumulative Impact Assessment**.

11.10 Conclusion

In the absence of impact avoidance and mitigation measures, the Project has the potential to affect a range of ecology receptors, including designated sites (Utrish SPNA, Kuban River Delta Ramsar, Delta of the Kuban River IBA, and Protective Forests), various natural habitats, and a number of red listed species (including the internationally Critically Endangered species, Nikolski's tortoise). In the absence of mitigation, the effect on receptors has the potential to be of up to **High** significance.

The Construction and Pre-Commissioning Phase of the Project has the greatest potential to affect terrestrial ecology receptors. The key impacts relate to habitat loss and fragmentation, habitat degradation, direct mortality and injury to species, and severance. Impacts to habitats and species have been avoided through project design and, where appropriate, through a suite of mitigation measures which have reduced the magnitude of all impacts to low or negligible levels. The residual impacts on all species, regardless of their sensitivity, has therefore been assessed as being either **Not Significant** or of **Low** significance.

The chapter has also assessed the potential for the Project to have significant effects on terrestrial ecology receptors during the Commissioning and Operational Phase of the Project. Impacts at this phase are anticipated to be limited given that all of the significant impacts (such as habitat loss and fragmentation) on habitats and species will have occurred during the Construction and Pre-Commissioning Phase. In the absence of mitigation, there is the potential for the Project to have impacts of **Moderate** significance, largely due to the potential for routine maintenance activities to cause mortality or injure Nikolski's tortoise and other herpetiles. Mitigation measures have been proposed which will reduce the magnitude of all impacts at the Operational Phase to negligible to low magnitudes. The residual effects on all receptors are therefore anticipated to be either **Not Significant** or of **Low** significance.

While it is not possible to fully assess decommissioning impacts at this stage, the ESIA has considered two scenarios: in situ abandonment and pipeline recovery. The ESIA has concluded that the former generates impacts broadly similar to those of the Pipeline's Operational Phase, while the latter generates impacts broadly similar to the construction phase, and are thus amenable to similar mitigation strategies.

The assessment has been mindful of the requirements of IFC PS (6), particularly in relation to the identification and consideration of critical habitat. A critical habitat assessment has been undertaken which has identified a number of ecological receptors which qualify as components of critical habitat. In accordance with IFC PS (6), mitigation measures (including provision of a BAP) have been designed and will be implemented to achieve a net biodiversity gain for these receptors.

The chapter has also assessed the potential for the Project to have cumulative impacts with other schemes within the vicinity of the landfall section. The cumulative impact assessment has identified a number of areas where adverse cumulative effects could occur due to the construction of the Project and the Russkaya CS development. Although the Project is not anticipated to make a significant contribution to cumulative effects, the importance of South Stream Transport engaging with Gazprom Invest to align Gazprom Invest's mitigation measures with those of the Project has been highlighted. This communication and alignment is considered to be important to avoid adverse cumulative effects on terrestrial ecology receptors within the wider environment.

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Chapter 12: Marine Ecology

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12 Marine Ecology

12.1 Introduction

This chapter presents an assessment of the Project's impacts on marine flora and fauna within Russian Federation waters encompassing Russian territorial waters out to 12 nautical miles (NM) and the Russian Exclusive Economic Zone (EEZ) of the Black Sea. The assessment considers impacts arising during the Construction and Pre-Commissioning, Operational and Decommissioning Phases. The most important impacts are predicted to arise during the Construction and Pre-Commissioning Phase. Construction activities, including dredging, seabed intervention and physical placement of the Pipeline on the seabed, have the potential to result in the loss of habitats and directly or indirectly affect associated plant and animal species.

Along the eastern Black Sea coast, faunal groups of particular interest, either due to their value or vulnerability, include a variety of commercial fish species (e.g. anchovy, turbot, sprat etc.), endangered species (e.g. sturgeon), marine mammals and seabirds. Marine flora is also important, particularly red and brown macroalgae. These are discussed further in Section 12.4.

The assessment has identified sensitive ecological receptors (including protected and/or notable habitats and species) within the Project's Area of Influence (as described in Section 12.3.2).

This chapter provides a description of the baseline conditions, assessment methodology, regulatory framework, the measures required to mitigate any significant adverse effects of the Project's Activities and the likely residual impacts assessed after these measures have been employed. The potential for cumulative impacts with other projects in the surrounding area is also considered.

12.2 Scoping

The scope of the marine ecology impact assessment for the Project was defined through a process that identified ecological receptors and potentially significant impacts related to the Project. Baseline information which informed the scoping process largely drew on information gathered from studies undertaken for the South Stream Offshore Pipeline, including feasibility, engineering and environmental surveys carried out in 2009 to 2013 (Section 12.3.3). Key steps in the scoping process for marine ecology comprised the following:

- The Project's Front End Engineering and Design (FEED) was reviewed to identify activities with the potential to significantly affect ecological receptors;
- Ecological receptors within the Project Area of Influence were identified through a review of secondary data, surveys undertaken for the Project (as described in Section 12.3.3), and professional expertise;
- A review of relevant national and international legislative requirements and lender requirements for compliance; and
- An Environmental Issues Identification (ENVIID) was undertaken to assist in the identification of impacts and receptors. During the ENVIID process, each activity was

examined to understand how activities were expected to interact with ecological receptors, which receptors would be impacted and the nature (positive or negative) of the likely impact. The outcome of the ENVIID was an ENVIID register which identified the various elements of the Project and their interaction or potential impact on sensitive ecological receptors.

The marine environment contains many potential receptors and is, therefore, an important consideration in the ESIA process. Marine ecological receptors are diverse and include a wide variety of organisms and habitats. For the purpose of this assessment, marine biota is broadly grouped into the following topics: plankton, benthic communities, fish, seabirds and marine mammals. In addition, the habitats that these organisms inhabit and the ecological processes of these habitats are considered as receptors. Species of conservation value, critical habitats and protected areas are discussed in terms of their importance and in terms of the potential impact that the Project may have on them.

The potential occurrence of species of conservation value was identified using the following sources:

- International United Conservation Network (IUCN) Red Data List (RDL);
- Red Data Book of the Russian Federation (RDBRF); and
- Red Data Book of the Krasnodar Krai region (RDBKK).

12.3 Spatial and Temporal Boundaries

12.3.1 Project Phases

This chapter has appraised the potential for the Construction and Pre-Commissioning, Operational and Decommissioning Phase activities of the Project, to have impacts on receptors. Decommissioning is considered in less detail, see Section 12.5.4.

12.3.2 Project Boundaries

12.3.2.1 Project Area

As described in **Chapter 5 Project Description**, the Project Area is divided into landfall, nearshore and offshore sections. This division is based on technical consideration of different construction activities to be employed in each section, and therefore the terms 'nearshore section' and 'offshore section' have no ecological meaning in this sense.

The landfall section includes four microtunnels that extend from onshore entry shafts, seaward, under the shoreline and under the seabed, to emerge from the seabed at a water depth of about 23 m, approximately 400 m from the shoreline. The nearshore section then extends from the exit point of the microtunnels for approximately 425 m to the pipeline tie-in with the offshore section at a water depth of about 30 m. The offshore section then extends from this point for approximately 225 km to the boundary between the Russian and Turkish EEZs.

For the purpose of this chapter on marine ecology, the nearshore is considered to also include the area from the shore to 23 m water depth, a distance of approximately 400 m which forms part of the "landfall section" as described for engineering reasons. Because these two sections of the Project Area are ecologically contiguous, they are considered as one in this chapter. From the microtunnel exit point the pipelines will be buried in trenches to a depth of approximately 2.5 to 3 m for a distance of approximately 170 m. From here, out to the edge of the nearshore section (30 m water depth), the pipelines will be coated in concrete and laid directly on the seabed.

During the Construction and Pre-Commissioning Phase of the Project the nearshore section of the Project Area is defined by the maritime safety exclusion zones around the construction vessels, extending out 3 km either side of the outermost pipeline, encompassing:

- The area impacted by sediment dispersion, based on sediment models;
- The route of the four individual pipelines;
- The likely anchor spread and movement locations of vessels directly associated with the pipeline installation and maintenance; and
- The proposed microtunnel exit pits.

The nearshore section Project Area (see **Chapter 5 Project Description** for further details) is approximately 5.2 km^2.

The offshore section is approximately 225 km in length and pipelines will be laid directly on the seabed from the maximum water depth where dredging works will take place (30 m water depth), to the boundary between the Russian and Turkish EEZs. The offshore section of the Project Area is primarily defined by the maritime safety exclusion zones around the construction vessels either side of the outermost pipeline. The Project Area of the offshore section consists of a corridor of 3 km from the boundary of the nearshore section to the 600 m water depth contour, after which the corridor decreases to 2 km width either side of the outermost pipeline from the 600 m water depth contour to the EEZ boundary. The change in corridor width is based on the type of pipe-lay vessel used (**Chapter 5 Project Description**). The offshore section of the Project Area encompasses:

- The route of the four individual pipelines; and
- The likely anchor spread and movement locations of vessels directly associated with the Pipeline installation and maintenance.

The offshore section is approximately 1,080 km^2 which is 206 km^2 from the nearshore boundary to the 600 m water depth contour and 874 km^2 from this to the EEZ boundary.

During the Operational Phase the Project Area will be smaller, defined by the operational exclusion zone of 0.5 km either side of the outside pipelines from the microtunnel exit point to the Russian / Turkish EEZ boundary (end of offshore section).

12.3.2.2 Study Area

The Study Area, or Zone of Influence, for the marine environment has been defined as the area that will encompass the largest extent of predicted potential impacts. In order to capture all impacts, including long range acoustic disturbance, this has been set at a nominal 100 km distance from the Project Area. The baseline study (both secondary and primary data) covers this Study Area. Relevant areas to survey within the Study Area have been determined based on the nature of individual receptors as described below.

12.3.2.3 Survey Areas

Surveys undertaken in 2013 (Section 12.3.3.3) were within the boundaries of the Study Area. The locations of and information related to these surveys are displayed in Table 12.1 and Figure 12.1. Survey Areas refer to the locations in which surveys were conducted for the Project during the feasibility and design stages from 2009 to 2013. The locations of and information related to these surveys (Ref. 12.1; Ref. 12.2) are displayed in Table 12.1 and Figure 12.1. The Survey Areas are separated for each topic (i.e. plankton, seabirds, etc.) and are defined under the topic headings in Section 12.4. Figures within each topic heading show the extent of the Survey Areas for each topic. These figures are:

- Plankton: Figure 12.2;
- Benthic: Figure 12.4;
- Fish: Figure 12.10;
- Seabirds: Figure 12.11 and Figure 12.12; and
- Marine mammals: Figure 12.17.

12.3.3 Baseline Data

Secondary data (i.e. data from third parties not specifically acquired for the Project, including literature reviews, etc.) and existing primary data (i.e. data acquired specifically for the Project through dedicated surveys) were reviewed prior to scoping. Following this, a data gap analysis was conducted and surveys to collect additional primary data were specified. The majority of the baseline information used to support this chapter comes from the results of marine surveys specifically conducted for the Project from 2009 to 2011 (Ref. 12.1), and in 2013 (Ref. 12.2). Details of the survey scopes are given in Section 12.3.3.3.

12.3.3.1 Secondary Data

Where possible, this assessment is based on primary data. Secondary Data were also consulted to inform the baseline of this chapter, as described below:

- The 2009 to 2011 survey reports (Ref. 12.1) included a thorough review of Russian published scientific literature that has been incorporated into this baseline as appropriate;
- Other recent published scientific literature was identified through a British Library data search;
- International, Federal and Regional Red Data Books were consulted in order to identify the potential presence of notable plant and animal species within the Survey Area (Ref. 12.3);
- Designation information for Utrish Specially Protected Natural Area (SPNA)was obtained from a 2009 World Wildlife Fund (WWF) report (Ref. 12.4);

- Information on fish, benthic communities, macroalgae and historic changes in the Black Sea flora and fauna are found in the Black Sea Commission "State of the Environment" reports (Refs. 12.5 to 12.11); and
- Other accounts of Black Sea ecology have been produced by regional NGOs and multilateral organisations e.g. the Agreement on the Conservation of Cetaceans in the Black Sea, Mediterranean Sea and contiguous Atlantic area (ACCOBAMS) (Ref. 12.12).

12.3.3.2 Data Gaps

As part of the data collection exercise, a gap analysis was conducted to identify areas where existing baseline data were insufficiently detailed to allow for a robust assessment. Furthermore, as the project design has evolved, the potential footprint of the activities has changed. Where secondary data were insufficient to meet these requirements, additional surveys were performed to:

- Increase the data coverage of some surveyed areas, by a combination of denser sampling and the use of underwater video and still photography; and
- Collect data along the modified pipeline alignment, in temporary spoil storage areas and in the proposed spoil dumping ground as well as in areas where the pipeline route changed from the route originally surveyed in the 2009 to 2011 surveys (Ref. 12.1).

The additional surveys undertaken to address the identified data gaps included:

- Benthic ecology surveys;
- Sediment sampling; and
- Visual seabird and marine mammal surveys.

12.3.3.3 Primary Data / Baseline Surveys

A series of marine surveys was conducted between 2009 and 2011 to collect data on marine ecological receptors that might be impacted by the project. These surveys collected ecological and physico-chemical data over a wide area and during several seasons. These surveys served to establish the broad environmental parameters of the Study Area, albeit at relatively low resolution.

Following the gap analysis described above, additional surveys were undertaken in 2013 to:

- Verify and supplement the findings of the previous benthic surveys (Ref. 12.1) in order to obtain a robust benthic habitats map for the assessment of impacts and to act as a baseline for future monitoring; and
- Expand the survey data set to capture areas which have the potential to be affected by the Project that were not previously surveyed, following finalisation of the pipeline alignment.

Table 12.1 and Table 12.2 list the marine ecology surveys undertaken. The survey sampling stations are shown in (Figure 12.1). Survey methodologies are summarised in Table 12.3.

Table 12.1 Marine Ecology Surveys (2009-2011)

Station	Water depth (m)	Distance from shore (km)	Phytoplankton, bacterioplankton, ichthyoplankton			Zooplankton		Photosynthetic pigments of phytoplankton		Macro-zoobenthos				Macro-phytobenthos				Fish			Seabirds and marine mammals*	
			Autumn 2010	Spring 2011	Summer 2011	Autumn 2010	Spring 2011	Autumn 2010	Spring 2011	Summer 2009	Autumn 2010	Spring 2011	Summer 2011	Summer 2009	Autumn 2010	Spring 2011	Summer 2011	Nov 2010	June 2011	Nov 2011	Autumn 2010	Spring 2011
1	32	15.1	✓	✓	-	✓	✓	✓	✓	-	✓	✓	-	-	-	✓	-	✓	✓		✓	✓
2	17	0.4	✓	✓	-	✓	✓	✓	✓	-	✓	✓	-	-	-	✓	-	✓	✓		✓	✓
3	87	7.2	✓	✓	-	✓	✓	✓	✓	-	✓	✓	-	-	-	✓	-	✓	✓		✓	✓
3a	50-100	6.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-	✓
4	50-100	2.9	-	-	-	-	-	-	-	-	✓	-	-	-	-	-	-	✓	✓		✓	-
5	~1,000	10.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	✓	✓		-	✓
6	1,510	23.4	✓	✓	-	✓	✓	✓	✓	-	-	-	-	-	-	-	-	✓	✓		✓	✓

Continued...

Station	Water depth (m)	Distance from shore (km)	Phytoplankton, bacterioplankton, ichthyoplankton			Zooplankton		Photosynthetic pigments of phytoplankton		Macro-zoobenthos				Macro-phytobenthos				Fish			Seabirds and marine mammals*	
			Autumn 2010	Spring 2011	Summer 2011	Autumn 2010	Spring 2011	Autumn 2010	Spring 2011	Summer 2009	Autumn 2010	Spring 2011	Summer 2011	Summer 2009	Autumn 2010	Spring 2011	Summer 2011	Nov 2010	June 2011	Nov 2011	Autumn 2010	Spring 2011
7	~1,700	39.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	✓	✓		-	✓
8	1,558	43.2	✓	✓	-	✓	✓	✓	✓	-	-	-	-	-	-	-	-	✓	✓		✓	-
9	2,082	67.6	-	✓	-	-	✓	-	✓	-	-	-	-	-	-	-	-	✓	✓		-	✓
10	2,040	98.5	-	✓	-	-	✓	-	✓	-	-	-	-	-	-	-	-		✓		-	✓
11	>2,000	104.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-	✓
12	>2,000	137.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-	✓
13	2,175	174.2	-	✓	-	-	✓	-	✓	-	-	-	-	-	-	-	-				-	✓
14	2,154	172.4	-	✓	-	-	✓	-	✓	-	-	-	-	-	-	-	-				-	-

Continued...

Station	Water depth (m)	Distance from shore (km)	Phytoplankton, bacterioplankton, ichthyoplankton			Zooplankton		Photosynthetic pigments of phytoplankton		Macro-zoobenthos				Macro-phytobenthos				Fish			Seabirds and marine mammals*	
			Autumn 2010	Spring 2011	Summer 2011	Autumn 2010	Spring 2011	Autumn 2010	Spring 2011	Summer 2009	Autumn 2010	Spring 2011	Summer 2011	Summer 2009	Autumn 2010	Spring 2011	Summer 2011	Nov 2010	June 2011	Nov 2011	Autumn 2010	Spring 2011
15	2,150	137.1	-	✓	-	-	✓	-	✓	-	-	-	-	-	-	-	-				-	-
16	2,133	106.7	-	✓	-	-	✓	-	✓	-	-	-	-	-	-	-	-				-	✓
17	1,822	41.9	✓**	✓	-	-	✓	-	✓	-	-	-	-	-	-	-	-				✓	-
18	95	8.2	✓	✓	-	✓	✓	✓	✓	-	✓	-	-	-	-	-	-				✓	✓
19	25	0.9	✓	✓	-	✓	✓	✓	✓	-	✓	-	-	-	-	-	-				✓	✓
1c	0-0.5	0	-	-	-	-	-	-	-	-	-	-	✓	-	-	-	✓				-	-
2c	10	0.2	-	-	-	-	-	-	-	-	-	-	✓	-	-	-	✓				-	-
3c	20	0.4	-	-	-	-	-	-	-	-	-	-	✓	-	-	-	✓				-	-

Continued...

Station	Water depth (m)	Distance from shore (km)	Phytoplankton, bacterioplankton, ichthyoplankton			Zooplankton		Photosynthetic pigments of phytoplankton		Macro-zoobenthos				Macro-phytobenthos				Fish			Seabirds and marine mammals*	
			Autumn 2010	Spring 2011	Summer 2011	Autumn 2010	Spring 2011	Autumn 2010	Spring 2011	Summer 2009	Autumn 2010	Spring 2011	Summer 2011	Summer 2009	Autumn 2010	Spring 2011	Summer 2011	Nov 2010	June 2011	Nov 2011	Autumn 2010	Spring 2011
4c/5s	0-0.5	0	-	-	✓***	-	-	-	-	✓	-	-	✓	✓	-	-	✓				-	-
5c/8s	20	0.4	-	-	-	-	-	-	-	✓	-	-	✓	✓	-	-	✓				-	-
6c/7s	10	0.2	-	-	-	-	-	-	-	✓	-	-	✓	✓	-	-	✓				-	-
7c/1s	0-0.5	0	-	-	-	-	-	-	-	✓	-	-	✓	✓	-	-	✓				-	-
8c/2s	10	0.2	-	-	-	-	-	-	-	✓	-	-	✓	✓	-	-	✓				-	-
9c/3s	0-0.5	0	-	-	-	-	-	-	-	✓	-	-	✓	✓	-	-	✓				-	-
10c/4s	10	0.2	-	-	-	-	-	-	-	✓	-	-	✓	✓	-	-	✓				-	-
11c/6s	20	0.3	-	-	-	-	-	-	-	✓	-	-	✓	✓	-	-	✓				-	-
12c	0-0.5	0	-	-	-	-	-	-	-	-	-	-	✓	-	-	-	✓				-	-

Continued...

Station	Water depth (m)	Distance from shore (km)	Phytoplankton, bacterioplankton, ichthyoplankton			Zooplankton		Photosynthetic pigments of phytoplankton		Macro-zoobenthos				Macro-phytobenthos				Fish			Seabirds and marine mammals*	
			Autumn 2010	Spring 2011	Summer 2011	Autumn 2010	Spring 2011	Autumn 2010	Spring 2011	Summer 2009	Autumn 2010	Spring 2011	Summer 2011	Summer 2009	Autumn 2010	Spring 2011	Summer 2011	Nov 2010	June 2011	Nov 2011	Autumn 2010	Spring 2011
13c	10	0.1	-	-	-	-	-	-	-	-	-	-	✓	-	-	-	✓				-	-
14c	20	0.4	-	-	-	-	-	-	-	-	-	-	✓	-	-	-	✓				-	-
Gillnets	<20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			✓	-	-

* - Seabird and marine mammal transects were also performed, originating at these stations.
** - no zooplankton recorded at this station
*** - phyto and zooplankton only recorded at this stations in August 2011. In addition to the above, fish trawls were conducted in November 2010 and April 2011 and fixed gillnets were used to survey in April 2011 (<20 m WD)

Complete.

Table 12.2 Marine Benthic Ecology, Marine Mammal and Seabird Surveys July 2013

Station	Water depth (m)	Sediment Particle Size Analysis	Macro-zoobenthos Grab Sampling	Seabed video sampling	Seabirds and marine mammals*
1	7			✓	✓
2	9			✓	✓
3	21	✓	✓	✓	✓
4	22	✓	✓	✓	✓
5	11			✓	✓
6	25	✓	✓	✓	✓
7	15	✓	✓	✓	✓
8	4			✓	✓
9	17	✓	✓	✓	✓
10	4			✓	✓
11	13			✓	✓
12	4			✓	✓
13	19			✓	✓
14	18	✓	✓	✓	✓
15	6			✓	✓
16	23	✓	✓	✓	✓
17	23	✓	✓	✓	✓
18	26	✓	✓	✓	✓
19	34	✓	✓	✓	✓
20	51	✓	✓	✓	✓

Continued…

Station	Water depth (m)	Sediment Particle Size Analysis	Macro-zoobenthos Grab Sampling	Seabed video sampling	Seabirds and marine mammals*
21	55	✓	✓	✓	✓
22	71	✓	✓	✓	✓
23	70	✓	✓	✓	✓
24	69	✓	✓	✓	✓
25	69	✓	✓	✓	✓
26	66	✓	✓	✓	✓
27	69	✓	✓	✓	✓
28	69	✓	✓	✓	✓
29	68	✓	✓	✓	✓
30	68	✓	✓	✓	✓
31	70	✓	✓	✓	✓
32	67	✓	✓	✓	✓
33	66	✓	✓	✓	✓
34	73	✓	✓	✓	✓
35	65	✓	✓	✓	✓
36	71	✓	✓	✓	✓
37	110	✓	✓	✓	✓
38	91	✓	✓	✓	✓
39	92	✓	✓	✓	✓
40	513	✓	✓	✓	✓
41	111	✓	✓	✓	✓

Continued…

Station	Water depth (m)	Sediment Particle Size Analysis	Macro-zoobenthos Grab Sampling	Seabed video sampling	Seabirds and marine mammals*
42	502	✓	✓	✓	✓
43	568	✓	✓	✓	✓
44	90	✓	✓	✓	✓
45	369	✓	✓	✓	✓
46	54	✓	✓	✓	✓
47	59	✓	✓	✓	✓
48	71	✓	✓	✓	✓
49	65	✓	✓	✓	✓
50	71	✓	✓	✓	✓
51	71	✓	✓	✓	✓

* - Seabird and marine mammal transects were also performed, originating at these stations.

Complete.

Table 12.3 Survey Methodologies

Receptor	Sampling method	May to June 2009	Nov 2010	April to June 2011	August 2011	2013
Bacterioplankton	Niskin bottle*	-	8 stations, 21 samples	14 stations, 39 samples		-
Phytoplankton	Niskin bottle*	-	8 stations, 21 samples	14 stations, 39 samples	1 station, 1 sample	-
Primary Production	Light-and-dark-bottle method**. Light intensity at depth measured with a Secchi disk†.	-	8 stations, 21 samples	14 stations, 39 samples		-
Zooplankton	Towed Juday net, 0.5 m/s speed Mesh size of 180 µm	-	8 stations, 8 samples	14 stations, 14 samples	1 station, 1 sample	-
Ichthyoplankton	Horizontal fishing with the IKS-80 fish roe net during 10-minute vessel circulation at speed 2.5 knots; Method of total (vertical) fishing (in the layers "bottom – 0 m" or "oxygen deficiency layer – 0 m"), during vessel stop and drifting.		8 stations, 16 samples	13 stations, 26 samples		-
Macro-phytobenthos	Photos within census frames: 25×25 cm (in 0-0.5 m water depth) and 50×50 cm – at the depth 10 and 20. One quantitative sample collected at each station Video transect of three stations (August 2011)	-	-	-	15 stations, 45 samples	-

Continued…

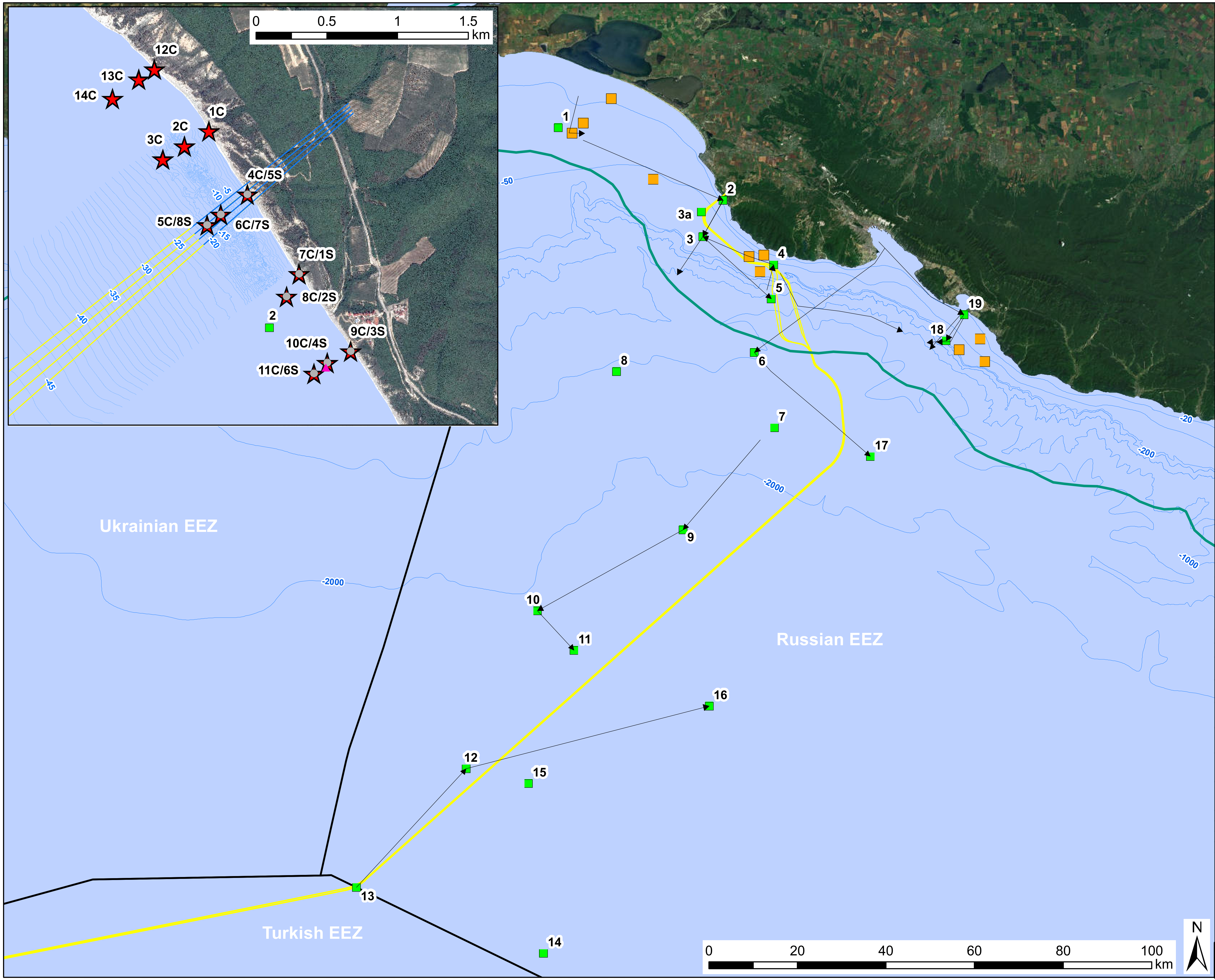
Receptor	Sampling method	May to June 2009	Nov 2010	April to June 2011	August 2011	2013
Macro-zoobenthos	Van Veen grab (0.1 m²), replicated (May-June 2009 & Nov 2010) Epifaunal collection of macroalgae by diving, replicated (August 2011) Video transect of three stations (August 2011)	8 stations, 24 samples	6 stations, 18 samples	-	15 stations, 45 samples	51 Stations
Fish	32 m multiple depth trawl with cod end. Trawling duration – 15 to 40 minutes, trawling speed – 2.8–3.2 knots. 4 trawls in water depths of less than 30 m, 3 trawls in water depths from 30 to 70 m, 2 trawls in the biotic water depths from 70 to 100 m (November 2010). 32 m multiple depth trawl with cod end. Trawling duration – 30 minutes, trawling speed – 3 knots (April – June 2011). Gillnets in 4 m to 21 m water depth, left in situ for 12 to 19 hours (May – June 2011)		9 trawls	10 trawls 4 gillnets		

Continued…

Receptor	Sampling method	May to June 2009	Nov 2010	April to June 2011	August 2011	2013
Seabirds & marine mammals	Observations were carried out visually, in the day-time. Daily duration of census made up no less than 7–8 hours. For species identification; 10x and 20x binoculars were used. Coastal surveys from coastal near Project Area		10 transects and stations, 9 transects during fish trawls	12 transects		

* A Niskin Bottle can be opened at both ends and the open bottle is lowered into the ocean on a wire from a Research Vessel until it reaches a certain depth and then the bottle is closed.
** A method used to determine the extent of Photosynthesis in an aquatic Ecosystem. Duplicate portions of a water sample are collected. One portion is incubated in a clear bottle, and the other is incubated in a dark, light-impermeable bottle. Following incubation for a prescribed time period, the net uptake of carbon dioxide in each is measured and compared.
† The Secchi disc is mounted on a pole or line, and lowered slowly down in the water. The depth at which the pattern on the disk is no longer visible is taken as a measure of the transparency of the water.

Complete.



LEGEND

Russian Sector of South Stream Offshore Pipeline

- Proposed microtunnels
- Proposed offshore pipelines
- 2009 sampling locations
- Autumn 2010 and Spring 2011 sampling stations
- Summer 2011 sampling stations
- Autumn 2010 and Spring 2011 seabird and mammal transects
- Autumn 2010 and Spring 2011 fish trawls
- Spring 2011 gillnets
- Russia territorial waters boundary
- Exclusive Economic Zone boundary
- Isobaths

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: For Information

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Project Title: SOUTH STREAM OFFSHORE PIPELINE

Drawing Title: MARINE ECOLOGY SURVEY SAMPLING LOCATIONS (2009-2011)

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Drawing Number: Figure 12.1 | Rev

Plot Date: 04 Mar 2014
File Name: I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA\Offshore Sampling\Figure 12.1 Marine Ecology Survey Sampling Locations (2009-2011).mxd

12.3.4 Data Assumptions and Limitations

In order to carry out this assessment, certain assumptions have been made regarding the input data, and it is acknowledged that some of the data used in the ESIA Report have attendant limitations:

- The assessment is based on a Project description that may be refined during detailed design. Nonetheless, the key design parameters are understood and the ESIA Report is based on these, with additional mitigations specified as appropriate. Design changes which may impact the results of this ESIA Report are captured in the management of change process discussed in **Chapter 5 Project Description**;
- Environmental standards may evolve during the lifetime of the Project. It is not possible to predict such changes but reference to Good International Industry Practice (GIIP) minimises the effect of this uncertainty;
- It has not been possible to provide definitive temporal trends in the baseline due to the differences in season of the various surveys undertaken. The two surveys that coincide (summer 2009 and summer 2013) are far enough apart that comparisons can only be tentative;
- Description of the deep sea environment is based on acoustic data interpretation as well as, some limited visual material and this makes it subjective to a degree. However, given the absence of potentially biogenic deep sea features in the Russian sector, this is not considered a risk to the assessment;
- There are no spatially continuous habitat data, thus mapping is the result of interpolating spot samples. Given the number of samples collected in the 2013 survey, this is considered adequate for the purposes of the assessment, but some uncertainty remains; and
- The ecology of seabirds and marine mammals in the Russian sector is not well understood (in terms of accurate details on migration, breeding etc.). Surveys undertaken for this Project give data on distribution but cannot provide this level of detail.

12.4 Baseline Characteristics

12.4.1 Black Sea Overview

The Black Sea is a semi-enclosed basin and is one of the most isolated from the major world oceans. It has connections to the Mediterranean Sea through the Bosphorus Strait and the Dardanelles Strait in the south-west, and with the Sea of Azov in the north-east through the Kerch Strait. It is a largely brackish water body, with a salinity of 17 to 18‰ on average, due to the massive freshwater influx from rivers including the Danube, Dnieper and Don via the Sea of Azov.

There are two layers of water with different salinity in the Black Sea. An upper brackish layer, with an average salinity of 17‰, results from the massive freshwater influx from rivers including the Danube, Dnieper and Don via the Sea of Azov. Below this is a layer of higher salinity seawater (20 to 30‰), originating from the Mediterranean. This stratification, which creates a distinct and permanent pycnocline[1] around 150 to 200 m, limits the vertical exchange of water between the surface and deeper waters creating a unique chemical and biological environment. Further details of environmental quality, hydrodynamics and seabed dynamics are set out in **Chapter 7 Physical and Geophysical Environment**.

These chemical and biological characteristics have resulted in the following broad marine habitat types in the Black Sea:

- Surface waters (typically 0 to 50 m water depth) are well oxygenated and have a fairly low salinity (typically 18-22‰). Because this zone is photic, it is biologically productive and has historically supported large populations of pelagic fish. There are a number of different benthic habitat types within these shallow waters:
    - Rocky substrates are present throughout the shallow area, including the supralittoral sea cliffs. Hard substrata are important as they allow the development of macroalgal beds that in turn support a highly diverse array of fauna;
    - Sandy sediments are also present in shallow areas where material has been deposited and wave energy has winnowed out fine material. These zones support a range of infaunal communities, typically bivalve dominated; and
    - Mud sediments are present in some low energy areas between 10 to 20 m water depth supporting infaunal communities.
- Mid-depth waters (approximately 50 to 100 m water depth) show decreasing oxygen concentrations and increasing salinity due to the influence of the bottom layer. This is typically referred to as the suboxic zone where the concentrations of both oxygen (O_2) and hydrogen sulphide (H_2S) are extremely low and do not exhibit any perceptible vertical or horizontal gradients (Ref. 12.13). Benthic habitats at these depths, where wave energy at the seabed is largely absent, are often muddy sediments; and
- In deep waters (below about 150 to 200 m) conditions are anoxic, and together with increased H_2S concentrations, restrict the vertical distribution of pelagic and bottom-dwelling metazoan organisms. This lower water layer accounts for as much as 87% of the Black Sea. Muddy sediments predominate in deeper waters, and while little is known about the benthos of the deep Black Sea, chemosynthetic bacteria can occur here. For example, in the anoxic shelf of the north-western Black Sea numerous gas seeps are populated by methanotrophic microbial mats that can form tall reef-like structures, though such have not been detected along the Pipeline route in the Russian sector (Ref. 12.5 and Ref. 12.14).

The Black Sea has a very large catchment area to sea surface area ratio and a densely populated coastal zone, making it highly vulnerable to pressure from land-based human activity. Rapid economic development and a lack of adequate management of marine resources in the later decades of the 20th century resulted in major environmental and ecological changes in the Black Sea. In particular, eutrophication from land-based sources resulted in changes to the diversity and distribution of flora and fauna throughout the Black Sea ecosystem.

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[1] A pycnocline is the cline or layer where the density gradient is greatest within a body of water. Formation of pycnocline may result from changes in salinity or temperature.

Eutrophication gave rise to massive increases in primary production and a shift in the abundance and composition of phytoplankton species in the Black Sea. Larger and more frequent algal blooms increased the flux of organic matter to the seabed inducing a sharp decline of dissolved oxygen and a silting of benthic communities in many areas. Increased incidence of harmful algal blooms (red tides) caused fish kills and the increased turbidity of the water column reduced light availability to benthic macrophytes and seaweeds in deeper waters. The distribution and extent of many algal species, including the red alga *Phyllophora* and the brown *Cystoseira barbata*, that inhabits rocky coasts, have reduced considerably in many areas of the Black Sea including the Russian coast.

There have been corresponding changes in zooplankton, with the loss of some species and a shift from larger to smaller species of crustacean. There has also been a sharp increase in the number of gelatinous species such as jellyfish, although the most drastic change in the zooplankton communities resulted from the invasion of the ctenophore, *Mnemiopsis leidyi*. This species is a voracious predator of copepods, which are important prey items for larval and juvenile fish (Ref. 12.15), and is a direct predator of fish eggs and larvae. The negative effects of this invasion are only recently showing signs of reversal.

Other human activities, in particular uncontrolled fisheries have added to the change in the structure and dynamics of the biology of the Black Sea.

Since the early 2000s, the governments of the Black Sea coastal states have adopted a basin wide approach to pollution prevention, with a strategic goal of restoring the ecological status of the Black Sea to a condition similar to that of the 1960s. Pollution pressure from land based sources although still intense shows a decreasing trend and some improvements in ecological status have been observed. For example, some species that disappeared appear to be recovering and the number and intensity of algal blooms is reported to be lower for all areas (Ref. 12.10).

Information presented in this report on benthic communities focuses on shallower waters of less than approximately 200 m because the diversity and abundance of benthic fauna and flora decreases rapidly with increasing depth due to decreasing light, increasing anoxia and high concentrations of H_2S. Beyond 200 m conditions are completely anoxic. The seabed of the deeper parts of the Black Sea is therefore unlikely to support significant macro- or meiofaunal communities (Ref. 12.9). Microbial reefs associated with mud volcanoes or "gas seeps" are known to occur in waters deeper than 200 m in some western areas of the Black Sea (Ref. 12.16); however, none have been recorded in the Study Area.

This section on baseline characteristics describes the marine habitats, flora and fauna of the Study Area and has been separated into the following sub-sections:

- Plankton;
- Benthic communities;
- Fish;
- Seabirds;
- Marine mammals; and

- Protected Areas and Species.

12.4.2 Plankton

12.4.2.1 Background

Plankton forms the basis of marine food webs and is therefore essential to the structure and functioning of marine ecosystems. As phytoplankton are photosynthetic, they are generally confined to the euphotic zone – the depth of water exposed to sufficient sunlight for photosynthesis to occur; in the open ocean this is typically around 200 m, although in the Black Sea it is in the order of 50 m. Vertical distribution of plankton in the Black Sea is also influenced by the decrease in oxygen from 50 to 100 m water depth (Ref. 12.9).

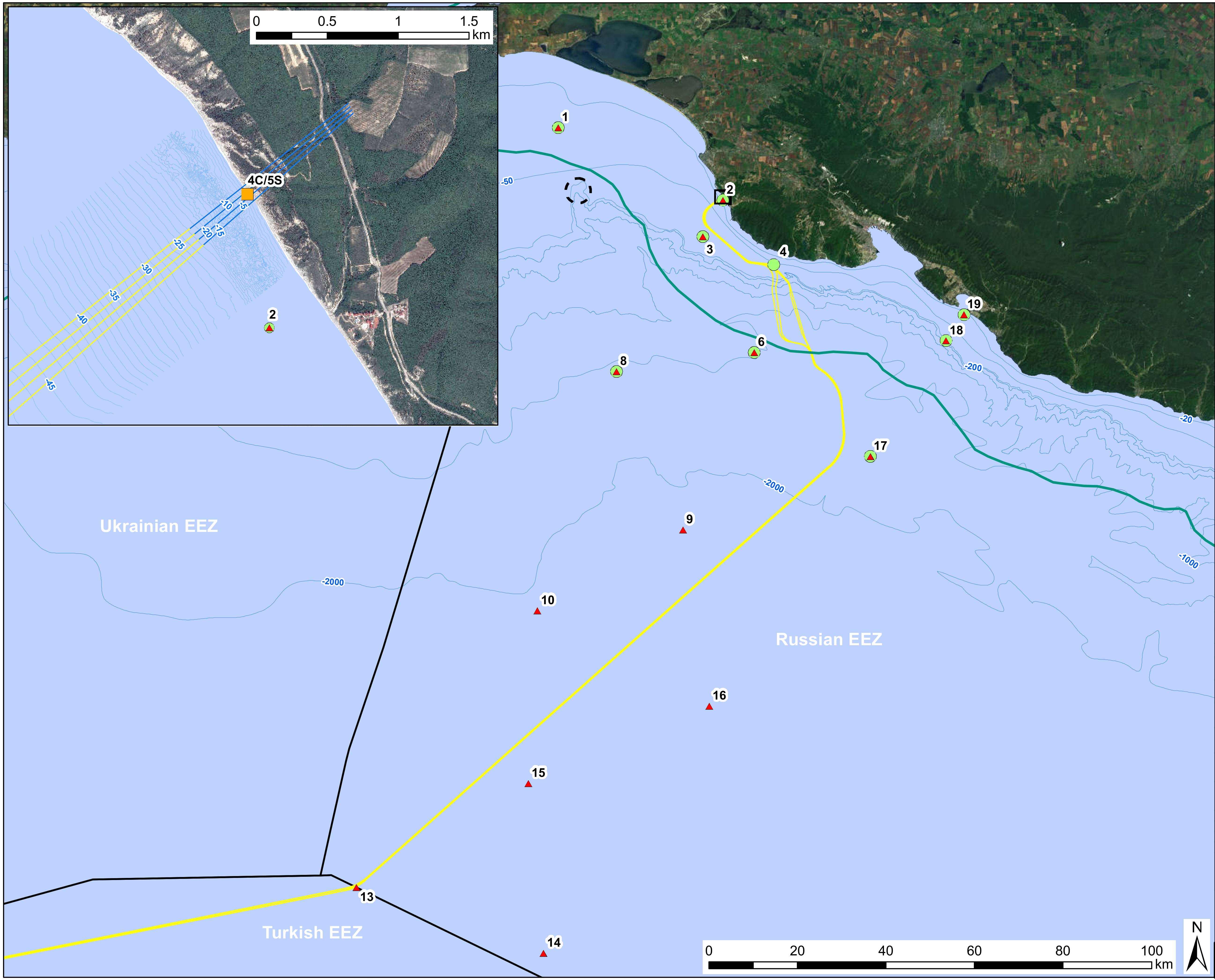
Significant changes in the phytoplankton community were observed within the Black Sea between 1985 and 1994. The existing seasonal succession pattern of a spring diatom bloom followed by blooms of dinoflagellates and then phytoflagellates was disrupted, with a reduction in the diatom component of the spring bloom. This fundamental shift still persists. The reasons for this are not clearly understood, but a variety of natural and anthropogenic causes have been postulated, including a cold period from 1985 to 1994 (Ref. 12.10), hot summers and early warming of the surface layer (Ref. 12.1), damming of the Danube River and a reduction in silicate inputs (Ref. 12.17), and a reduction in inorganic nutrients allowing coccolithophorids to more successfully compete with diatoms (Ref. 12.1).

Historical changes have also occurred in the zooplankton of the north-eastern shelf of the Black Sea, particularly through the accidental introduction of the predatory ctenophore (comb jelly), *Mnemiopsis leidyi*. This introduced species preyed on the indigenous plankton of the Black Sea which led to a major decline in copepod (a type of planktonic crustacean) populations (Ref. 12.7). This situation persisted until 1997 to 1998, with another accidental introduction, possibly from ship ballast water, of the ctenophore *Beroë ovata* (Ref. 12.6). This species is the main predator of *M. leidyi* and subsequently the zooplankton community began to recover both in species composition and abundance (Ref. 12.18).

12.4.2.2 Plankton Survey

Survey Area

Plankton samples were collected at the locations shown in Figure 12.2. Bacterioplankton, phytoplankton, zooplankton and ichthyoplankton were analysed. Summary information on the water depth, distance from shore, as well as survey methodologies is provided in Table 12.1 and Table 12.3.



LEGEND

Russian Sector of South Stream Offshore Pipeline

- Proposed microtunnels
- Proposed offshore pipelines
- Plankton sampling stations (November 2010)
- Plankton sampling stations (April-June 2011)
- Plankton sampling stations (August 2011)
- Licenced disposal site 923
- Russia territorial waters boundary
- Exclusive Economic Zone boundary
- Isobaths

Projection: Lambert Conformal Conic

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Plot Date: 12 Mar 2014
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Survey Results

Phytoplankton and Primary Production

In autumn (November) 2010, 75 species of phytoplankton were recorded from a total of eight sampling stations. Dinoflagellates represented 52% of the total number of species and were more abundant in the northern samples of the Survey Area (Stations 1 to 3 in water depths of 32 m and 87 m respectively). Diatoms comprised 29% of the total number of species and were more abundant in the south of the Survey Area, around Gelendzhik (Stations 18 and 19 in water depths of 95 m and 25 m respectively) (Ref. 12.1, Table 12.4).

Table 12.4 Taxonomic Composition of Phytoplankton

Systematic group	Autumn 2010		Spring 2011	
	Number of species	% of total number of species	Number of species	% of total number of species
Diatoms	22 (10 L-B)	29 (45% L-B)	28 (18 L-B)	37.4 (64% L-B)
Dinoflagellates	39	52%	39	52%
Chlorophyta	4	5.4%	1	1.3%
Chrysophytes	3	4%	3	4%
Cyanobacteria	2	2.7%	2	2.7%
Cryptomonads	2	2.7%	1	1.3%
Coccolithophorids	1	1.4%	1	1.3%
Euglenophytes	1	1.4%	-	-
Alveolates*	-	-	1	1.3%
Total	**75**	**100**	**75**	**100**

Note: L-B – littoral-benthic species,* - alveolates are protists and include protozoa, ciliates and dinoflagellates

Phytoplankton of the Survey Area were typically marine, with some species associated with lower salinity observed in the surface layer at Stations 1, 18 and 19 (in water depths of 32 m, 95 m and 25 m respectively). However, the contribution of these low salinity species to the community abundance was not substantial; accounting for 8% of the total number of phytoplankton species. In the autumn of 2010, the coccolithophorid *Emiliania huxleyi* was the dominant species in terms of abundance at all stations (Table 12.5).

Table 12.5 Abundance of Dominant Phytoplankton Taxa in November 2010 and April 2011 Surveys

Species name	Maximum abundance, cells per litres (cell/l) (Autumn 2010)	Maximum abundance, cell/l (Spring 2011)	Station No. (Autumn 2010)	Station No. (Spring 2011)
Dominants				
Small flagellates (cells between 2 and 10 μm)	$1.6x10^6$	$4.4x10^7$	18	19
Picoplankton (cells between 0.2 and 2 μm)	Not recorded	$4.2x10^8$	-	19
Emiliania huxleyi	2.8×10^5	$1.2x10^6$	1	18
Subdominants				
Prorocentrum cordatum (dinoflagellate)	9.6×10^3	10.8×10^3	18	1
Thalassionema nitzschioides (diatom)	$6.0x10^3$	$1.6x10^5$	2	16
Prorocentrum micans (dinoflagellate)	2,000	Not recorded	18	-
Gonyaulax polygramma (dinoflagellate)	Not recorded	$6x10^3$	-	19

For all stations and depths sampled in autumn 2010, the greatest contribution to phytoplankton biomass was made by dinoflagellates (up to 90%, Station 19, depth of 0 m), small flagellates (up to 84%, Station 18, the near-bottom layer) and coccolithophorids (up to 50%, Station 1, depth of 30 m). Maximum phytoplankton biomass was, unsurprisingly, recorded in the well–lit surface layer (Ref. 12.1) and generally, the biomass of near bottom samples at all stations was half that of the surface layer most likely because of lower light levels. However, high variability in phytoplankton biomass was observed, a feature typical of phytoplankton populations.

In spring (April) 2011, 75 species of phytoplankton algae were recorded from 14 stations in the Survey Area. Dinoflagellates (52% of the total number of species) dominated in terms of number of species. Diatoms (37.4% of the total number of species) ranked second by abundance after coccolithophorids. There was a high percentage of littoral-benthic forms (up to 64% of the number of diatoms) in the water column as a result of intensive mixing at the shallow-water stations (Stations 1, 2 and 19; less than 30 m water depth). In coastal shallow waters, up to 30 m water depth, a fairly uniform vertical distribution of algae was observed (Ref. 12.1). The highest abundance of phytoplankton was observed at Stations 2 and 19 in 17 m and 25 m water depth respectively.

In spring 2011, when the contribution of picoplankton is discounted, coccolithophorids dominated the total biomass. This is comparable to 2002-2009 data collected from the north-eastern shelf of the Black Sea although a lack of information regarding survey methodology creates a level of uncertainty with this comparison (Ref. 12.1).

A comparison of the dominant species in terms of number between autumn 2010 and spring 2011 surveys is shown in Table 12.5. The data show that phytoplankton are more abundant around the time of the seasonal spring bloom (March to May) as would be expected (Table 12.5).

In summer 2011, 13 species of phytoplankton were recorded at Station 4c. The main contribution to the biomass was from the diatom *Pseudosolenia calcar-avis* (approximately 56% of the total biomass).

Data on primary production and photosynthetic pigment concentration in the Survey Area in spring 2011 are consistent with published data for the spring period of other years (Demidov, 2008 in Ref. 12.1). Two coastal stations (Stations 18 and 19 near Gelendzhik, at water depths of 95 and 25 m respectively) had higher concentrations of chlorophyll and other pigments, possibly due to anthropogenic eutrophication (Ref. 12.1). The biomass of phytoplankton and annual primary production in the Survey Area suggests a mesotrophic nutrient status in the Survey Area (i.e. water containing moderate levels of inorganic nutrients) (Ref. 12.1). Low values for primary production were recorded in Spring 2011 at stations 18 and 19 (in water depths of 95 m and 25 m, respectively) which was attributed to an increase in suspended sediments and corresponding turbidity of the water column and a result of a storm event (Ref. 12.1.).

Zooplankton

Zooplankton samples were collected in autumn 2010 and spring 2011 (Figure 12.2) at the following locations:

- Stations 1 to 4, 6, 8, 17, 18, 19 in November 2010;
- Stations 1-3, 6, 8, 9, 10, and 13 to 19 in April 2011; and
- Station 4c in August 2011.

Surveys conducted in autumn 2010 (Ref. 12.1) identified 24 species of zooplankton (Figure 12.6), including meroplankton[2]. Copepods were the most diverse component of the community and dominated zooplankton abundance at most stations. Across all samples, copepods accounted for an average of 86% of total biomass. Other permanent members of the zooplankton were chaetognaths (arrow worms), ctenophores (comb jellies) and larvaceans (pelagic tunicates) and the meroplankton was composed of the larvae of benthic groups such as bivalves, gastropods, ascidians and barnacles. Arrow worms accounted for an average of 12%

[2] Species which are only planktonic for some stages of their life cycle

of total biomass. The greatest abundance of zooplankton was at Stations 2 and 18 (in water depths of 17 m and 95 m, respectively).

In April, 2011, 14 species of zooplankton were recorded from 14 samples in the Survey Area (Table 12.6) and the dominant taxa were the copepod crustaceans which accounted for between 68 and 96% of total abundance. Large heterotrophic dinoflagellates and the larvae of molluscs were the next most abundant groups. Highest abundance values were observed at Stations 6 and 8 which are located around 1,500 m water depth near the continental slope edge (Ref. 12.1). The number of species of the meroplankton, primarily the larvae of benthic species, was much lower in spring 2011 compared to autumn 2010.

Table 12.6 Zooplankton Species Observed in 2010 and 2011

Group	Species / form	Autumn 2010	Spring 2011	Summer 2011
No of stations sampled		8	14	1
Dinoflagellates[3]	*Noctiluca scintillans*		H	
Hydrozoans	*Sarsia tubulosa*[4]			M
Ctenophora (comb jellies)	*Pleurobrachia rhodopis*		H	
Cladocera (water fleas)	*Penilia avirostris*	H		H
	Pleopis polyphemoides	H		
	Pleopis tergestina	H		
	Evadne spinifera			H
Calanoid copepods	*Calanus euxinus*	H	H	
	Pseudocalanus elongatus	H	H	
	Paracalanus parvus	H	H	
	Acartia clausi	H	H	H
	Centropages ponticus	H	H	H

Continued…

[3] Dinoflagellates may functionally belong to both phytoplankton and zooplankton; many species are photosynthetic and grouped with the former while larger predatory or grazing forms are grouped with the latter.
[4] Reported as Coryne tubulosa.

Group	Species / form	Autumn 2010	Spring 2011	Summer 2011
	Calanoida, nauplii	M		
Cyclopoid copepods	*Oithona similis*	H	H	
	Oithona nana	H		
	Cyclopoida, nauplii	H		
Harpacticoid copepods	*Ectinosoma* sp.	H		
Cirripedia (barnacles)	Nauplius larvae	M	M	M
Ostracoda (seed shrimps)	*Euphilomedes interpuncta*	M		
Decapoda (crabs, prawns, etc)	Zoëa larvae	M		M
Bivalvia (clams and mussels)	Veliger larvae	M	M	M
Gastropoda (snails)	Larvae	M	M	
Nematoda (roundworms)	Nematoda sp.	M		
Polychaeta (segmented worms)	*Vigtorniella zaikai*	M		
	Spio filicornis			H
Chaetognatha (arrow worms)	*Sagitta setosa*	H	H	H
Copelata (larvaceans)	*Oikopleura dioica*	H	H	H
Tunicata (sea squirts)	Ascidia, larvae	M		
Pisces	Larvae and eggs	M	M	
Total taxa observed		**23**	**14**	**11**

Note: H= Holoplankton (permanent plankton) M= Meroplankton (temporary plankton e.g. larvae etc.)

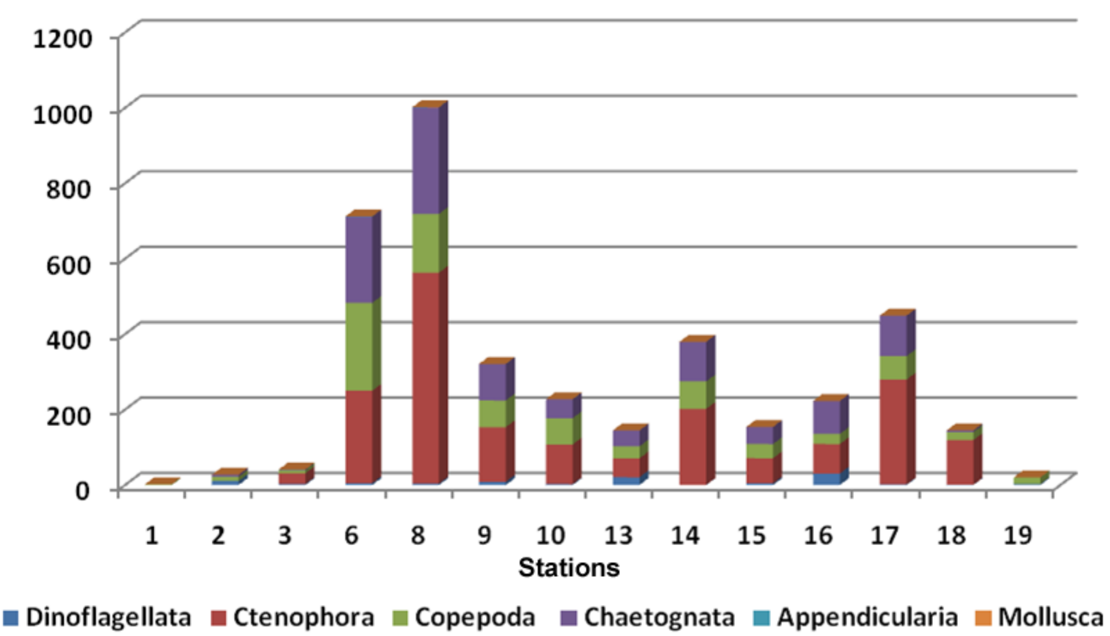
Complete.

The abundance and biomass of zooplankton was spatially highly variable. This difference between stations is typical of the highly patchy nature of zooplankton. Abundance varied between 78 and 3990 individuals/m^3 and biomass from 2 to 1001 mg/m3 per station. Stations located in depths less than 150 m (Stations 1 to 3, 18 and 19) were characterised by large biomass, but lower abundance of zooplankton due to the presence of larger animals such as arrow worms. Station 6 and 8 (water depth of around 1,500 m) had the greatest zooplankton biomass (Figure 12.3).

The biomass of zooplankton was lowest in Stations 1, 2, 3 and 19 (water depths of less than 100 m). In terms of numbers, the community was dominated by arrow worms such as *Sagitta* sp. and mature stages of copepods. Predatory species such as *Sagitta setosa* and the ctenophore *Pleurobrachia rhodopis* dominated the biomass in the majority of deep water stations (i.e. stations in water depths of > 1,500 m) (Ref. 12.1).

Only 11 species of zooplankton were recorded in summer 2011 as only one location was surveyed; Station 4c at less than 20 m water depth (Figure 12.2). Cladocerans dominated the zooplankton community, comprising almost half the abundance and 45% of the biomass. The thermophilic cladoceran *Penilia avirostris* was the most common species (Ref. 12.1).

Figure 12.3 Zooplankton Biomass (g/m^3), Spring 2011



Ichthyoplankton

Ichthyoplankton samples were collected in 2010 and 2011 (see Figure 12.2) at the following locations:

- Stations 1 to 3, 6, 8 and 17 to 19 in November, 2010; and
- Stations 1 to 3, 6, 8, 9, 10 and 13 to 19 in April, 2011.

During the November 2010 survey, the only ichthyoplankton recorded were eggs and larvae of sprat (*Sprattus sprattus*) and whiting (*Merlangius merlangus*). This could be due to the survey period not coinciding with the reproduction period of most fish inhabiting this area of the Black Sea (Ref. 12.1). The maximum abundance in 2010 was observed in coastal areas with the maximum abundance of eggs recorded at Station 1 and larvae at Station 19 in 32 and 25 m water depth respectively (Table 12.1).

Eggs and larvae of fish were determined at almost all stations of the survey. In April 2011, eggs and larvae of sprat were determined at only three of the stations (Station 3, 8 and 17). However, in almost every sample there were young fish of launce (*Gymnamodytes cicerelus*), blennies (*Blennius sp*.) and stickleback (*Pungitius sp*.). During the April 2011 survey, larvae of sprat and prickly pipefish (*Syngnathus phlegon schmidti*) were most numerous (Ref. 12.1).

There were no larvae of any fish species of conservation concern (IUCN Red List or national / regional Red Data Books) collected from either survey.

12.4.2.3 Summary

The phytoplankton community observed in Russian waters was composed of typical marine species, some of which are found in lower salinities. The number of species observed was different between surveys with 75 species recorded from eight stations in spring 2010 and 75 species recorded from 14 stations in autumn 2011. In both surveys, species composition was dominated by dinoflagellates (just over half of all species) and diatoms (around 30%). In terms of abundance small flagellates (a group which can contain some dinoflagallates) dominated the phytoplankton in both surveys. In both 2010 and 2011, phytoplankton species were more abundant at stations in less than 100 m water depth and the highest abundances were generally recorded at the surface. This is to be expected as phytoplankton are photosynthetic species and are usually observed in highest numbers in this euphotic zone which, extends to a depth of 50 m in the Black Sea.

The biomass and production of phytoplankton in the Survey Area suggests a mesotrophic nutrient status which means that the waters are moderately productive with moderate nutrient levels.

Copepods were the most diverse component of the zooplankton community and were dominant in abundance at most stations in 2010 and 2011. In both years, the main contribution to the total biomass comprised four groups; copepods, ctenophores, arrow worms and flagellates. In April 2011, highest abundance values were observed at Stations 6 and 8 which are located around 1,500 m water depth near the continental slope edge whereas in November 2010, the greatest abundance of zooplankton was at Stations 2 and 18 (in water depths of 17 m and 95 m, respectively).

For ichthyoplankton, the difference in the composition during the autumn (2010) and spring (2011) periods corresponded to the reproductive periods of fish. The results of spring investigations in 2011 are comparable with stock data of AzNIIRKh (Azov Research Institute of Fish Industry) for different sectors of the Russian Sector of the Black Sea (Ref. 12.1).

In general, plankton species abundance and biomass was variable and greatest in the spring surveys which correspond with the seasonal bloom in phytoplankton and in turn zooplankton species.

12.4.3 Benthic communities

12.4.3.1 Background and Literature Review

Overview

The northeast region of the Black Sea has historically been considered to comprise two distinct regions: from the Kerch Strait to around Anapa and Gelendzhik in the north, and from Anapa and Gelendzhik to Adler in the south (Ref. 12.6). The oceanography and ecology of these two areas is understood to be distinct, and they have been variously affected by the changes that have affected the entire basin over the last few decades.

The invasion of the ctenophore *Mnemiopsis leidyi* (discussed in Section 12.4.1) affected the benthos by reducing both light and dissolved oxygen available to the seabed communities (through increased sedimentation[5]). Bivalve beds of *Chamelea* sp. and *Gouldia* sp. were displaced from deeper water and *Mytilus galloprovincialis* was completely eliminated at depths of 30 to 50 m. The subsequent reduction of M. leidyi numbers, as a result of predation by another invasive ctenophore, *Beroë ovata*, in the Black Sea resulted in a rapid increase in bivalve recruitment. This was in turn followed by a brief surge in numbers of the large predatory snail *Rapana venosa* as new prey resources became available. As the *R.venosa* population depleted its food resource, its population in turn collapsed and the benthic community became dominated by polychaete worms (Ref. 12.6).

Additional changes in ecology have been noted over the last ten years in relation to the southern region of the Russian coast of the Black Sea. For example, the once extensive areas of the seaweeds *Phyllophora* sp. and *Cystoseira* sp. have been reduced (Section 12.4.1). This has had significant implications for benthic ecology as the structurally complex red algae habitats were replaced by simpler, less diverse communities featuring fast growing pollution tolerant green algae (Ref. 12.6).

The nearshore Project Area runs through the Anapa Bank fishery protected zone. This is legally protected for a number of commercial fish species and is thought to be important for these species due to the benthic communities in the area. Anapa Bank is discussed in more detail in Section 12.4.8.1. In addition, the Utrish SPNA, which is protected for a number of macroalgal species, is located around 2 km at its closest point, from the Pipeline. This is also discussed in detail in Section 12.4.8.1.

Macrophytes

Macrophytes comprise macroalgae (seaweeds) and vascular plants (mainly seagrasses). They are key components of the marine ecosystem as primary producers, providing food to a wide variety of organisms either as living plant matter or detritus. Macrophytes also enrich water with

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[5] It has been shown, particularly in eutrophic waters that outbreaks of jellyfish predation can reduce or eliminate the grazing of zooplankton which results in an increased sedimentation of phytoplankton. This may cause severe oxygen depletion and release of nutrients from the anoxic sediment, creating a feedback system and exacerbating the effect (Ref. 12.16).

oxygen and take up dissolved organic matter, thus increasing the quality of coastal waters. Macrophyte stands serve as spawning grounds and shelter for many fishes and invertebrates.

Large perennial algae and grasses are thus habitat forming plants (edificators) in seabed communities that occupy significant areas on the continental shelf.

The marine flora of the Black Sea has been subject to significant changes in both biodiversity and abundance in the past few decades due to eutrophication. For example, a decrease in macrophyte diversity and reduction in extent of perennial algae, such as *Phyllophora* and *Cystoseira*, has been observed across most of the Black Sea together with an increase in the diversity and abundance of opportunist, fast growing green algae that are more tolerant of eutrophic conditions.

On the Russian coast of the Black Sea, macrophytes include some 143 species of macroalgae (41 species of green, 29 species of brown and 73 species of red) and six species of vascular plants (including two seagrass species of the genus *Zostera*). Both species of the seagrass *Zostera* (*Zostera marina* L. and *Z. noltii*) have declined drastically in the Black Sea due to pollution (Ref. 12.19). By the 1980s, seagrass communities on the North Caucasian coast of the Black Sea had practically disappeared (Ref. 12.1) and significant seagrass beds are now confined to Taman Bay and Dinskoy Bay, on the shore of the Strait of Kerch (Afanasiev, Korpakova, 2008 in Ref. 12.1).

The important changes in the past few decades are an increase in the diversity and abundance of green algae and a simultaneous decrease of brown species. There have also been geographical shifts in species distributions as some species have spread to the North Caucasian coast from the other regions of the basin (Ref. 12.1).

Although green algae have become increasingly common as a result of the ecological changes, particularly eutrophication, in past decades, brown algae, such as *Cystoseira* spp., are still locally the most important group in that they form the most widely spread communities throughout the region despite falling abundance and diversity. The stock of *Cystoseira* along the North Caucasus shore has declined from almost 2 million tons to no more than 100 thousand tons in the past 30 years (Ref. 12.8). Nonetheless, it remains the most widely spread and richest macroalgal community along the coast (Ref. 12.1).

Red algae are the most taxonomically diverse group, but form less extensive communities. Large perennial species such as *Phyllophora crispa* (also known as *P. nervosa*) and *Coccotylus truncatus (also known as P.brodiae*) and others, form perennial communities either alone or in combination with *Cystoseira*. This is in contrast to the western Black Sea, where *Phyllophora* was historically the most important alga, forming fields of thousands of hectares.

The type of macroalgal community present is dependent to a large extent on depth. Large scale zonation across the entire photic zone can be observed (Ref. 12.1. and Ref. 12.4) as follows:

- **The Upper photic zone** comprises mosaics of red, green and brown algae, 0 to 2 m water depth;
- **The Mid photic zone** features primarily brown algae, particularly of *Cystoseira* spp., in water depths around 2 to 10 m. These species support a high diversity of macrofauna (Ref. 12.4). There is also a high diversity of red algae, present as epiphytes and understory

cover. The density and extent of the *Cystoseira* zone is greatest at depths of 3 to 5 m. The distribution and density of this algal association has been considerably reduced in recent decades due to poor light penetration resulting from the effects of eutrophication and super-abundance of invasive ctenophores (Ref. 12.20); and

- **The Lower photic zone** (at depths below about 10 m) is characterised by a mosaic of different associations. Red algal species diversity is high although the recent ecological changes observed throughout the Black Sea have resulted in an increase in the presence of several species of green algae. The red alga *Phyllophora* is found at depths of 15 to 20 m though its extent and percentage cover have been considerably reduced in recent decades. In addition, there has been an increase in the presence of green algae at these depths, particularly of *Codium* spp. such that a *Phyllophora-Codium* association is recorded from many areas where *Phyllophora* alone was previously dominant.

Macrozoobenthos

Studies in the first half of the 20th century described the Black Sea benthic fauna as uniform and stable. The most common fauna were molluscs, polychaetes and crustaceans (Ref. 12.21). Since the mid-twentieth century, the benthos of the north-eastern Black Sea has undergone extensive changes. The first of these was the introduction, in 1947, of the large predatory snail *Rapana venosa* (also known as *R. thomasiana*). This resulted in a significant reduction in oyster beds in the Black Sea although it did not have an impact on the distribution of other species or communities (Ref. 12.1). As discussed in Section 12.4.3.1, as *R.venosa* depleted its food resource, its population collapsed and the soft sediment benthic community became dominated by polychaete worms. Another non-native species, the ark shell *Anadara cornea* (also reported as *A. inaequivalvis* and *Cunearca cornea*) became well established in the 1980s. It was first noted in the Black Sea in 1981 near the Bulgarian coast and in 1986 along the Caucasian coast in the region of Tuapse-Shepsy. It has since become one of the dominant benthic species (Ref. 12.9).

However, the greatest changes to the Black Sea benthos started in the 1980s as a result of eutrophication and increases in water turbidity due to increased primary production. The first changes became obvious in the coastal communities of the shelf region to the east of the Crimea peninsula, with shifts in the abundance and biomass of bivalve mollusc species. The common bivalve *Chamelea gallina* was seen to be replaced by more siltation resistant species such as *Polititapes petalina* and *Plagiocardium simile*. The small bivalve *Lucinella divarica*, found in abundances up to 6,500 individuals per square metre (ind./m^2), totally vanished from these communities. Similar shifts to siltation tolerant bivalve species and the final disappearance of *Chamelea gallina* from sand biotopes at depths of 20 to 25 m were observed in the 1980s in surveys carried out between Anapa and Gelendzhik on the north-eastern coast (Nikolaenko, Povchun, 1993 in Ref. 12.1).

Further changes to benthic communities resulted from the explosive proliferation of the ctenophore *Mnemiopsis leidyi* in the late 1980s. As a voracious predator *M. leidyi* reduced zooplankton numbers resulting in further increases in primary production and sedimentation of particulate matter to the benthos (Ref. 12.1). This sharp increase of turbidity caused significant changes in the distribution of macroalgae because of the reduction in light availability. There was a thinning out of the seaweed *Cystoseira*, a decrease in the depth limit to which the species was found and a general degradation of the deep-water vegetation at the southern part of the North Caucasian coast (Ref. 12.1). Another effect of the loss of algal cover was to make some mussels more available to predation by the snail *R. venosa*, resulting in an increase in the predator's numbers. The more recent arrival of a second invasive ctenophore, *Beroë ovata,* which is a predator of *M.leidyi,* has reversed this situation to some extent.

In the southern part of the North Caucasian coast, the reduction in oxygen levels over silty ground has given the bivalve invader *Anadara cornea* a competitive advantage over the previously dominant *Chamelea gallina.* By 1999 even the most developed *Chamelea gallina* communities in depths of 20-30 m had come to be dominated by the non-native species (Ref. 12.1).

Thus, the recent dynamics of the benthic communities of the North Caucasian coast of the Black Sea have been determined by the combined influence of two pelagic invaders *M. leidyi* and *B. ovata* combined with the influence of the carnivore invader *R. venosa* and the appearance of the bivalve competitor species *A. cornea* (Ref. 12.1).

Research carried out by the P.P. Shirshov Institute of Oceanology (summarised in Ref. 12.1) between 1999 and 2007 shows the communities of macrozoobenthos along the North Caucasian coast to be typical for the Black Sea. Coastal reefs and rocky ground to 12 m water depth have a dense cover of *Cystoseira* spp. and are occupied by a community dominated by the small bivalve *Mytilaster lineatus*, crustaceans, gastropod, various bryozoans and other encrusting animals. Permanent macrozoobenthos are absent from marginal littoral sandy areas (to 5 m) because of wave action and substrate instability. At depths between 7 and 20 m a community dominated by the bivalve *Chamelea gallina* is present. This has been replaced in deeper water (20 to 30 m) by *Anadara*, the edible mussel *Mytilus galloprovincialis* from approximately 35 to 50 m, and the horse mussel *Modiolula phaseolina* below 60 m. *Modiolula* beds may extend to the edge of the shelf although this would need to be confirmed by survey. A total of 120 benthic species have been recorded in the region.

12.4.3.2 Survey

Survey Area

The survey locations shown in Figure 12.4 make up the Survey Area discussed in this section for benthic communities. Information on the water depth and distance from shore of each station and survey methodologies is given in Table 12.1 and Table 12.3.

Survey Results

Macrophytobenthos

Phytobenthos surveys were conducted in 2009 and 2011 (Figure 12.4) at the following locations:

- In May to June 2009, samples were collected at Stations 1 to 8s; and
- In August 2011, samples were collected at Stations 1 to 14c, and video footage was obtained from a transect survey between Stations 4c to 6c.

In shallow waters, macroalgae communities were characterised by a relatively low biomass and the prevalence of green algae, primarily sea lettuce (*Ulva sp.*) and *Enteromorpha sp*[6]. At 10 m water depth, biomass was higher and *Cystoseira* was the dominant species. Over 15 m water depth, *Codium, Phyllophora* and in some cases sea lettuce, were dominant, but macroalgal biomass was lower than shallower areas (Ref. 12.1).

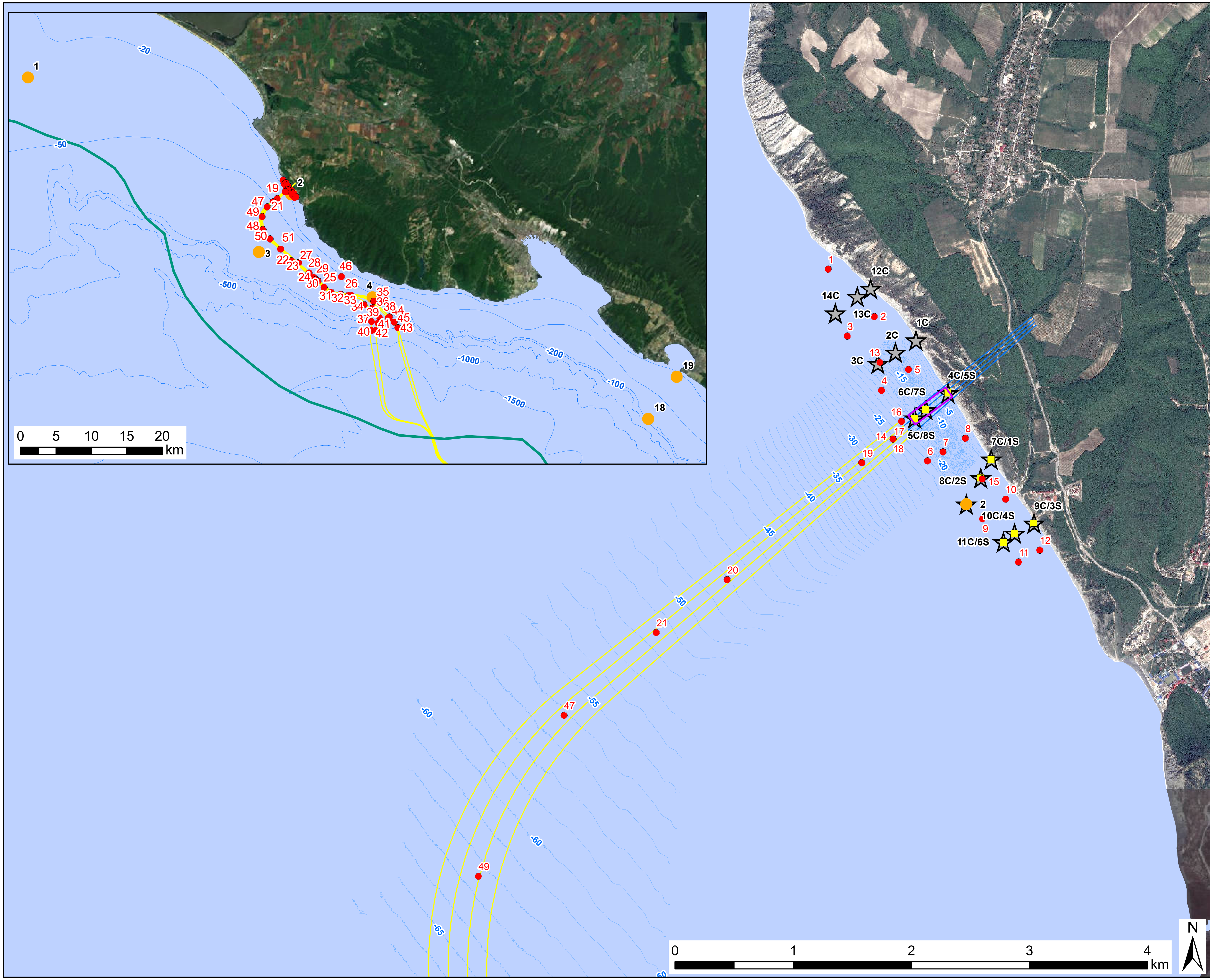
The following algal communities, generally on areas of bedrock and boulders, were observed:

- A *Cladophora dalmatica* community and a *Ceramium ciliatum* / *Padina pavonica* community in shallow waters at the coastline;
- A *Cystoseira crinite / Cystoseira barbata* community at a water depth of approximately 10 m, succeeded by a *Cladostephus spongiosus / Corallina elongata* community; and
- A *Codium vermilara* community succession towards 20 m water depth.

No vascular plants, in particular seagrasses of the *Zostera* genus, were observed during the 2009 and 2011 surveys.

Cladophora communities had the greatest algal biomass. The biodiversity of macroalgae increased with depth in the Survey Area (Figure 12.4). The highest algal diversity was noted at the stations situated at a depth of 20 m (in *Cystoseira* and *Codium* communities) and the lowest at stations in 0 m water depth.

[6] It is currently considered that Enteromorpha is synonymous with Ulva and all the relevant species are now in the latter genus.



LEGEND

Russian Sector of South Stream Offshore Pipeline

- Proposed microtunnels
- Proposed offshore pipelines
- Macrophyto & macrozoobenthos sampling stations (May-June 2009)
- Macrophyto & macrozoobenthos sampling stations (November 2010)
- Macrophyto & macrozoobenthos sampling stations (August 2011)
- Macrobenthos sampling stations July 2013
- Area of video sampling (August 2011)
- Russian territorial waters boundary
- Isobaths

Projection: Lambert Conformal Conic

Revision Details	By	Check	Check Date	Suffix

Purpose of Issue: For Information

Client: South Stream Offshore Pipeline — ENERGISING EUROPE

Project Title: SOUTH STREAM OFFSHORE PIPELINE

Drawing Title: BENTHIC SURVEY AREA FOR 2010, 2011 AND 2013 SURVEYS

Drawn	Checked	Approved	Date
DH	RW	MW	04 Mar 2014

URS Internal Project No.	Scale @ A3
46369082	1:30,000

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Drawing Number: Figure 12.4

Rev

Plot Date: 04 Mar 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA\Offshore Sampling\Figure 12.4 Benthic Survey Area for 2010, 2011 and 2013 Surveys.mxd

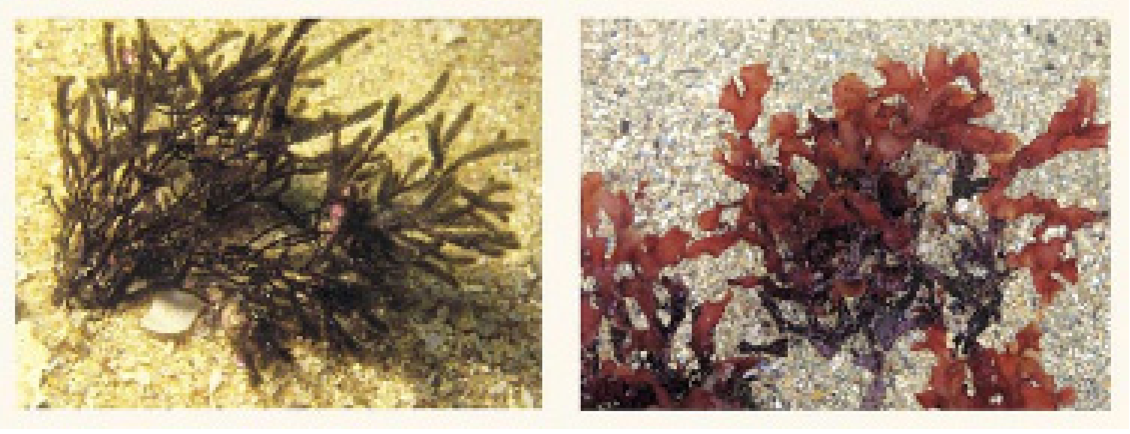
Two species of macroalgae that are listed in the Red Data Book of Krasnodar Krai were found during the survey (Figure 12.5). None were found on the IUCN Red List although the marine realm, and seaweeds in particular, are currently very poorly covered (Ref. 12.3). The brown algal species *Cladostephus spongiosus* and *Phyllophora crispa* were observed along the pipeline route alignment at Station 5. *Cladostephus spongiosus* and *Phyllophora crispa* both also occur in the Utrish SPNA (Ref. 12.4) which is discussed more fully in Section 12.4.8.1.

Table 12.7 presents the total number of species identified at the stations sampled and identifies the stations at which protected species were recorded.

Table 12.7 Macroalgae Species Observed Listed in Red Data Book of Krasnodar Krai (August 2011)

Station	2c	3c	5c	7c	8c	9c	10c	11c	12c	13c
Water Depth (m)	**10**	**20**	**10**	**0**	**10**	**0**	**10**	**20**	**0**	**10**
Cladostephus spongiosus	+	+	+		+		+	+		+
Phyllophora crispa [= *P. nervosa*]	+		+					+		
Total number of species present	18	23	16	9	15	5	12	24	9	17

Figure 12.5 Protected Species of Algae Identified during Field Work in 2011 (left to right, *Cladostephus spongiosus* and *Phyllophora crispa*)



Source: (Ref. 12.1)

The August 2011 survey (Figure 12.4) shows that the communities of macroalgae were characterised by relatively low biomass, and a prevalence of the green algae Ulva (which now includes *Enteromorpha*, previously thought to be a separate species but now included in the

Ulva genus). At depths less than 10 m, *Cystoseria* sp. was the most abundant and its biomass was higher in these shallow water areas. At deeper (over 15 m) locations the biomass of *Cystoseira* sp. was lower; *Codium, Phyllophora* and in some cases Ulva were the most dominant macroalgae (Ref. 12.1). The August 2011 survey observed 44 species of macroalgae (seven green, eight brown and 29 red). The maximum species diversity was observed at a depth of 20 m, at stations 3c and 11c (23 - 24 species) with the least diversity at stations 7c, 9c and 12c on the shoreline. The prevalence of brown algae over the green algae, the high population of pollution-intolerant species such as *Padina pavonica* and *Codium vermilara*, and the low number of epiphytes (algae that grow on other species) on *Cystoseira synusia*, indicate a low degree of eutrophication. The macroalgae community observed was similar in composition and biomass to that recorded in the 2009 surveys (Ref. 12.1).

Other surveys in the region, conducted to inform the Black Sea Commission 'State of the Environment' Report (Ref. 12.9), observed significant macroalgae populations attached to the shells of live molluscs on the soft bottom habitats of the Anapa region and Gelendzhik Bay. The area of this association between the algae and mollusc was large enough for it to be considered a significant contributor to primary production in soft sediment areas (Ref. 12.8).

Macrozoobenthos

Zoobenthos surveys were conducted at the following locations (Figure 12.4):

- During May-June, 2009 samples were collected at Stations 1 to 8s;
- In November 2010, samples were collected at Stations 1 to 4, 18, 19;
- In August 2011, samples were collected at Stations 1 to 14c and video footage was taken along a transect between Stations 4c to 6c; and
- In July 2013 51 stations were sampled by benthic grab and video.

The survey methodology is summarised in Figure 12.3. These locations comprise the Survey Area discussed in this section for zoobenthos.

Results of the 2009 surveys (spring-summer) found the epibenthic amphipod *Gammarus olivii* dominated both biomass and numbers at the shore stations 1S, 3S and 6S.

In 2009, at water depths of around 10 m (Stations 2S, 4S and 7S), the benthos was highly diverse comprising polychaetes, crustaceans, bivalves and gastropods. The substrate at these stations represented a mixture of sand with fine pebbles and shells. The distribution of organisms was uneven and species composition and abundance in repeated samples selected at a distance of 10 to 15 m water depth from each other varied considerably. The small polychaete *Staurocephalus rubrovittatus* and the soldier crab *Diogenes pugilator* were encountered at all stations.

Two samples were taken at stations 6S and 8S at a water depth of 15 m. Sediment composition at Station 6S comprised fine sands, while sediment composition at Station 8S comprised large stones and shells. Due to this difference in sediment type, the composition of the zoobenthic community at these stations differed significantly (Ref. 12.1).

The abundance and biomass of the dominant species recorded in the 2009 survey (less than 20 m water depth) is shown in Table 12.8. At Station 5S, the polychaete *Saccocirrus papillocercus* was the most abundant and at Station 8S three species (the polychaete worm *Melinna palmata*, the acorn barnacle *Balanus improvisus* and the crab *Macropipus arcuatus*) were dominant in number. A total of 15 species of macrozoobenthos were found in the Survey Area in 2009. None of these was a rare (i.e. IUCN Red List Categories 1 to 3, national or regional RDBs as endangered or critically endangered) or legally protected species.

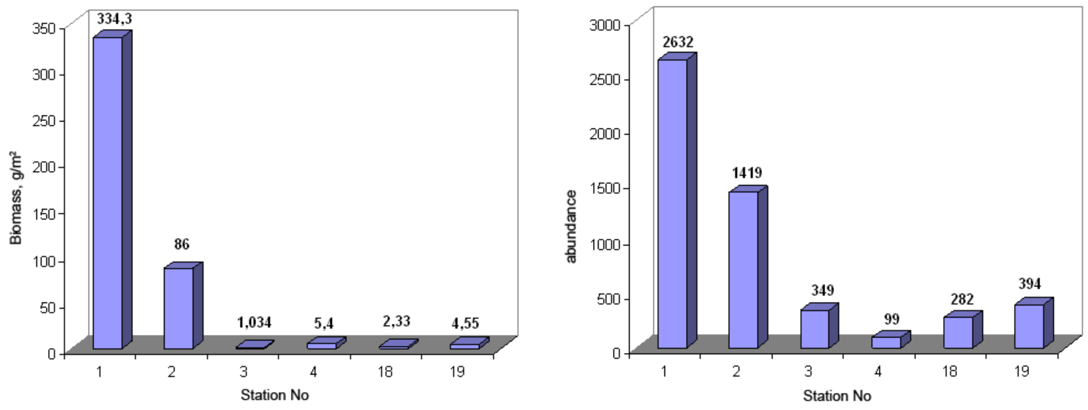
Table 12.8 Abundance and Biomass of Dominant Species in May to June 2009 Survey

Station No.	Species Name	Abundance		Biomass	
		ind./m^2	%	Grams per square metre (g/m^2)	%
1S	*Gammarus olivii*	28685	90.7	25.01	73.6
2S	*Xantho poressa*	145	26.9	13.64	39.0
3S	*Gammarus olivii*	13764	82.4	9.71	41.2
4S	*Staurocephalus rubrovittatus*	290	45.2	-	-
	Macropipus arcuatus	-	-	16.74	72.3
5S	*Saccocirrus papillocercus*	207	29.4	-	-
	Diogenes pugilator	-	-	12.61	42.8
6S	*Gammarus olivii*	7068	80.5	7.23	44.6
7S	*Microspio mecznikowianus*	103	23.8	-	-
	Saccocirrus papillocercus	103	23.8	-	-
	Tricolia pulla	103	23.8	4.13	39.2
8S	*Melinna palmata*	62	17.6	-	-
	Balanus improvisus	62	17.6	-	-
	Macropipus arcuatus	62	17.6	-	-
	Pectinaria koreni	-	-	11.37	44.0

Project surveys conducted in November 2010 extended the Survey Area along the Caucasian coast from near Kerch to near Gelendzhik. A community of *Spisula subtruncata* (reported as

Spisula triangula) was found at Station 1 near Kerch at a depth of 30 m over silty shelly ground (65% shell/gravel, 15%, 0.1 millimetres (mm)). This community was characterised by a relatively high richness of 35 species (13 polychaetes, eight bivalves, four gastropods, five crustaceans, two cnidarian, one nemertean, one turbellarian and one oligochaete). Average total biomass of the community at Station 1 was 334.27 g/m^2, average total abundance was 2,632 ind./m^2, and represented the highest biomass and abundance of any sample taken during the survey (Figure 12.6).

Figure 12.6 Benthic Biomass (g/m^2) and Abundance (ind./m^2) in November 2010 Surveys



Further south, a *Pitar rudis* community was found at Stations 2 (near Anapa) and 19 (near Gelendzhik) at depths of 20 m and 34 m respectively. Bottom sediments at these stations comprised silty sand with shells. The bivalves *Pitar* and *Chamelea* are associated with a wide range of grounds, although they prefer sand deposits. The two stations showed some differences in richness and species composition[7]. The northern site was richer (24 species as opposed to 15 in the south) and had a higher average biomass (86.0 g/m^2 compared to 4.55 g/m^2 in the south) and abundance (1,419 ind. /m^2 compared to 394 ind. /m^2 in the south). The northern sample comprised 10 species of polychaete, two bivalves, two gastropods, six crustaceans, two cnidarians, one nemertean and one phoronid. The southern sample comprised six polychaetes, two bivalves, four crustaceans, one nemertean, one cnidarian and one phoronid. It has been suggested that the impoverishment of the community near Gelendzhik Bay is due to anthropogenic effects (Ref. 12.1), though this site also had an appreciably finer sediment structure (56% particles 0.1 mm, cf. 35% in the northern, shallower sample).

The sample from deeper water (Station 4 at 58.8 m) was characterised by a community dominated by *Plagiocardium papillosum* and *Modiolula phaseolina*. The bottom sediments were silty sand (63% <0.1 mm) with shells, most of which showed evidence of gastropods predation (drill marks). The sample included seven polychaetes, two bivalves, one crustacean and one

[7] Richness is distinct form diversity in that the former considers the total number of species in a sample, while measurements of diversity also factor in their relative abundance.

echinoderm). Average total biomass of the community was 5.4 g/m^2 and average abundance 99 ind./m^2.

At depths greater than 80 m, the samples were dominated by the brittlestar *Amphiura stepanovi*. Here the seabed was characterised by fine clay ooze (86-99% < 0.01 mm), oxygen levels were lower and some H_2S was present. The average biomass of this type of community was low, from 1 to 2.3 g/m^2, total abundance ranged from 282 to 349 ind./m^2, and was composed of a large number of small-sized polychaetes.

In August 2011, the littoral communities of soft sediments and macroalgal thickets were surveyed at Station 4c, 5c and 6c using a video transect. On sandy grounds at 20 m isobath a *Pitar rudis* community was found, similar to that observed in 2010 but less rich (although high levels of spatial variability in species diversity and abundance is common in marine communities). It included six mollusc species, one polychaete and one bryozoan. The bivalves *Pitar rudis* and *Gouldia minima* dominated the assemblage both numerically and in terms of biomass. At station 14c, which had a reduced gravel component and relatively fine sediment (40% <0.1 mm), a high density of the small bivalve *Lucinella divaricata* was recorded (63 ind./m^2). This community also included *Bittium reticulatum*, *Calyptraea chinensis, Mytilus galloprovincialis, Harmothoe reticulata* and *Scrupocellaria bertholletii* in low numbers.

The main macroalga at 10 m water depth was *Cystoseira*, which supported a faunal community comprising 35 species of macrozoobenthos. The bivalve *Mytilaster lineatus* and the snail *Bittium reticulatum* together dominated the biomass of this community (15.48 g/m^2 and 4.04 g/m^2 respectively). *M.lineatus* is one of the main components of seaweed thickets throughout the Black Sea due to its high settlement density and resistance to pollution (Ref. 12.1). This is of wider significance because *M.lineatus* is therefore the main provider of natural bio-filtration along the Black Sea coast and can be present in high densities. The maximum abundance of *M.lineatus* observed in this survey was 2,826 ind./m^2 (average 891 ind./m^2). The fouling polychaete *Spirorbis pusilla* was also common on algal thalli and *M.lineatus* shells in this community, and is considered a dominant species. The dominance of *M.lineatus* is consistent with historical data collected from 1999 to 2007 by the P.P. Shirshov Institute of Oceanology (summarised in Ref. 12.1) along the North Caucasian coast.

At a depth of 20 m, the main thicket forming algae were *Phyllophora* and *Codium*. The associated faunal community includes 34 species (11 molluscs, 11 crustaceans, 7 polychaetes, 4 bryozoans and 1 hydroid). Again, *M. lineatus* dominated the biomass (10.35–28g/m^2). The snail *Bittium reticulatum* was numerically dominant (910–1,781 ind./m^2). The gastropods *Tricolia pulla* and *Rissoa splendida* were present in lower numbers, but in the same order of magnitude as *M.lineatus*. The most significant encrusting animals were the bryozoan *Cryptosula pallasiana* (reported as *Lepralia pallasiana*) and *Spirorbis pusilla.* The high diversity of macrofauna within the algal beds observed in this survey are consistent with other data sources located near Utrish (around 2 km from the Project Area) located along the Caucasian coast (Ref. 12.1 and Ref. 12.4).

In July 2013 a further benthic survey of the coastal area (Figure 12.4), including locations of the proposed seabed intervention work, was carried out. Of the 51 target stations, 10 were in shallow waters (<20 m) where grab samples could not be collected because the seabed comprised mainly bedrock and boulder. There is however, Remotely Operated Vehicle (ROV) video and stills data for all stations, which have been used to identify the benthic communities present.

There was considerable variability in both the number of individuals and the number of benthic species. Grab samples contained between 6 and 397 individuals, and between 2 and 14 different species.

The distribution of invertebrate marine fauna is often correlated with the nature of the substratum and so abundance and number of species has been analysed by sediment type (Table 12.9). This analysis shows that the highest variability in abundance occurred in muddy habitats. The fact that the maximum abundance (397 individuals) is far higher than the average abundance of 66 individuals indicates the highly discontinuous and patchy distribution of fauna typical of marine sediments.

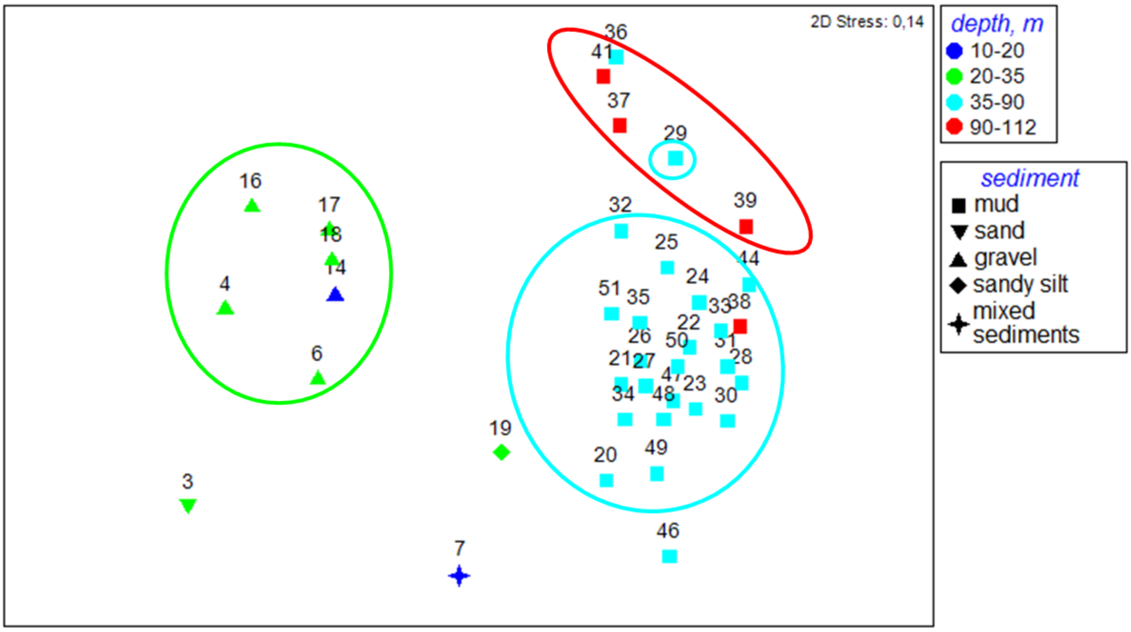
Table 12.9 Abundance And Species Richness by Sediment Type in July 2013 Survey Samples

Sediment Type*	Abundance (ind. /m^2)			No. of Species (Richness)		
	Min	Max	Average	Min	Max	Average
Coarse (gravel)	39	197	100.7	3	11	7.6
Mixed sediment	65	161	100.2	5	9	6.9
Sand	22	34	26.7	2	14	5
Mud	6	397	66.2	4	6	7.2

* Sediment type was classified using the FOLK sediment triangle on the basis of sediment particle size analysis data (Ref. 12.22)

Multivariate analysis of the benthic communities, using PRIMER, identified broad groups that were grouped largely by sediment type with some influence of depth (Figure 12.7). Muddy stations cluster together showing a similar species composition, although a number of samples from between 90 and 112 m are included within a separate group (circled in red), which may reflect changes in species distribution in response to lower levels of oxygen in deeper sites, and/or in response to slight variations in the sediment composition of muds between stations.

Figure 12.7 Multi-Dimensional Scaling (MDS) Plot, using Bray-Curtis Dissimilarity Index, indicating Structural Similarity between Benthic Stations*



* Structurally similar (i.e. with a similar species composition) samples cluster together

There was only one sandy station sampled during the 2013 survey so the species present may not be representative. The sample was characterised by burrowing organisms including the bivalves *Gouldia minima* and *Chamelea gallina* and amphipods of the family Corophiidae. The lancelet, *Branchiostoma lanceolatum*, a species typically found only in sandy sediments, was also present (Table 12.10).

Table 12.10 Average Abundance of Species Present in Sand Samples

Faunal group	Species	Average Abundance (ind. /m^2)
Bivalvia	*Gouldia minima*	8.3
Euchordata	*Branchiostoma lanceolatum*	5.0
Crustacea	*Diogenes pugilator*	4.3
Bivalvia	*Chamelea gallina*	3.7
Crustacea	*Corophiidae*	3.3
Polychaeta	*Schistomeringos rudolphi*	2.0

Species in the mixed and coarse sediments sampled in the Survey Area were dominated by bivalves and polychaetes (Table 12.11 and Table 12.12). The bivalves *Gouldia minima* and *Pitar rudis* are common in both sediment types as are the predatory polychaete *Glycera tridactyla*. Amphipods were also common in coarse sediments (Table 12.12).

Table 12.11 Average Abundance of Top 10 Species Present in Mixed Sediment Samples

Faunal group	Species	Average Abundance (ind./m^2)
Polychaeta	*Spio filicornis*	22.8
Bivalvia	*Gouldia minima*	16.0
Crustacea	*Corophiidae*	7.7
Polychaeta	*Glycera tridactyla*	7.0
Bivalvia	*Pitar rudis*	6.5
Polychaeta	*Capitellidae gen.sp.*	4.0
Polychaeta	*Harmathoe reticulata*	3.8
Bivalvia	*Chamelea gallina*	2.8
Bivalvia	*Anadara inaequivalvis*	2.3
Bivalvia	*Spisula subtruncata*	2.0

Table 12.12 Average abundance of Top 10 Species Present in Coarse Sediment Samples

Faunal group	Species	Average Abundance (ind./m^2)
Bivalvia	*Gouldia minima*	37.1
Polychaeta	*Glycera tridactyla*	14.1
Bivalvia	*Pitar rudis*	10.3
Polychaeta	*Harmathoe reticulata*	7.8

Continued…

Faunal group	Species	Average Abundance (ind./m^2)
Crustacea	*Amphipoda sp.C*	6.4
Polychaeta	*Schistomeringos rudolphi*	6.1
Polychaeta	*Prionospio cirrifera*	5.7
Bivalvia	*Anadara inaequivalvis*	4.3
Bivalvia	*Moerella donacina*	3.0
Polychaeta	*Spio filicornis*	2.8

Complete.

The muddy sediments of the Survey Area support communities dominated by bivalves such as *Modiolula phaseolina* and *Parvicarcium* simile and by a number of polychaete species (Table 12.13). There is, however, considerable variability in total abundance between stations, as shown in Table 12.9, and abundance by species is similarly variable between stations.

Table 12.13 Average Abundance of Top 10 Species Present in Mud Sediment Samples

Faunal group	Species	Average Abundance (ind. /m^2)
Bivalvia	*Modiolula phaseolina*	21.2
Polychaeta	*Aricidea claudiae*	6.9
Polychaeta	*Terebellides stroemii*	5.0
Bivalvia	*Parvicardium simile*	4.4
Polychaeta	*Phyllodoce lineata*	4.1
Bivalvia	*Angulus tenuis*	3.7
Polychaeta	*Capitellidae* gen.sp.	2.8
Polychaeta	*Prionospio cirrifera*	2.3
Polychaeta	*Nereidae* sp. A	1.5
Echinodermata	*Amphiura stepanovi*	1.5

The sediment particle size and biological community data (Figure 12.7) have been analysed together to determine the nature of the benthic habitats in the survey area. Whilst EUNIS biotope codes are not presented for habitats the data has been analysed using similar methods to determine habitat types in the Survey Area (Ref. 12.23). Where a grab sample data was not available, e.g. for the rocky areas, the habitat has been identified on the basis of video and stills images and data from previous diver surveys. A total of nine habitat types in the survey area have been identified. These habitat types are clearly related to depth and nature of the seabed as described below and in Table 12.14 and their distribution is shown in Figure 12.8.

At all stations sampled between 3 and 20 m the seabed was uneven bedrock and boulders with some small patches of sediments between boulders or in crevices in the bedrock. These areas were dominated by algal communities and the depth based zonation of algal species seen in previous surveys was observed.

In the shallower regions, between 3.9 and 11.0 m, there were dense algal communities, with 90 to 100% algal cover, dominated by *Cystoseira* spp. In water depths from approximately 12 to 19 m, samples were also dominated by rocky seabed, but with less dense coverage of algae, predominantly *Codium vermilara*. Diver recordings in previous years' surveys indicate that these algal habitats support a high abundance of the mussel *Mytilaster lineatus* which, is found attached to *Cystoseira thalli* and the small needle whelk *Bittium reticulatum*.

In water depths between 19 and 27 m a variety of sediment types are found including sand, mixed and coarse sediments. There was no bedrock observed in any of the samples in water depths greater than 20 m. The communities in these areas are dominated by infaunal organisms, predominantly burrowing bivalves such as Gouldia minima and *Chamelea gallina* and *infaunal polychaetes* including *Spio filicornis*.

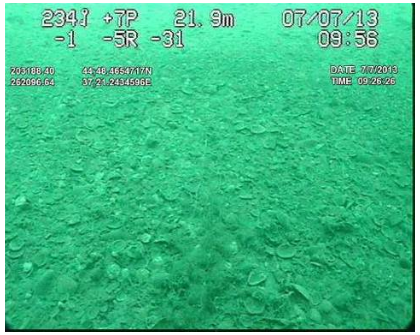
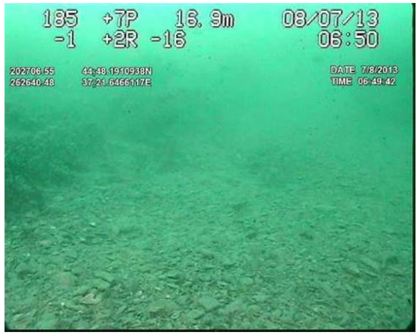
Beyond 33 m water depth the seabed consists of muddy sediments which support communities of burrowing bivalves and infaunal polychaetes. At one station, Station 19, dense patches of large ascidians were observed on the video footage. The number of species per grab sample is not particularly high, between 4 and 6 species, but abundance is highly variable with between 6 and 397 individuals recorded. These communities, as shown in Figure 12.14, were found at all stations sampled between 33 and 113 m.

Muddy sediments were also found at stations in much deeper water, between 365 and 573 m, but at these depths the sediments are completely devoid of fauna because conditions are anoxic below about 150 to 200 m water depth.

Table 12.14 Marine Habitats Identified During the July 2013 Survey

Seabed description	Stations	Depth range of stations sampled	Community type	Representative image
Bedrock and boulders	1, 2, 5, 8-13, 15	3.7 to 11.0	Bedrock and boulders with dense algal communities dominated by *Cystoseira* spp. with *Mytilaster lineatus* and *Bittium reticulatum*	
	7, 9, 11, 13, 13, 14	12.9 to 19.7	Bedrock and boulders with moderate algal cover, primarily *Codium vermilara*, with *Mytilaster lineatus* and *Bittium reticulatum*	

Continued…

Seabed description	Stations	Depth range of stations sampled	Community type	Representative image
Mixed sediment	4, 6	16.9 to 25.0	Mixed sediment with burrowing bivalves (particularly *Gouldia minima*)	
	7	16.9	Mixed sediment with infaunal polychaetes (particularly *Spio filicornis*)	

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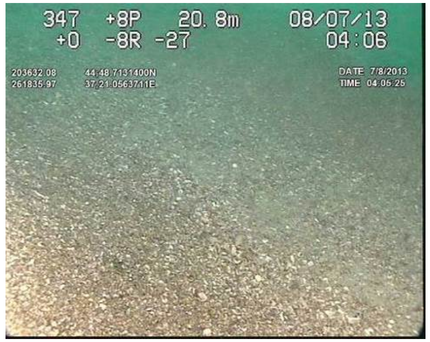
Seabed description	Stations	Depth range of stations sampled	Community type	Representative image
Coarse sediments (gravel)	14, 16-18	19.1 to 26.7	Coarse sediment (gravel) and sand with burrowing bivalves (particularly *Gouldia minima*)	
Sand	3	20.5 to 21.7	Sand with burrowing bivalves (particularly *Chamelea gallina*)	

Continued…

Seabed description	Stations	Depth range of stations sampled	Community type	Representative image
Mud	19	33	Mud with burrowing bivalves (*Pitar rudis* and *Chamelea gallina*) and patches of large sediment covered ascidians	
	20-35, 38, 44, 46-51	50.6 to 92.0	Mud with infaunal polychaetes and burrowing bivalves (*Terebellides stroemii* and *Parvicardium simile*)	

Continued…

Seabed description	Stations	Depth range of stations sampled	Community type	Representative image
	36, 37, 39, 41	70 to 113	Mud with burrowing bivalves and anemones (*Modiolula phaseolina* and *Pachycerianthus solitaries*)	
	40, 42, 43, 45	>365	Anoxic deep sea mud with high levels of H_2S and devoid of fauna	

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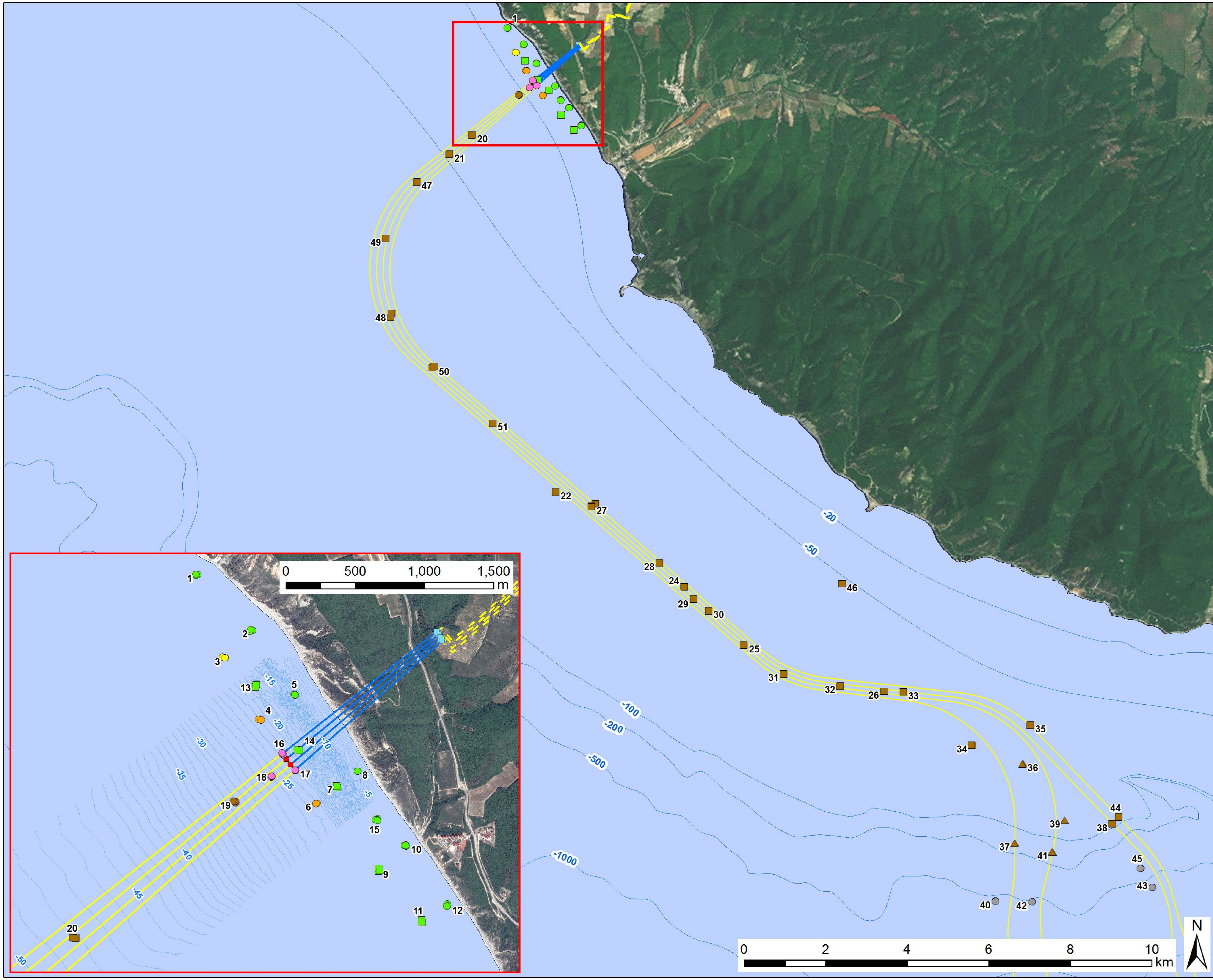

LEGEND

Community Groups

- Bedrock and boulders with dense algal communities dominated by *Cystoseira* spp. with *Mytilaster lineatus* and *Bittium reticulatum*
- Bedrock and boulders with moderate algal cover, primarily *Codium vermilara*, with *Mytilaster lineatus* and *Bittium reticulatum*
- Coarse sediment (gravel) and sand with burrowing bivalves (particularly *Gouldia minima*)
- Sand with burrowing bivalves (particularly *Chamelea gallina*)
- Mud with burrowing bivalves (*Pitar rudis* and *Chamelea gallina*)
- Mud with infaunal polychaetes and burrowing bivalves (*Terebellides stroemii* and *Parvicardium simile*)
- Mud with burrowing bivalves and anemones (*Modiolula phaseolina* and *Pachycerianthus solitaries*)
- Anoxic deep sea mud with high levels of hydrogen sulphide and devoid of fauna
- Mixed sediment with burrowing bivalves (particularly *Gouldia minima*)
- Mixed sediment with infaunal polychaetes (particularly *Spio filicornis*)

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Proposed microtunnels
- Proposed offshore pipelines
- Microtunnel entry shaft
- Microtunnel exit pit
- Isobaths

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue
For Information

Client
South Stream Offshore Pipeline — ENERGISING EUROPE

Project Title
SOUTH STREAM OFFSHORE PIPELINE

Drawing Title
DISTRIBUTION OF BENTHIC HABITATS IDENTIFIED FROM DATA COLLECTED DURING 2013 BENTHIC SURVEYS

Drawn	Checked	Approved	Date
DH	RW	MW	19 Mar 2014

URS Internal Project No.	Scale @ A3
46369082	1:85,000

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Scott House
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Drawing Number: Figure 12.8 | Rev

Plot Date: 19 Mar 2014
File Name:R:\Report Maps - Russia\Russian ESIA v2\Chapter 12 Offshore Sampling\Figure 12-8 Distribution of benthic habitats identified from data collected during 2013 benthic surveys.mxd

12.4.3.3 Summary

In shallow waters, where there is rock, cobbles or pebbles for attachment, the benthos is characterised by macroalgal communities. There is distinct zonation of algal communities in the Survey Area, with distinct macrophyte communities at different depth ranges.

In shallow waters (up to 2 to 3 m depth) macroalgae communities characterised by a relatively low diversity and biomass were observed. This includes a community of *Cladophora dalmatica* and an association of *Ceramium ciliatum* and *Padina pavonica*. There was also a prevalence of green algae, primarily sea lettuce (*Ulva sp*.) and *Enteromorpha sp*. In the mid photic zone, from about 3 to 10 m algal communities dominated by large structural brown algae dominate. In particular associations of *Cystoseira* spp. are found, succeeded by a *Cladostephus spongiosus* and *Corallina elongata* as depth increases. At depths over approximately 10 m, communities of *Phyllophora* and *Codium vermilara* are observed. The highest diversity of algae is found in the mid-photic zone and *Cystoseira* communities also support a high diversity of macrofauna and considerable biomass of the mussel *Mytilaster lineatus* in some areas.

Species diversity of macroalgae was greater in the *Cytoseria* and *Codium* communities at 20 m water depth. Abundance and biomass was greatest at 10 m water depth with *Cytoseria* as the most abundant species observed. This is consistent with the historical data of bathymetric heterogeneity along the Caucasian coast of the Black Sea, in which the Survey Area is located (Ref. 12.1 and 12.4). The data from the 2009 and 2011 surveys, which were carried out at different times of the year, indicate that this general distribution pattern is not subject to seasonal changes.

Two species of macroalgae that are listed in the Red Data Book of Krasnodar Krai were found during the 2011 survey. The brown algal species *Cladostephus spongiosus* and *Phyllophora crispa* were observed along the nominal pipeline route alignment at Station 5c.

Macroalgae also supported animal communities, particularly of bivalve molluscs, but also polychaetes and crustaceans. The macrozoobenthic communities of soft sediments are largely determined by the sediment type and comprise a number of infaunal animals, particularly bivalves and polychaetes but also crustaceans, gastropods and echinoderms. There were no macrofaunal species of commercial or conservation importance recorded in the Survey Area.

12.4.4 Deep Sea Benthic Habitats

The deep waters of the Black Sea have recently been shown to support significant biogenic structures in some areas (Ref. 12.7). At certain sites on the northwest Black Sea shelf, carbonate accumulation has formed reef towers structures that can reach several metres in height (Ref. 12.7). These towers may release methane bubbles so that they superficially resemble hydrothermal vent chimneys found on tectonic margins, though they have no associated multicellular life and are characterised by the presence of morphologically and phylogenetically distinct unicellular communities.

Sidescan and ROV data from the deep water parts of the pipeline route have been examined in detail to ascertain the nature of the deep seabed and to identify, as far as possible, the presence of deep sea microbial reefs or other structures (Ref. 12.5). A summary of the findings is presented below but the full report can be found in Appendix 7.1: Abyssal Plain Report.

Small carbonate mounds related to fluid seepage can be identified at a few locations along the Russian shelf edge. On sidescan data, they are hard targets with a typical irregular 'knobbly' appearance. Most cannot be identified on bathymetric data, partly because they are small, low relief features, but also because their occurrence is masked by the typically steep terrain in which they occur. Carbonate mounds occur in the relatively narrow depth band between about 110 and 140 m. This suggests that in addition to fluid seepage, the location of these features is constrained by other factors, most likely the low level of oxygen in the stratified water column. There is no suggestion that these are biogenic structures.

The lower Russian continental slope and the contiguous abyssal plain are generally relatively smooth with a gradient that gradually decreases until the slope merges with the plain. No significant bacterial communities, such as cold seep communities with associated macrofauna, microbial mats or microbial reefs were encountered anywhere along the pipeline route (Ref. 12.5).

12.4.5 Fish

12.4.5.1 Background and Literature Review

A long term data set in the north-eastern Black Sea has been collected by the Azov Fish Industry Research Institute between 2003 and 2011 and is summarised in Ref. 12.1. This information has been used to support this section.

In recent years (the last two decades), 103 species of fish[8] have been recorded from the Black Sea shelf of the Russian Federation (Zaika 2000 in Ref. 12.1). These are divided into several groups according to their lifestyle and biogeographic origin:

- Anadromous species that feed at sea and breed in freshwater include sturgeons (*Huso huso, Acipenser gueldenstadti, A.persicus, A.sturio and A.stallatus*), Sea of Azov-Black Sea herrings or shad (*Alosa pontica*) and Black Sea salmon-trout (*Salmo labrax*);
- Semi-anadromous fish only occur in the least saline areas of the sea and include the Batumi shemaya (*Alburnus chalcoides*) and vimba (*Vimba vimba*);
- Two freshwater species occasionally enter the sea (goldfish *Crassius auratus* and mosquito fish *Gambusia affinis*[9]), but are essentially non-marine;
- True brackish-water species reside in low salinity basins and estuaries. Some are euryhaline (tolerant of a wide range of salinity). This group includes the stickleback *Pungitius platygaster*, and several goby species;

[8] This number must be viewed as approximate due to significant uncertainty regarding the taxonomic status of some species.
[9] Introduced from North America to eradicate malaria mosquitos in the region

- The group of Boreal Atlantic relics is represented by species that prefer colder water, including dogfish (*Squalus acanthas*), sprat (*Sprattus sprattus*), and whiting (*Merlangius merlangus*); and
- The most numerous group of fish are the 'thermophillic' species, generally of Mediterranean origin, that prefer the warm surface layers of the sea. This includes pelagic species such as sardine (*Sardina pilchardus*), garfish (*Belone belone*) and horse-mackerel (*Trachurus mediterraneus*); demersal species such as bogue (*Boops boops*), drum (*Sciaena umbria*) and several species of wrasse; benthic species such as stingray (*Dasyatis pastinaca*), rockling (*Gaidropsarus mediterraneus*) and weever (*Trachinus draco*) and cryptic[10] species such as seahorse (*Hippocampus guttulatus*), clingfish (*Lepadogaster spp.*) and pipefish (*Syngnathus spp*.).

In general, water shallower than 25 m is characterised by the greatest species diversity, particularly over rocky grounds. Numerous species of fish, including some of commercial interest, (refer to **Chapter 14 Socio-Economics** for more discussion on commercial fisheries) use the vegetated shallow waters where thickets of *Cystoseira* provide shelter and cover for spawning. These rocky bottoms are not subject to fish trawling. Areas of sandy substrate appear to support fewer species (Ref. 12.1). The number of species decreases with the increase of the depth with only 20 species recorded below 50 m. This pattern of distribution also reflects the dominance of Mediterranean thermophillic species that prefer the well-warmed surface layers of the sea (Azov Fish Industry Research Institute in Ref. 12.1).

Eutrophication, combined with invasions of non-native species, discussed in Section 12.4.1, and significant over-fishing in recent decades have caused changes in offshore pelagic fish populations (Ref. 12.8). Sprat, horse mackerel, and anchovy (*Engraulis encrasicolus*) populations all collapsed in the 1990s though there have been some recent signs of recovery. Populations of larger pelagic fish such as tuna (*Thunnus thynnus*), swordfish (*Xiphias gladius*), and mackerel (*Scomber colias* and *S.scombrus*) have also substantially declined (Ref. 12.8).

There are a number of fish species caught commercially including sprat, anchovy, horse mackerel, whiting, goatfish and some mullet. However, total fisheries catch is dominated (over 90% of total biomass) by sprat and anchovy (Azov Fish Industry Research Institute in Ref. 12.1). The distribution of many of the commercial fish species is highly seasonal as populations migrate between spawning and feeding grounds. Anchovy overwinter in the Anapa region and sprat and horse mackerel migrate here for feeding, mostly during the warmer spring and summer months (Ref. 12.1). The regional migrations of these species are shown in Figure 12.9:

- Anchovy feed in the area shown during October and November;
- Sprat spawn in mid-March to early April and then migrate to the coastal zone for feeding until late-spring / early summer; and
- Horse mackerel feed near the coast during the summer months.

---

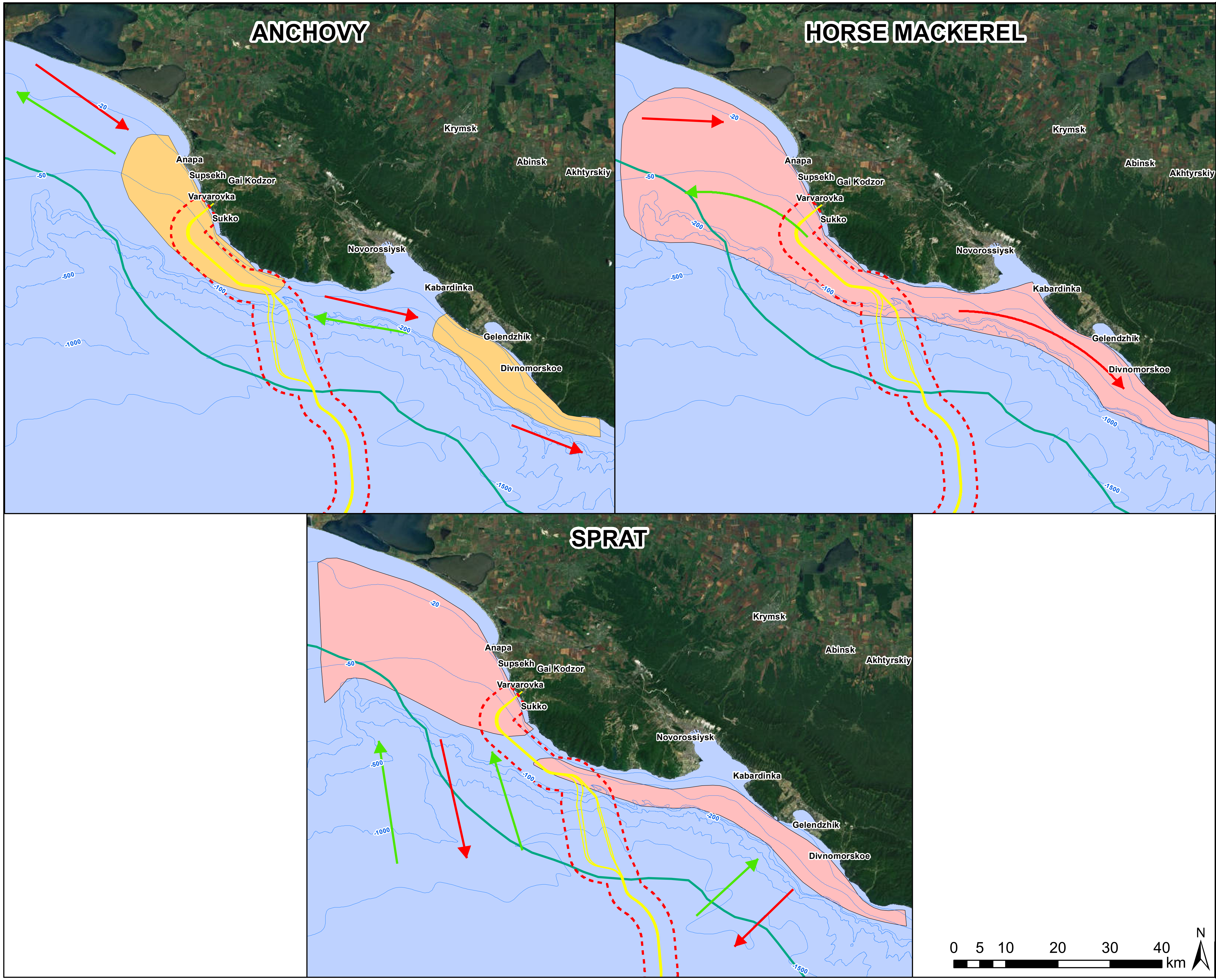
[10] In this context, cryptic species are those that spend most of their time hidden in weeds, under stones etc.

- Several species of fish of conservation importance have been observed from the Russian Black Sea coastline caught in fixed gear at commercial fishing stations[11] (Table 12.15). Of particular note is the presence of Russian sturgeon (*Acipenser gueldenstaedtii*) and stellate sturgeon (*Acipenser stellatus*). These sturgeon species are listed by IUCN as critically endangered (Ref. 12.9), though they are not included in the Red Books of either the Russian Federation (RDBRF) or Krasnodar Krai (RDBKK). They were only recorded in single cases, when immature fish were caught (Azov Fish Industry Research Institute in Ref. 12.1) but given their naturally wide ranging habit, it is possible that sturgeon might be present, albeit as individuals, in the Survey Area.
- Table 12.15 Species of Conservation Interest Observed in the North Eastern Black Sea Region

Common name	**Latin name**	**Conservation Status**		
		IUCN Global Red list	**RDBRF**	**RDBKK**
Russian sturgeon	*Acipenser guldenstaedtii*	CR	-	
Stellate sturgeon	*Acipenser stellatus*	CR	-	-
Beluga sturgeon	*Huso huso*	CR	1	1a
Black Sea salmon-trout	*Salmo trutta labrax*	LC	1	7
Long-snouted seahorse	*Hippocampus guttulatus* (listed as *H.ramulosus* by IUCN)	DD (previously listed as VU)		*
Corb	*Umbrina cirrosa*	-	-	3
Tub gurnard	*Chelidonichthys lucerna*	-	-	2
Leaping mullet	*Liza saliens*	-	-	Annex 3
Chestnut goby	*Chromogobius quadrivittatus*	-	-	5

- IUCN: CR=Critically Endangered; VU=Vulnerable; LC=Least Concern; DD=Data Deficient. Red Data Books: 1=Endangered (1a=Critically Endangered); 2= Vulnerable species declining in number; 3=Rare; 5=Requiring further study; 7=specially Controlled* Not listed but catching prohibited under regional fishing regulations.
-

[11] Comprising 4 set net locations and analyses of catches from four commercial observation stations ("Bolshoy Utrish", "Novorossiysk", "Gelendzhik" and "Arkhipo-Osipovka") (Ref. 12.1)



LEGEND

- Approximate 3km offshore construction safety exclusion zone
- Feeding grounds
- Wintering Areas
- Autumn migration
- Spring migration
- Russian territorial waters boundary
- Isobaths (mbsl)

Russian Sector of South Stream Offshore Pipeline

- Proposed offshore pipelines

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check / Date	Suffix

Purpose of Issue: For Information

Client: South Stream Offshore Pipeline — Energising Europe

Project Title: SOUTH STREAM OFFSHORE PIPELINE

Drawing Title: MIGRATION, FEEDING AND WINTERING GROUNDS OF ANCHOVY, SPRAT AND HORSE MACKEREL

Drawn	Checked	Approved	Date
AH	RW	MW	04 Mar 2014

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File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA\Offshore Sampling\Figure 12.9 Migration, feeding and wintering grounds of Anchovy, Sprat and Horse Mackerel.mxd

Russian sturgeon are very large slow growing anadromous fish, generally taking ten or more years to mature to a size that may exceed 2 m and 100 kg (Ref. 12.26). Adults dwell at depths from 20 to 100 m, exhibiting complicated patterns of spring and autumn runs such that adults and juvenile ranges overlap both spatially and temporally. They feed on a variety of benthic invertebrates and fish. The Russian sturgeon is now very rare in the Black Sea basin where almost all of the species' spawning sites have been lost due to dam construction, except in the lower Danube where some spawning still exists. The last natural population still migrates up the Danube and the Rioni (last recorded in Rioni in 1999), where the sturgeons are heavily overfished and poached (Ref. 12.26). It is estimated that the species' wild native population has undergone a massive population decline of over 90% in the past three generations.

Stellate sturgeon is a smaller species, generally only less than 10 kg though 50 kg specimens are known (Ref. 12.37). It is less benthic in habit than other sturgeon species and may be encountered at the surface on occasion. Though fish may spawn throughout the year (where spawning sites are available), there are two peak spawning runs in spring and autumn. It too has suffered drastic population declines across its range, due to a combination of habitat loss, overfishing and poaching. In addition, its semi-pelagic habit meant that the stellate sturgeon was more affected by the *Mnemiosps leidyi* outbreak (discussed earlier) than other sturgeon species (Ref. 12.3).

Both these sturgeon species were only found as single juvenile specimens in fixed nets at the four commercial observation stations. The Fishing Rules for the Sea of Azov-Black Sea commercial fishing region prohibit the catching of all sturgeon species. Sturgeons also fall within the scope of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) which prohibits trade and movement across national borders of both living sturgeon and sturgeon products (notably caviar) (Ref. 12.3).

Thornback rays are demersal coastal species that inhabits a variety of substrates, including mud, sand, shingle, gravel and rocky areas, mainly recorded at water depths up to 50 m (Ref. 12.1). Young and juveniles predominantly eat small crustaceans, such as shrimps, mysids, amphipods and small crabs. Larger specimens prey on larger crustaceans, including prawns and crabs and will also consume fish. Because it is an important component of many European fisheries, and its numbers are declining, it is classed by the IUCN as near threatened (Ref. 12.3). Thornback rays are non-migratory and in Russian waters are distributed from Novorossiysk to Adler, approximately 50 km to the south of the Pipeline route (Ref. 12.1).

Black Sea salmon spawns in all large mountain rivers all along the Caucasus coast. Because of dams on most of the Black Sea basin's rivers, most returning adults are unable to reach spawning sites and the anadromous population is now rare. The sea period of the lifecycle has been poorly studied. Because the species has been impacted by the construction of dams (mostly more than three generations ago), it has now considered a stable, albeit rare, population and does not qualify for IUCN Threatened or Near Threatened status despite its scarcity. This species has been observed in fixed stations in the four commercial observation stations.

Long snouted seahorse, currently listed as data deficient by the IUCN (formerly considered vulnerable), were observed at depths of 1 to 30 m throughout the survey area. Seahorses live in shallow water amongst underwater vegetation. Long-snouted seahorses were noted throughout at depths of 1 to 30 m. They breed between April and October, with the timing being dependent on water temperature (Ref. 12.24). Long-snouted seahorses have low dispersal and limited migration (Ref. 12.25). This reduces their ability to colonize new areas, recolonize old ones, and in addition reduces their ability to move when habitat becomes unfavourable. However, the long snouted seahorse matures at an early age, has rapid growth rates, and a short generation time which may assist populations to recover as effects of disturbance cease. Seahorses have been significantly exploited by manufacturers of souvenir products and were initially included in the Red Data Book of the Krasnodar Krai as a protective measure. However, the population of long snouted seahorse in the Black Sea has increased significantly and it was removed from this Red Data Book. It remains on a list of species that are prohibited for catching by the Fishing Rules for the Sea of Azov-Black Sea commercial fishing region.

The corb is a solitary demersal fish usually found over sandy or muddy ground as well as inhabiting seagrass beds. It feeds on a wide variety of invertebrates. Spawning usually occurs from April to June (Ref. 12.38). During the surveys it was recorded at depths of 10 to 50 m but infrequently. Until recent years it has been a preferred object of spear fishing and is now included in the Red Data Book of the Krasnodar Krai and catching it is prohibited.

Tub gurnards are widely in the areas of Bolshoy Utrish, Novorossiysk, Gelendzhik and Arkhipo-Osipovka at depths of 10 to 50 m. It is a benthic species usually inhabiting sand, muddy sand or gravel bottoms where it feeds on a variety of fish and invertebrate prey. The largest of the gurnards, it may grow to 6 kg and live for 14 years (Ref. 12.9). Tub gurnards have been heavily exploited for the manufacturer of souvenirs and by underwater hunters. The pollution of the marine environment as well as illegal fishing has made this species quite rare in the last decade. This species has been entered into the Red Data Books of the Russian Federation and the Krasnodar Territory to ensure its strict protection.

Leaping mullet are native to the Eastern Atlantic, Mediterranean and Black Seas, though they have been introduced to the Caspian. They inhabit coastal waters, sometimes in lagoons and estuaries. The adults are herbivorous though the juveniles feed on zooplankton until about 3 cm, then on benthic invertebrates until 5 cm. The adults feed on algae and vegetal detritus (Ref. 12.38). They reproduce in summer and the eggs are pelagic. The species is of some commercial interest, being consumed fresh, smoked and frozen, as well as for its roe.

Bluefish are a large shoaling pelagic predator. It is a voracious feeder, and has been noted to destroy sardine, anchovy and horse mackerel shoals in excess of its feeding requirements (Ref. 12.11). It is known to spawn and feed in the Survey Area and fingerlings are relatively abundant within 30 km of the coast (Ref. 12.1). Juveniles and adult individuals spend the winter period offshore, outside the Russian sector of the Black Sea.

The presence of sardine (*Sardina pilchardus*) is also noteworthy; although it is not protected it is rare in this area. The sardine is a well-known shoaling pelagic species of considerable economic importance globally, though less so in Russian sector of the Black Sea where it is not common. It shows slight diurnal vertical migrations, moving slightly deeper by day (Ref. 12.25). Sardines feed mainly on planktonic crustaceans. They spawn over a wide area in June to

August. This species was not caught in fixed stations in the four commercial observation stations.

Other notable species are Black Sea turbot (*Scophthalmus maeoticus*) and sprat that form the basis of commercial fisheries, and are the focus of a fisheries protection zone at Anapa Bank, which was initially set up as a protected breeding ground for the former.

The Black Sea turbot can reach 85 cm and 15 kg and attain sexual maturity at the age of seven to ten years. In the summer, they keep close to the shore, where they spawn and feed. Their diet consists of small fish and crustaceans. Annual spawning occurs from May to July. The roe is pelagic and fertility ranges from 3 to 13 million eggs. Black Sea turbot do not undertake long migrations along the coast and only swim locally to feed and reproduce. The North Caucasus and Anapa schools swim in the north-eastern part of the Black Sea (Ref. 12.1).

Sprat are wide ranging pelagic planktivores. The main part of the stock spawns from October until March when the shoals are scattered throughout the central Black Sea. Once the fish have spawned (from mid-March to mid-June) they migrate to feeding grounds over the shelf, usually coinciding with the warming of the surface layers and formation of the stable thermal stratification. During this period, sprat form intensive concentrations at depths between 20 and 80 m on the shelf of the Kerch-Taman area (the Panagiya Cape to the Utrish Cape). Sprat clusters remain in coastal shelf areas until early-October, when they disperse to spawn.

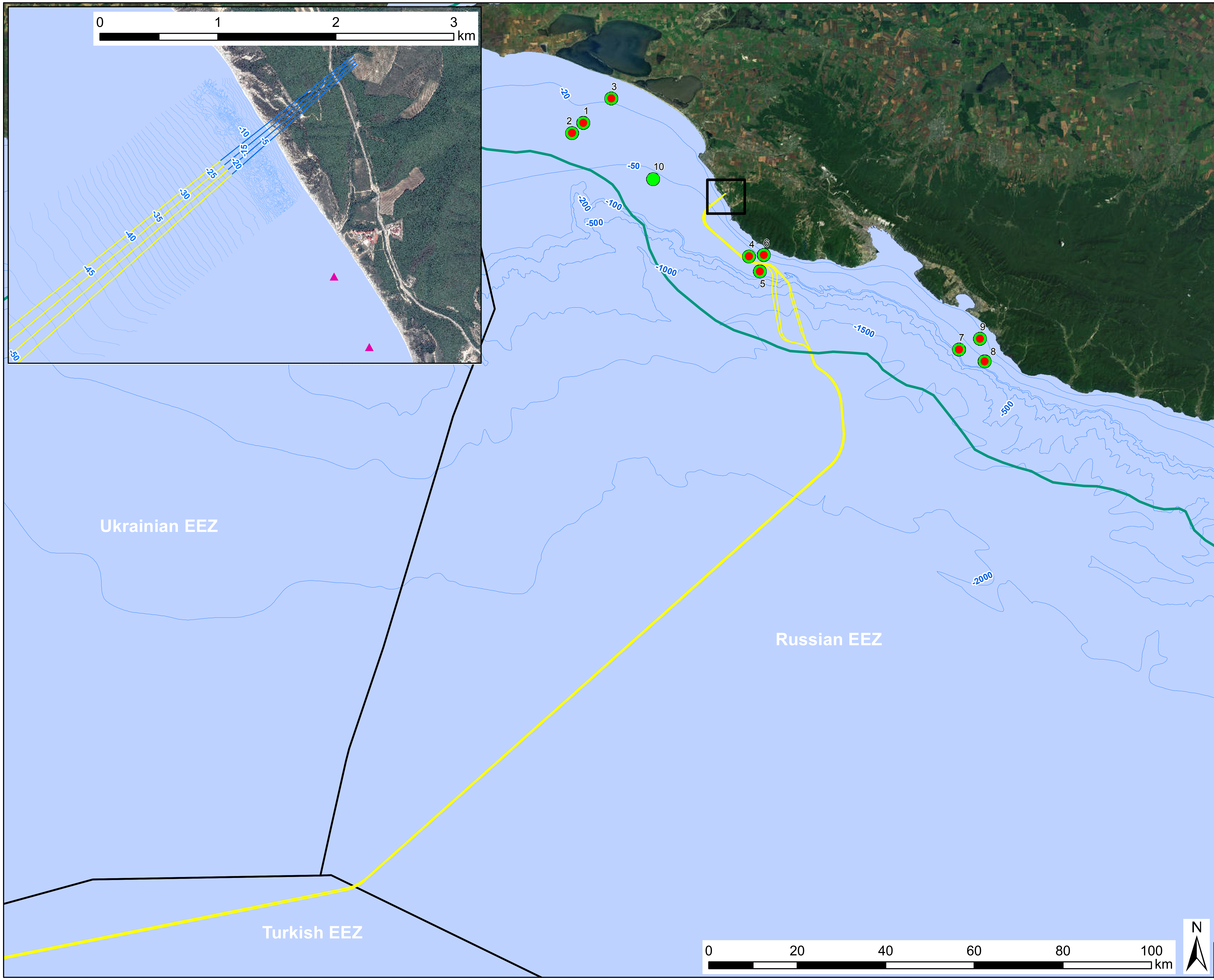
12.4.5.2 Survey

Survey Area

The survey locations given in Figure 12.10 make up the Survey Area discussed in this section for fish. Information on the water depth, distance from shore and survey methodologies is given in Table 12.1 and Table 12.3.

Fish surveys were conducted using fish trawls in November 2010 and June 2011 at a range of depths (15 to 98 m) and gillnet surveys in less than 20 m water depth, were conducted in June 2011 (Figure 12.10) as follows:

- Nine fish trawl transects (Trawl stations 1 to 9) in November 2010;
- Ten fish trawl transects (Trawl stations 1 to 10) in June 2011; and
- Four gillnet surveys in shallow waters (less than 20 m depth) in June 2011.



LEGEND

Russian Sector of South Stream Offshore Pipeline

- Proposed microtunnels
- Proposed offshore pipelines
- Fish Trawls (November 2010)
- Fish Trawls (April - June 2011)
- Fish gillnets (April - June 2011)
- Russia territorial waters boundary
- Exclusive Economic Zone boundary
- Isobaths

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Project Title: SOUTH STREAM OFFSHORE PIPELINE

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File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA\Offshore Sampling\Figure 12.10 Fish Survey Area.mxd

Survey Results

In November 2010 a total of 15 fish species were found in trawls. Table 12.16 shows the total biomass of fish caught in the trawls and the relative percentages of the main species recorded in trawls in November 2010. The biomass of fish was greatest in the trawls from shallower waters (Trawls 1, 2 and 3 up to 30 m depth) although Trawl 9 biomass, from 28 m, was low. Catches in waters between around 20 and 30 m (Trawl 1, 2, 3 and 9) were dominated by anchovy. In deeper waters (over 30 m), Sprat recorded the highest values for abundance and biomass. Horse mackerel and whiting were also abundant in deeper water trawls (over 60 m water depth).

Table 12.16 Species Composition, Abundance and Weight from Fish Trawls (November 2010)

Trawl No.	Depth range (m)	Total trawl weight (kg/hr)	Species	Latin Name	Percentage of weight	Percentage of Total Trawl Biomass
1	19-20	60.0	European Anchovy	*Engraulis encrasicolus*	100	100
2	28-30	150.8	European anchovy	*Engraulis encrasicolus*	58.8	94.4
			Whiting	*Merlangius merlangus*	0.1	0.1
			Horse mackerel	*Trachurus trachurus*	1.0	1.7
			Spurdog	*Squalus acanthias*	19.2	0.1
			Bluefish	*Pomatomus saltatrix (reported as P. saltator)*	20.8	3.7
3	15-16	94.8	European anchovy	*Engraulis encrasicolus*	89.5	98.1
			Mediterranean horse-mackerel	*Trachurus mediterraneus*	1.0	0.9
			Thornback ray	*Raja clavata*	4.0	0.1

Continued...

Trawl No.	Depth range (m)	Total trawl weight (kg/hr)	Species	Latin Name	Percentage of weight	Percentage of Total Trawl Biomass
			Blotched picarel	*Spicara maena (reported as S. flexuosa)*	5.5	0.9
4	60	0.6	Sprat	*Sprattus sprattus*	6.3	50.0
			Mediterranean horse-mackerel	*Trachurus mediterraneus*	93.8	50.0
5	93-94	0.14	Sprat	*Sprattus sprattus*	82.4	85.7
			Pipefish	*Syngnathus spp.*	17.6	14.3
6	93-98	1.0	Whiting	*Merlangius merlangus*	100	100
7	68-70	21.3	Sprat	*Sprattus sprattus*	41.8	99.7
			Caspian shad	*Alosa caspia*	0.5	0.2
			Black Sea turbot	*Scophthalmus maeoticus*	57.7	0.2
8	40-46	10.3	Sprat	*Sprattus sprattus*	83.1	97.5
			Seahorse	-	4.3	2.3
			Common stingray	*Dasyatis pastinaca*	12.5	0.2
9	28	6.0	Mediterranean horse-mackerel	*Trachurus mediterraneus*	32.9	87.6
			Black Sea shad	*Alosa maeotica*	67.1	12.4

Complete.

In the June 2011 surveys there were 14 species recorded from the trawls and 17 species from the gill nets. There were only 6 species in common between the two sampling techniques giving a total of 25 species observed in both surveys (Table 12.17).

Table 12.17 Fish Species Observed in Trawl and Gillnet Surveys (April - June 2011)

Common name	Latin name	Trawls	Gillnets
Annular sea bream	*Diplodus annularis*		✓
Black drum	*Sciaena umbra*		✓
Black goby	*Gobius niger*	✓	
Black scorpionfish	*Scorpaena porcus*	✓	✓
Black Sea turbot	*Scophthalmus maeoticus*	✓	
Blotched picarel	*Spicara maena* (reported as *S. flexuosa)*		✓
East Atlantic peacock wrasse	*Symphodus tinca*		✓
European Anchovy	*Engraulis encrasicolus*	✓	
Five-spotted wrasse	*Symphodus roissali*		✓
Flounder	*Platichtys flesus*	✓	
Goatfish	*Mullus barbatus*	✓	✓
Greater weaver	*Trachinus draco*	✓	
Grey wrasse	*Symphodus cinereus*		✓
Kilka	*Clupeonella cultriventris*	✓	
Knout goby	*Mesogobius batrachocephalus*		✓
Leaping mullet*	*Liza saliens*		✓
Mediterranean horse-mackerel	*Trachurus mediterraneus*	✓	✓
Painted comber	*Serranus scriba*		✓
Red-mouth goby	*Gobius cruentatus*		✓
Round goby	*Neogobius melanostomus*	✓	✓
Rusty blenny	*Parablennius sanguinolentus*		✓
Sprat	*Sprattus sprattus*	✓	

Continued...

Common name	Latin name	Trawls	Gillnets
Spurdog	*Squalus acanthias*	✓	
Thornback ray*	*Raja clavata*	✓	✓
Whiting	*Merlangius merlangus*	✓	✓

* Species of conservation importance

Complete.

As with the November 2010 trawls the greatest diversity of species observed in 2011 was found in shallow waters. Spurdog (*Squalus acanthias*), sprat, anchovy and Black Sea turbot (*Scophthalmus maeoticus*) and flounder (*Platichthys flesus*) were only found below 25 m. At water depths between 50 to 85 m, species composition was the poorest with sprat, anchovy, whiting (*Merlangius merlangus*), Mediterranean horse mackerel, Black Sea turbot, spurdog and the thornback ray recorded (Ref. 12.1). This was also observed by the Azov Fish Industry Research Institute in Ref. 12.1, which recorded a decrease in species abundance with increasing depth and is also reported elsewhere (Ref. 12.11). The lower species diversity in deeper waters was probably due to the absence of Mediterranean species that prefer warm surface waters and comprise the largest group of the Black Sea's fish fauna. In addition, the anoxic conditions which occur in deeper water (at depths below about 150 m) restrict the vertical distribution of organisms, including bottom-living fish (Ref. 12.8).

Several species of commercially important fish were recorded from the November 2010 and June 2011 trawls, particularly sprat and anchovy.

The species of conservation importance caught during the surveys in November 2010 and June 2011 were the leaping mullet (*Liza saliens*) and the thornback ray (*Raja clavata*).

12.4.5.3 Summary

The Russian coastal area of the Black Sea supports around 103 species, dominated by Mediterranean thermophillic fish. The highest diversity of fish is found in shallow waters, below 25 to 30 m, in association with Cystoseira thickets that provide important fish habitat. The number of fish species declines with increasing water depth.

Trawl and gillnet data confirmed the presence of several commercially important fish, particularly, anchovy and sprat, in the Survey Area. The shallow waters of the coastal region are used by many of these species as feeding grounds.

Two species of fish of conservation importance, the thornback ray and the leaping grey mullet were recorded from trawls and gillnets in the Survey Area. A further seven protected species, whilst not observed in the Survey Area, have been recorded from nearby locations (Table 12.17).

12.4.6 Seabirds

12.4.6.1 Background and Literature Review

The Black Sea lies within the Mediterranean-Black Sea Flyway, and the Caucasian coast forms an important migration route (the Trans-Caucasian Flyway) within this larger zone. Owing to its geographic location and varied landscape the region is ornithologically important (Ref. 12.28). The habitat diversity and climate create conditions suitable for the nesting, migration and wintering for thousands of seabirds. During seasonal migrations the whole Black Sea region carries millions of birds from their European nesting sites to their wintering areas (Ref. 12.28 There are two periods for migration in the north-eastern Black Sea region; one during the spring (mid-February to early-June) and one in the autumn (early-August to end-November) (Ref. 12.1).

The available information on wintering seabirds in the north eastern Black Sea is relatively scarce (Ref. 12.1). Mediterranean shearwaters (*Puffinus yelkouan*), cormorants (*Phalacrocorax carbo*), Arctic skua (*Stercorarius parasiticus*) and several species of gull overwinter along the Caucasian coast, but there are no known large permanent colonies of seabirds in the Survey Area. Other birds known to winter in the area of the North Caucasian coast of the Black Sea includes loons and grebes. In general, there is no large grouping of seabirds on the sea surface in the winter (Ref. 12.1).

The most significant seabird habitats in the Black Sea are found on the north Coast from the Danube Delta in Romania to the Kerch Strait (north of Anapa). **Chapter 11 Terrestrial Ecology** contains more detail on terrestrial habitats for nesting, migrating and overwintering seabirds along the Black Sea coast of Russia.

The seabird species which are known to occur at different times of the year along the north-eastern part of the Black Sea and the sea coast of the Gelendzhik area (60 km south of the Project Area) can be loosely divided into the Groups shown in Table 12.18.

Table 12.18 Seabird and Coastal Species Groups in North-Eastern Black Sea Region (Ref. 12.1)

Group	Information
Loons and Grebes	Fish eating and typically water birds. They mainly nest in freshwater environments. Nests are often floating. In the region, they are found only during migration and wintering, from mid-October to mid-May.
Tube-noses	Typical sea birds. Only one type is known in the region; the Mediterranean shearwater. Shearwaters nest in colonies on sea islands in burrows or crevices of rocks. They feed on small fish, crustaceans and shellfish.

Continued...

Group	Information
Pelecaniformes e.g. pelicans and cormorants	They are typical water birds, but they do use the land. They nest in colonies in inland waters and on the coast. The nearest known nesting areas are the south-eastern part of the Sea of Azov. They are present in the region generally from November to April. They feed exclusively on fish.
Geese	Geese are only found on migrations in the region from late October to mid-November and early March to mid-April. They nest on the ground in open habitats. They are exclusively herbivorous birds, feeding mostly on land.
Swans	They nest on inland waters, but during migration and in winter they can be observed on marine waters. In the region they may occur during migration from September to late April, but they are most common in winter. The closest nesting site is the Sea of Azov. They are herbivorous.
Dabbling ducks	Typically freshwater. They nest on the ground along banks of water courses. They occur during migration and wintering from late August to late May. They feed on phytoplankton and zooplankton and sometimes eat larger invertebrates - crickets, etc.
Diving and sea ducks	They nest primarily along the freshwater shores. In the region they can be observed during migration and, more rarely, during wintering from September to May. They feed mainly on zooplankton, larger invertebrates (crustaceans, molluscs, etc.), sometimes eat small fish.
Coot	Coot nest in fresh and brackish waters or sea bays with dense thickets of rush, reeds and other macrophytes. They are known to nest in the Sea of Azov area. In the region they are likely to be observed throughout the year, but mainly from September to May. Feed mainly on plant foods but can sometimes eat medium-sized invertebrates and small fish.
Raptors	They are associated with water due to their diet of fish. Raptors nest on large trees, usually not further than 1 km from water. They are most likely to be observed in the region in the autumn-winter period.
Waders	Ground-nesting birds that nest near water. They feed on small invertebrates In the described area, most species can occur only during the migrations - from September to late November and from early March to May.

Continued…

Group	Information
Gulls	This group includes ground-nesting colonial birds connected with different bodies of water. "Marine" gulls such as Caspian gull (*Larus cachinnans*) and lesser black-backed gull (*L.fuscus*) are closely linked to marine waters and coasts. All species are found in marine waters primarily at non-breeding times. In the region, gulls are marked both during migration (from September to May) and in winter. Summer residence of some species is not connected with nesting and migrations. All gulls feed mainly on fish.
Terns	Ground-nesting colonial birds. The Caspian tern (*Hydroprogne caspia*) is among them and its environmental requirements are most similar to those of gulls: it nests on the sandy shores of lakes and seas, including the Black Sea, and it mainly feeds on fish. A significant portion of its diet is small fish. Small quantities of terns may be encountered in the region during migrations.

Complete.

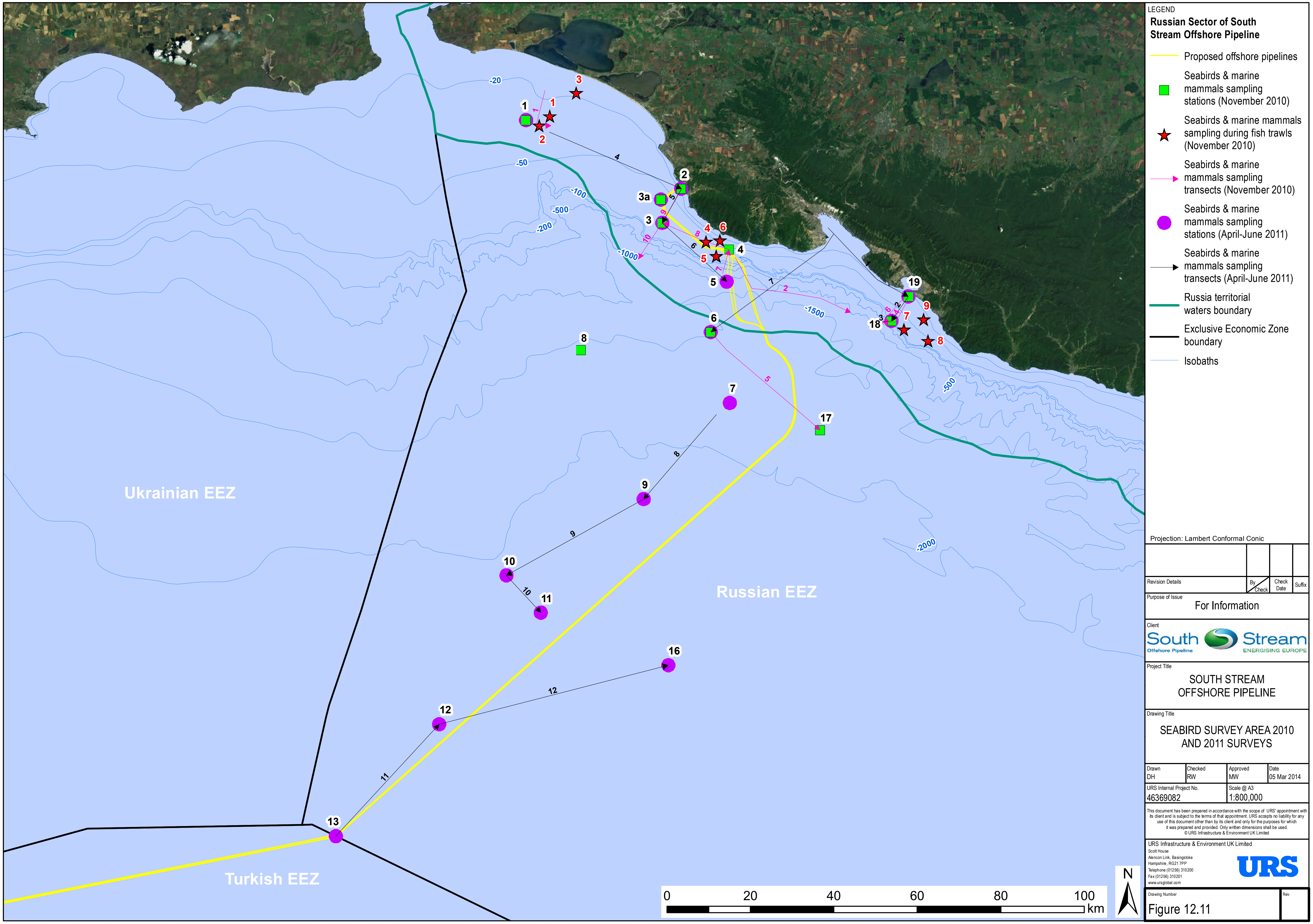
12.4.6.2 Survey

Survey Area

The survey locations given in Figure 12.11 comprise the Survey Area discussed in this section for seabirds. Information on the water depth, distance from shore and survey methodologies is given in Table 12.1 and in Table 12.3.

Seabird transects were conducted in November 2010, April to June 2011 and in July 2013. Figure 12.11 shows the locations of the 2010 and 2011 surveys. Figure 12.12 shows the locations of the 2013 survey. The surveys were conducted at the following locations:

- Ten transects in November 2010;
- Nine transects in November 2010 (during fish trawls);
- Twelve transects in June 2011; and
- In July 2013; 38 transects and 51 stations in coastal region were sampled.



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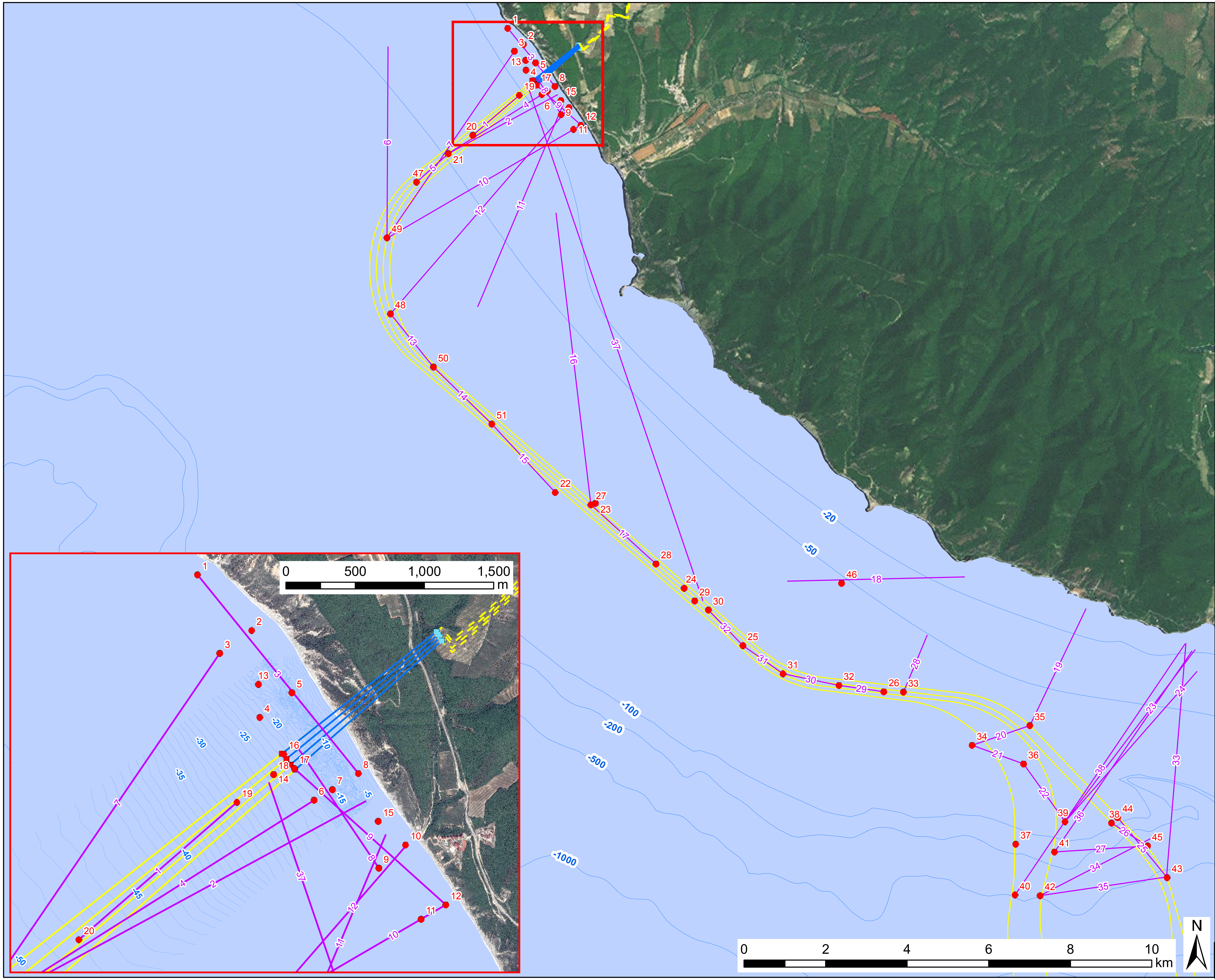

LEGEND

- Fixed survey stations
- Survey transects

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Proposed microtunnels
- Proposed offshore pipelines
- Microtunnel entry shaft
- Microtunnel exit pit
- Isobaths

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File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA\Offshore Sampling\Figure 12.12 Seabird Survey Area July 2013 Survey.mxd

Survey Results

During November 2010, 24 species of seabird were observed. The Charadriiformes (which includes gulls, skuas, terns, waders and auks) were the most abundant group of seabirds (Table 12.19). Migrations of Charadriiformes in the region take place during spring from March to early June, and in autumn from August to November (Ref. 12.1). The most abundant species that were observed in transects during 2010 were the Mediterranean shearwater (*Puffinus yelkouan*), and the Caspian gull (*Larus cachinnans*), Table 12.19).

In April 2011, a total of 23 seabird species were recorded during transects (Figure 12.11). Large groups of migratory species were observed, such as grebes, which were more abundant than all other species, especially in coastal areas (Ref. 12.1). Grebes are freshwater species which may use coastal areas as a feeding ground. Groups of the black-throated diver (also known as a black-throated or Artic loon, *Gavia arctica*) were also detected. The common cormorant is a typical species for the Black Sea and 110 individuals were recorded. Cormorants were generally found near the coast of Novorossiysk and to the lesser extent near Gelendzhik (south of the Survey Area) (Ref. 12.1). The sandwich tern (*Sterna sandvicensis*), Caspian gull and lesser black-backed gull (*Larus fuscus*) were also abundant in transects throughout the entire Survey Area (Table 12.19).

Charadriiformes were the most commonly observed group of birds during offshore transects. The majority of birds observed were concentrated near the coast (no more than 20 km from land). In offshore areas of the Survey Area (Figure 12.11), the number of seabird sightings was reduced (Ref. 12.1).

The full list of species observed during transects for all three years is shown in Table 12.19.

Table 12.19 Seabird Species Observed during November 2010, April 2011 and July 2013 transects

Species	Ecological Status in NE Black Sea*	Density, birds/km^2 (Nov 2010)	Density, birds/km^2 (April 2011)	Density birds/km^2 (July 2013)
Black-throated diver *Gavia arctica*	Wintering	0.13	5.2	0
Mediterranean gull *Larus melanocephalus*	Breeding and wintering**	0.09	2.1	0
Little gull *Larus minutus*	Wintering	0.98	23.4	0
Black-headed gull *Larus ridibundus*	Wintering	2.07	3.6	<0.1

Continued...

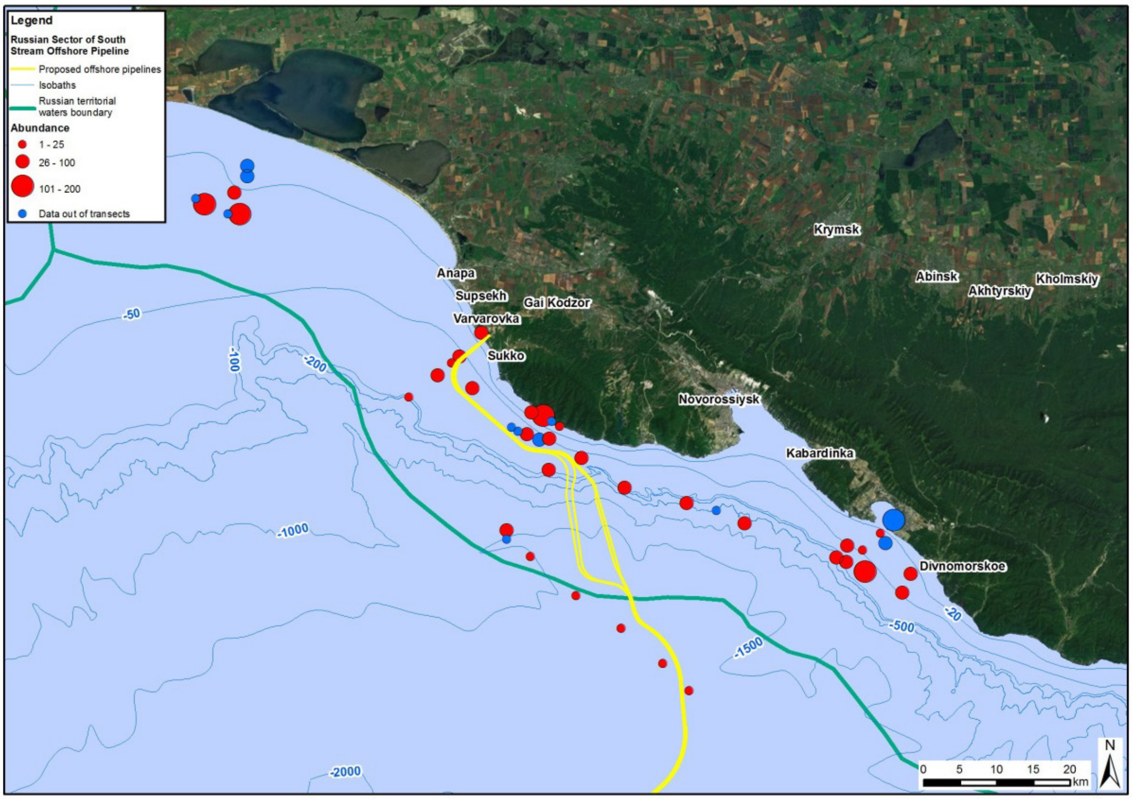
Species	Ecological Status in NE Black Sea*	Density, birds/km^2 (Nov 2010)	Density, birds/km^2 (April 2011)	Density birds/km^2 (July 2013)
Caspian Gull *Larus cacchinans*	Wintering	4.56	9.1	6.9
Sandwich tern *Sterna sandvicensis*	Nesting and wintering**. Resident subadults	0.07	16.2	<0.1
Lesser black-backed gull *Larus fuscus*	Wintering	-	1.6	0
Great-crested grebe *Podiceps cristatus*	Migratory and wintering	-	138.2	<0.1
Red-necked grebe *Podiceps grisegena*	Migratory (nesting and wintering) and resident birds.	-	15.9	0
Black-necked grebe *Podiceps nigricollis*	Migratory and wintering	-	9.1	0
Mediterranean shearwater *Puffinus yelkouan* †	Wintering	3.67	12.6	11.5
Common cormorant *Phalacrocorax carbo*	Nesting and wintering	-	63.7	<0.1
Widgeon *Anas penelope*	Wintering	-	3.5	0
Garganey *Anas querquedula*	Wintering	-	2.6	0
Arctic skua *Stercorarius parasiticus*	Wintering (occasional)		1.0	<0.1
Total	**-**	**11.57**	**307.8**	**18.70**

* Ecological status based on published data Ref. 12.29.
** Some of the Black sea population winters locally, though mostly in the Mediterranean.
† There is significant taxonomic confusion regarding European shearwaters; for the purposes of this report, all have been reported as *P. yelkouan*, which is currently considered the only species that regularly occurs in the Black Sea.

Complete.

In November 2010, the highest numbers of birds were observed at coastal transects (Figure 12.13) (Ref. 12.1). This is similar to the results in April 2011 although more migratory species were observed in April 2011. The density of birds decreases with increasing distance from the shore. At around 40 km offshore, no birds where observed during transects (Ref. 12.1). The abundance (absolute number) of seabirds in the Survey Area is shown in Figure 12.13. Some species were not observed during transects but were seen during sailing time to and from stations; the locations of these species have also been recorded in Figure 12.13 as "data out of transects".

Figure 12.13 Abundance of Birds Recorded During Surveys in November 2010

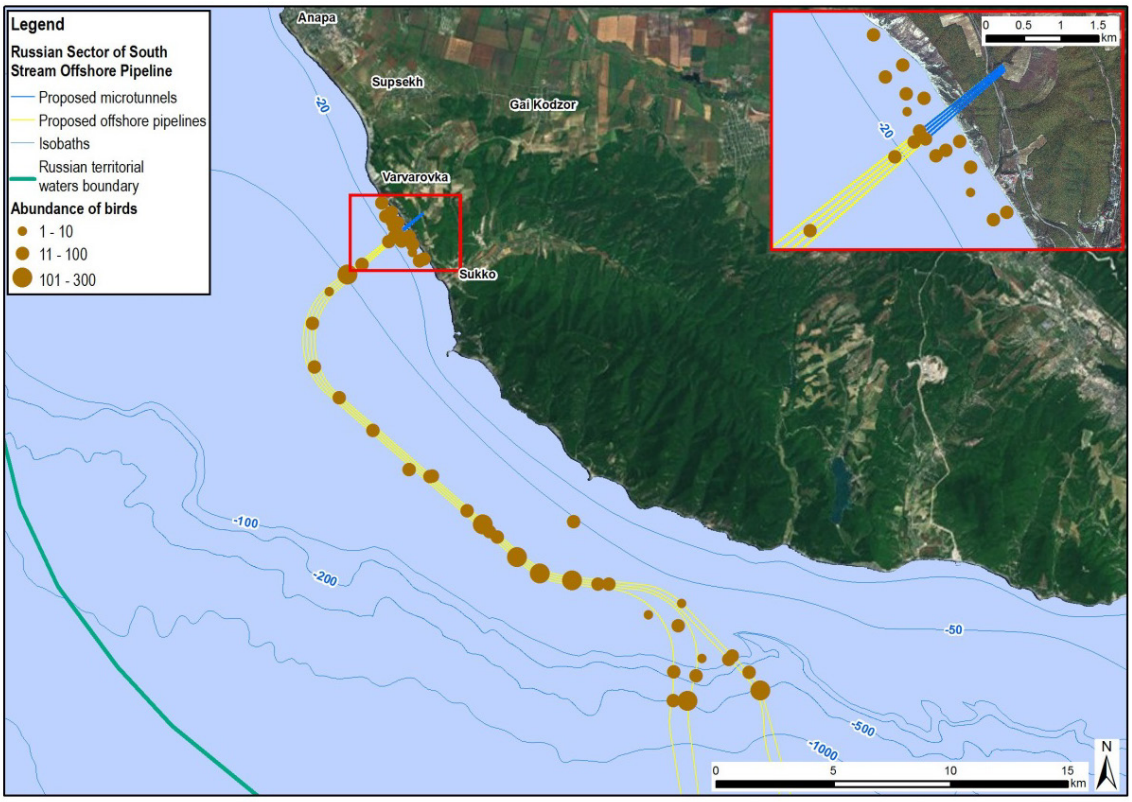


During the July 2013 surveys a total of 13 species were observed. However, two seabird species, the Mediterranean shearwater (*Puffinus yelkouan*) and the Caspian gull (*Larus cachinnans*), dominated seabird numbers (Table 12.19) together accounting for over 98% of transect observations and over 96% of sightings from fixed stations. The abundance of birds was variable throughout the Survey Area (Figure 12.14).

The Mediterranean shearwater was observed throughout the survey area as individual specimens and in small groups of 5 to 10 birds. There were very high densities, up to a maximum of 108 individuals/km^2, mostly in areas away from the very near shore (within a kilometre or two), such as close to the shelf break. The average density of Mediterranean shearwaters across the survey area was 11.5 observations/km^2 with a maximum of 108 individuals/km^2. The average density of the Caspian gull was 6.9 observations/km^2 with a maximum of 30/km^2.

The data from the three surveys reflects the seasonality in the abundance of some bird species in the survey area. In particular, the little gull, sandwich tern, great crested grebe and common cormorant were observed at much higher densities in April compared to July and November although some differences may be due to normal interannual variability.

Figure 12.14 Abundance of Birds Recorded at Stations During July 2013 Survey



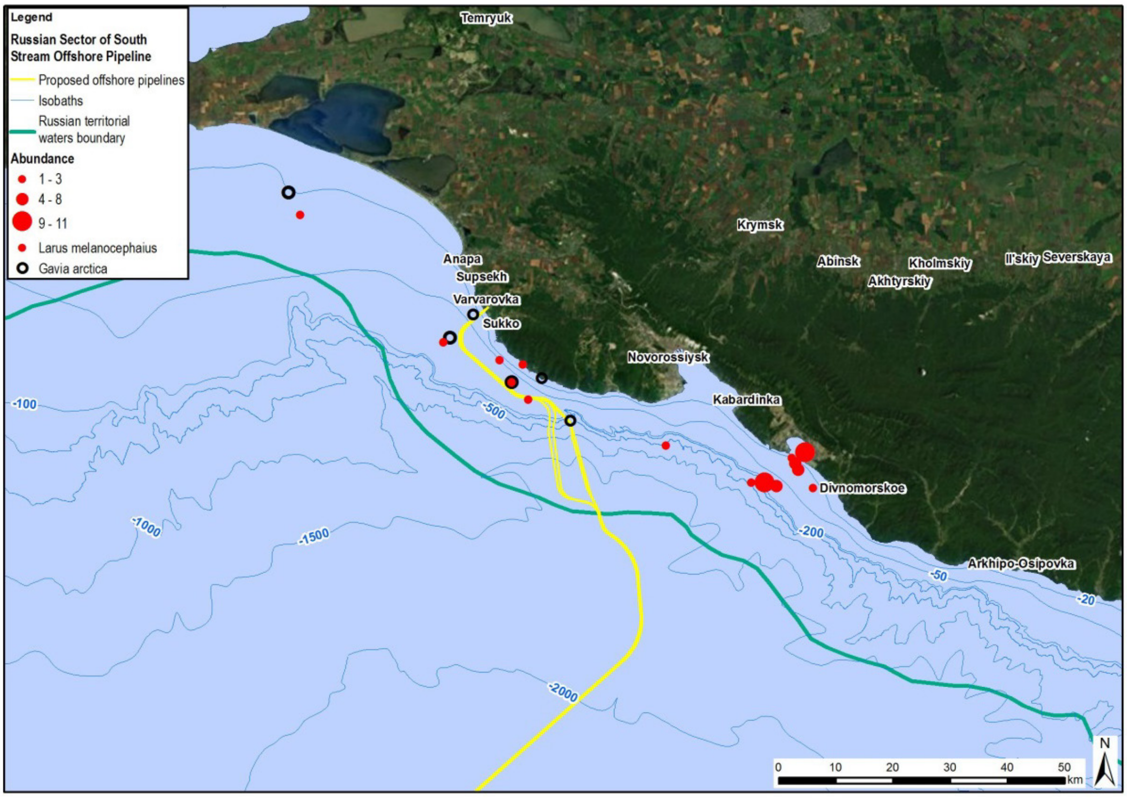
Three species observed offshore are of conservation interest (Table 12.20). These were the only species recorded during offshore surveys that are listed in the Russian Federation (RDBRF) or Krasnodar Red Data Books (RDBKK) or listed as 'vulnerable' or above on the IUCN Red List. The locations of the Red Data Book species observed during 2010 and 2011 surveys are given in Figure 12.15.

Table 12.20 Seabird Species of Conservation Interest Observed in November, 2010, April, 2011 Surveys

Species	Latin name	IUCN Global Red List1	RDBRF2	RDBKK2
Black-throated diver (Artic loon)	*Gavia arctica*	LC	2	2
Mediterranean gull	*Larus melanocephalus*	LC	3	3
Mediterranean shearwater	*Puffinus yelkouan*	VU		

[1]IUCN: LC=Least Concern; NT=Near threatened; VU=Vulnerable; EN=Endangered; CR= Critically endangered; EW=Extinct in the wild; EX=Extinct [2]Red Data Books: 2= vulnerable species and subspecies declining in number; 3=rare species and subspecies.

Figure 12.15 Occurrence of Red Data Book of Russia Bird Species Observed

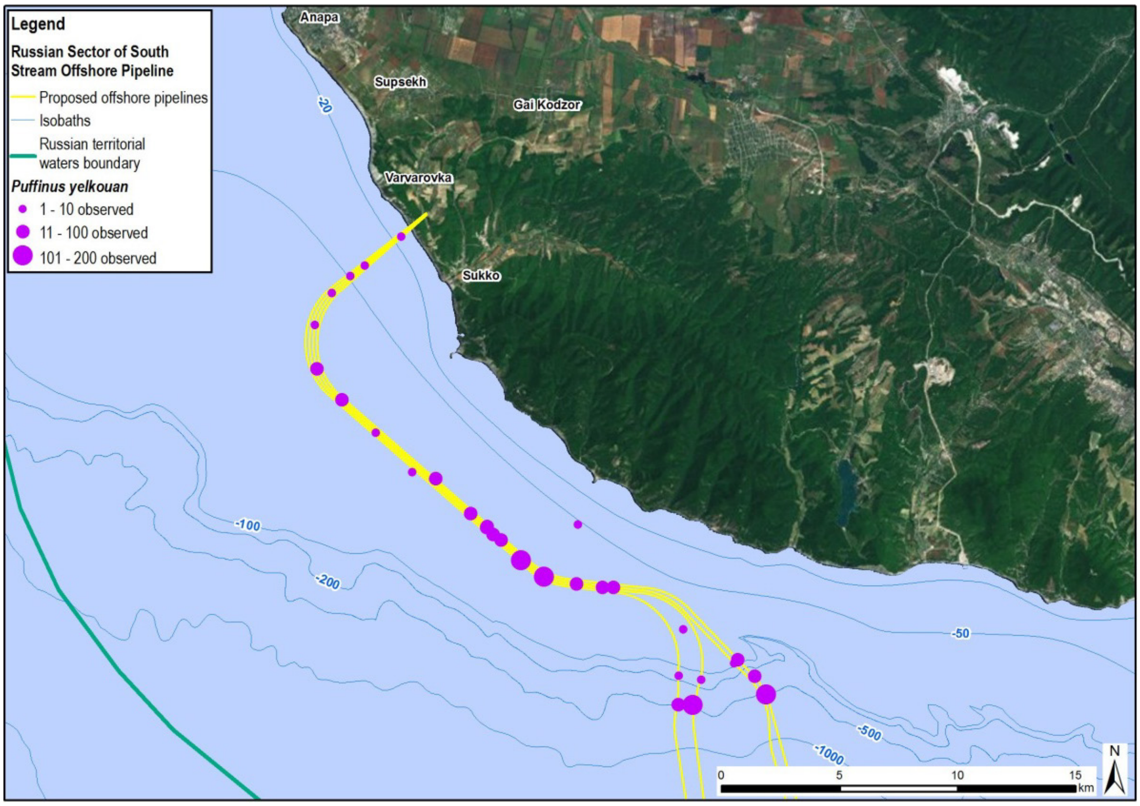


In the July 2013 surveys the only protected species observed was the Mediterranean shearwater, *Puffinus yelkouan* which was present in high abundance, as many as 200 observations at some stations (Fig. 12.16).

An additional protected species that is likely to occur in the Survey Area (Ref. 12.1), but was not directly observed in surveys, is the gull-billed tern (*Gelochelidon nilotica*). This species is in both the Russian and Krasnodar Red Data Books. Notes on these species are provided in Section 12.4.6.2.

The black-throated diver or Arctic loon (*Gavia arctica*) is strongly migratory, breeding in isolated solitary pairs in deep cold lakes or inlets generally at high latitudes from April onwards. When migrating, divers often form flocks of around 50 individuals which then disperse, so that wintering birds generally occur singly, in pairs or small flocks (Ref. 12.29). However, because their diet is predominantly fish, they may occasionally form large congregations in rich coastal fishing areas. Divers overwinter along many European coasts, including the Black Sea, where they are most common in inshore waters along sheltered coasts (Ref. 12.29). Though globally common, black-throated divers are relatively scarce in the Eastern Black Sea, and are thus listed in both Russian Federation and Krasnodar Red Data Books.

Figure 12.16 Occurrence of Protected Bird Species Observed in July 2013 surveys



During the breeding season black-throated divers are threatened by the pollution of breeding waters, as well as disturbance. Wintering birds are vulnerable to coastal oil spills, especially in rich fishing grounds where large congregations may occur. The species is also commonly caught and drowned as by-catch in fishing nets (Ref. 12.3).

The Mediterranean gull breeds almost entirely in Europe, mainly on the Black Sea coast of Ukraine, with a recent spread to the northern Caucasian Plains (Ref. 12.3). Most populations of this species are fully migratory and travel along coastlines between their breeding and wintering areas, although some travel inland across Anatolia or follow major river valleys through Eastern and central Europe (Ref. 12.29). Outside the breeding season the species becomes entirely coastal, favouring estuaries, harbours, saline lagoons and other sheltered waters.

Mediterranean gulls migrate to breeding colonies at lagoons, estuaries and coastal saltmarshes from late-February to early-April, with most beginning to breed from early-May. A significant portion of the population also breeds on lakes and lowland marshes away from the coast (Ref. 12.29). It often breeds near but not among Sandwich terns *Sterna sandvicensis* (which also occurs in the Survey Area), or intermingling with black headed gulls (*Larus ridibundus*) (Ref. 12.3). The migration to the wintering grounds occurs from late-June onwards through to autumn. The gulls breed in colonies, usually of less than 1,000 pairs and occasionally in single pairs amidst colonies of other species.

Mediterranean gulls are susceptible to heavy losses as a result of tourist disturbance at breeding colonies. They may also be threatened by habitat loss resulting from coastal development and by marine pollution (e.g. oil spills and chemical discharges). Eggs and adults are collected from breeding colonies by fishermen in some areas of the species' range (Ref. 12.3), though it is protected in Russia.

The Mediterranean or Yelkouan shearwater (*Puffinus yelkouan*) was formerly considered a subspecies of the Manx Shearwater *(P. puffinus*). It is a gregarious species, nesting in burrows which are only visited at night to avoid predation by large gulls. It breeds on islands and coastal cliffs in the eastern and central Mediterranean in spring and early summer, after which the birds disperse throughout their range.

Mediterranean shearwaters may range widely, with birds ringed in Malta having been observed in the Black Sea. Increasing numbers have been observed entering the Black Sea since the 1970s though there are no recent records of breeding birds there. Non breeding birds are mostly present in the Black Sea from February to October, though some are present all year. This species has been reported to make large scale clockwise movements around the Black Sea, with flocks of up to 20,000 gathering in the north during summer months (Ref. 12.30).

The Mediterranean shearwater is under some threat from coastal development in its breeding range as well as predation of eggs and young by rats and cats. Adult birds are frequently caught in long line fisheries, and may also suffer from depleted food stocks due to the overfishing of anchovy in some areas (Ref. 12.6). Genetic studies suggest that the Mediterranean Shearwater may have suffered a marked population decline historically and thus could be vulnerable to adverse effects of inbreeding (Ref. 12.30). It was formerly classified as a species of least concern by the IUCN but in 2012 this was changed to vulnerable.

12.4.6.3 Summary

In November, 2010, the Caspian gull and the Mediterranean shearwater were the most abundant species observed offshore during transects. These birds were most likely observed wintering in and around the Survey Area. In April 2011, the great-crested grebe had the highest abundance and was most likely migrating along the Black Sea coast. The cormorant was also abundant in this survey and was most likely migrating.

Coastal transects in both years recorded the highest abundances of birds, with no birds observed over 40 km from the coast in transects in April 2011.

Three species of conservation interest were encountered during in the Survey Area; the black-throated diver or Arctic loon, the Mediterranean gull and the Mediterranean shearwater. All three species were recorded in both the November 2010 and April 2011 surveys however, higher abundance of all three species were recorded in the April 2011 survey.

12.4.7 Marine mammals

12.4.7.1 Background and Literature Review

Three species of cetacean reside in the Black Sea and these are listed in Table 12.21 along with their international, national and regional conservation status. The cetacean species off the Russian coast are represented by Black Sea subspecies, namely Black Sea harbour porpoise (*Phocoena phocoena relicta*), Black Sea bottlenose dolphin (*Tursiops truncatus ponticus*) and Black Sea common dolphin (*Delphinus delphis ponticus*). All three are protected at a national level by environmental legislation and governmental decrees (Ref. 12.3).

Table 12.21 Marine Mammal Species Reported from the Russian Black Sea Coast

Species	IUCN Global Red List*	Black Sea Convention**	RDBRF	RDBKK
Black Sea harbour porpoise (*Phocoena phocoena relicta*)	EN	E	3	2
Black Sea common dolphin (*Delphinus delphis ponticus*)	VU	E	Not listed	Not listed
Black Sea bottlenose dolphin (*Tursiops truncatus ponticus*)	EN	E	3	3

* IUCN: VU=Vulnerable; EN=Endangered. Red Data Books: 2= vulnerable species and subspecies declining in number; 3=rare species and subspecies.
** Species included in the *Agreement on Conservation of Biodiversity and Landscapes of the Convention on the Protection of the Black Sea from Pollution* (Ref. 12.31): E= endangered

Harbour porpoises inhabit mainly shallow waters (0 to 200 m deep) over the continental shelf around the entire perimeter of the Black Sea, although they also occur quite far offshore in deep water. Sizeable groups have been observed in the central Black Sea over 200 km from the nearest coast (Ref. 12.27). During warm periods they occur in the Azov Sea and Kerch Strait (among other areas). These different locations may represent geographically distinct breeding-calving-feeding areas.

Harbour porpoises in Russian waters undertake annual migrations, leaving the Azov Sea and north-western Black Sea before winter and returning in spring. The primary wintering areas are in the south-eastern Black Sea, extending into Georgian and Turkish waters. These are also the wintering grounds of anchovy, which, along with sprat, whiting and various goby species, are its principal prey. During their seasonal migration, animals may remain for a few days at different sites (usually bays with abundant fish, e.g. off the southern coast of Crimea) forming dense aggregations of some hundreds of individuals.

The ecology of Black Sea harbour porpoises may be considered unusual. It reflects the high degree of geographical isolation of their habitat, relatively low water salinity, significant seasonal fluctuations in water temperature, and large amount of anoxic waters saturated with H_2S usually below 150 to 200 m (Ref. 12.27).

Until 1983, unregulated hunting was the primary threat and the directed fishery for the porpoise drastically reduced populations. At present, incidental mortality in fishing nets is the most serious threat (Ref. 12.27). The majority (95%) of recorded cetacean entanglements in the Black Sea are of harbour porpoises, mostly in bottom set nets for turbot. Large-scale pelagic and small-scale coastal fisheries may affect Black Sea harbour porpoises indirectly by reducing their prey populations and degrading their habitat (Ref. 12.21). Other industrial activities, including shipping, dredging and hydrocarbon exploitation, also pose a threat (Ref. 12.32); for example an explosion at a gas-drilling platform in the Azov Sea in August 1982 resulted in the deaths of over 2,000 harbour porpoises (Ref. 12.27).

Commercial hunting of Black Sea cetaceans, including harbour porpoises, was banned in 1966 in the former USSR (the present Georgia, Russia and Ukraine), Bulgaria and Romania, and in 1983 Turkey and Russia assumed international obligations to protect Black Sea cetaceans as contracting parties to a wide range of international conventions[12]. At a national level, the harbour porpoise is listed in the Red Data Book of the Russian Federation which means that the species should be monitored and managed by appropriate state or national programmes.

Common dolphins are distributed mainly offshore and visit shallow coastal waters following seasonal aggregations and regular mass migrations of their preferred prey, small pelagic fishes such as anchovy and sprat. Annual winter concentrations of anchovies in the south-eastern Black Sea and to a lesser degree, south of the Crimean peninsula, create favourable conditions for wintering concentrations of dolphins. Summer concentrations of sprats in the north-western, north-eastern and central Black Sea attract common dolphins to different feeding grounds in summer months. Common dolphins avoid waters with low salinity, and this may explain their absence from the Sea of Azov and scarcity in the Kerch Strait (Ref. 12.27).

Last century, the population collapsed because of directed takes. The total number of animals killed is unknown, but it was estimated that before the mid-1950s common dolphins comprised

[12] The Russian Federation is party to the Convention on Biological Diversity (CBD), Convention on the Protection of the Black Sea Against Pollution (Bucharest Convention), Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES, Appendix II). It is not party to Convention on the Conservation of Migratory Species of Wild Animals (CMS) or the Agreement on the Conservation of Cetaceans in the Black Sea, Mediterranean Sea and Contiguous Atlantic Area (ACCOBAMS).

94.8% of the total number of Black Sea cetaceans killed and processed in the former Soviet Union (Ref. 12.27).

Reduced prey availability has been considered an on-going major threat to Black Sea common dolphin since the late 1980s. Two mass mortality events that killed unknown but large numbers of common dolphins (in winter to spring 1990 and summer to autumn 1994) coincided with a drastic decline in the abundance of both principal prey species (anchovy and sprat), which has been attributed to overfishing, eutrophication and the invasion of the introduced predatory ctenophore *Mnemiopsis leidyi*, discussed in Section 12.4.1 (Ref. 12.27). This correlation between large die-offs of Black Sea common dolphins and prey scarcity could signify that reduced prey availability compromised the health of the dolphins and increased their susceptibility to viral infection. The 1994 summer-autumn die-off was also associated with an outbreak of morbillivirus (Ref. 12.27).

Bottlenose dolphins are distributed across the Black Sea shelf and may occur far offshore. In the northern Black Sea they form scattered communities of some tens to approximately 150 animals in different locations around the Crimean peninsula, including the Kerch Strait and coastal waters off the western and southern shores. Accumulations are also known to form off the Russian Caucasus and close to the Turkish coast. Bottlenose dolphins typically aggregate during autumn, winter and spring in a relatively small area between Cape Sarych and Cape Khersone. According to a two-year photo-identification study in this area off the southern Crimea this "winter" accumulation consists of animals from other "summer" concentrations. Mean group sizes varied from 2.0 to 2.9 individuals in different surveyed areas (Ref. 12.27).

Bottlenose dolphins are primarily piscivorous (fish eating) in the Black Sea, taking both benthic and pelagic fishes, large and small. A total of 16 fish species have been reported as prey off the Crimean and Caucasian coasts including four species of mullet (*Liza aurata, L.saliens, Mugil cephalus* and *M. so-iuy)*.

In the past, the population of bottlenose dolphins was subject to extensive commercial exploitation for the manufacture of oils, paint, glue, varnish, foodstuffs, medicine, soap, cosmetics, leather, "fish" meal and bone fertiliser. The total number of animals killed is unknown but it is acknowledged by the International Whaling Commission that all Black Sea cetacean populations, including bottlenose dolphins, were greatly reduced by the dolphin fishery. Isolated cases of deliberate killing and harassment (with pyrotechnic devices and firearms) have been reported in coastal fisheries. For instance, at least two bottlenose dolphins were reportedly shot in Balaklava, Ukraine in 2004 (Ref. 12.27).

Since the mid-1960s, hundreds of bottlenose dolphins (probably over 1,000) have been live-captured in Russia, Ukraine and Romania for military, commercial and scientific purposes. The capture operations sometimes caused accidental (but usually unreported) deaths. In recent years, 10 to 20 animals have been taken annually from May to June from a small area in the Kerch Strait (Ref. 12.27). During the 1980s to early 2000s, the number of facilities for dolphin shows and "swim with dolphins" programmes greatly increased in Black Sea countries. The export of bottlenose dolphins from Russia and Ukraine for permanent and seasonal shows also expanded to over 20 countries in Europe and the Middle East. According to CITES statistics, at least 92 individuals were removed from the Black Sea region during 1990 to 1999 and Russia reportedly has exported at least 66 for traveling shows since 1997 (Ref. 12.27).

At present, incidental mortality in fishing gear is probably one of the main threats to Black Sea bottlenose dolphin. They are known to be susceptible to capture in a variety of fishing nets, including bottom-set gillnets for turbot, spiny dogfish, sturgeon and sole, purse seines for mullet and anchovy, trammel nets and trap nets. However, only bottom-set gillnets are thought to take significant numbers, especially during the turbot fishing season between April and June. Small-scale coastal fisheries also affect Black Sea bottlenose dolphins indirectly by depleting their prey populations (Ref. 12.21). Though there has been concern regarding decreasing populations of indigenous mullets (*M. cephalus* and *Lisa* spp.) this might be offset to some extent by the introduced far-east mullet, M. so-iuy, which has since become abundant in the northern Black Sea and may be a factor a recent marked increase in dolphin density along the Crimean coast (Ref. 12.27).

Microbial pollution from untreated sewage in coastal waters poses a chronic risk of opportunistic bacterial infections to bottlenose dolphins, and there is evidence that they (as well as other Black Sea cetaceans) are exposed to morbillivirus infection (Ref. 12.27). Another potential source of exotic infections and genetic "pollution" is the poorly managed intentional releases and spontaneous escapes of captive bottlenose dolphins and other marine mammals from dolphinaria.

12.4.7.2 Survey

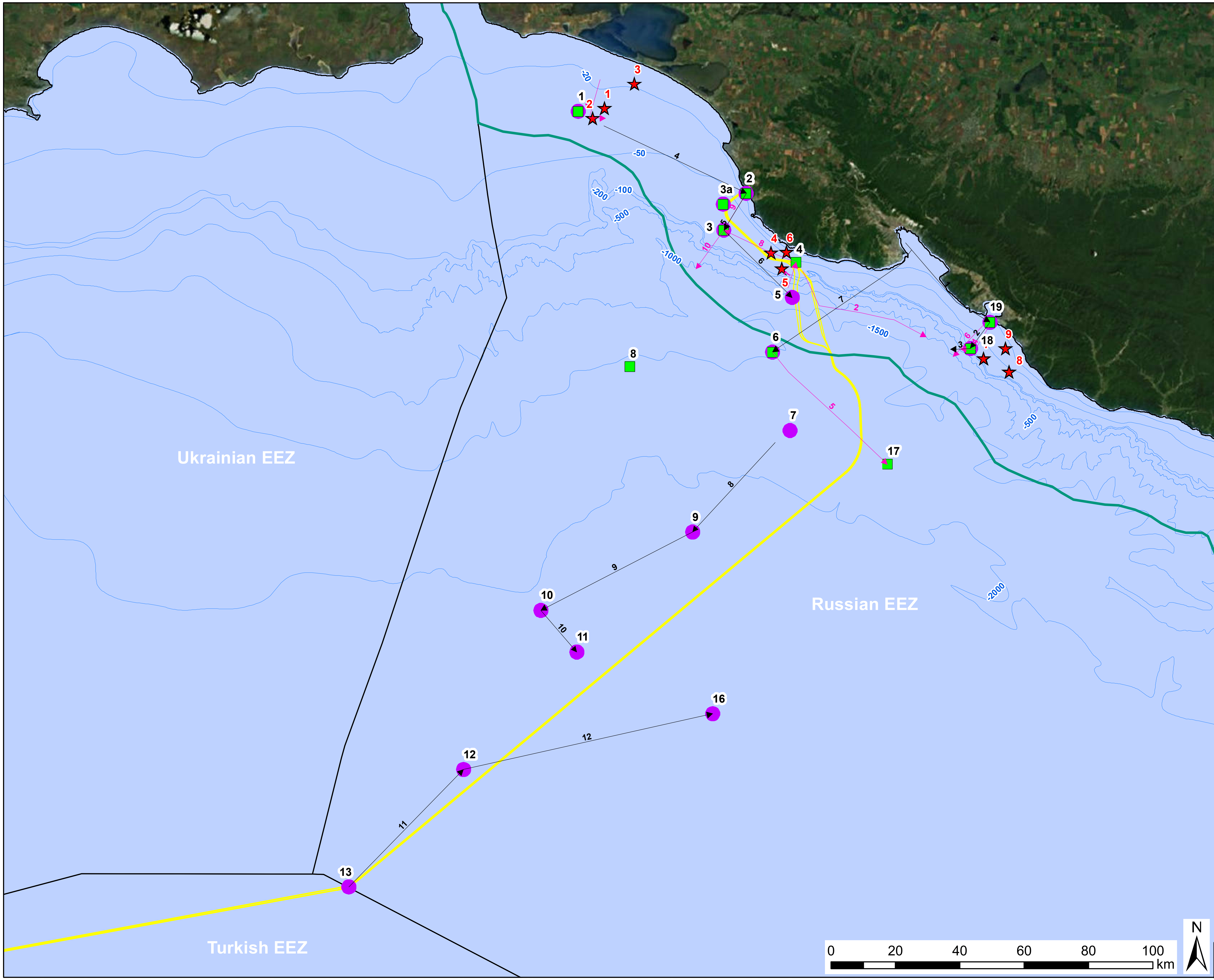
Survey Area

The survey locations given in Figure 12.17 make up the Survey Area discussed in this section for marine mammals. Information on the water depth, distance from shore and survey methodologies is given in Table 12.1 and Table 12.3.

Marine mammals transects were conducted along with the seabird surveys in November 2010, April to June 2011 and July 2013. Figure 12.17 and Figure 12.18 show the locations of these surveys. The surveys were conducted at the following locations:

- Ten transects in November 2010;
- Nine transects in November 2010 (during fish trawls);
- Twelve transects, including some in offshore areas, in June 2011; and
- In July 2013, 38 transects and 51 stations in coastal region were sampled.

Coastal surveys were also conducted in June 2010 in the vicinity of Anapa and along the Russian coast.



LEGEND

Russian Sector of South Stream Offshore Pipeline

- Proposed offshore pipelines
- Seabirds & marine mammals sampling stations (November 2010)
- Seabirds & marine mammals sampling during fish trawls (November 2010)
- Seabirds & marine mammals sampling transects (November 2010)
- Seabirds & marine mammals sampling stations (April-June 2011)
- Seabirds & marine mammals sampling transects (April-June 2011)
- Russia territorial waters boundary
- Exclusive Economic Zones
- Isobaths

Projection: Lambert Conformal Conic

Revision Details	By Check	Check Date	Suffix

Purpose of Issue: For Information

Client: South Stream Offshore Pipeline — ENERGISING EUROPE

Project Title: SOUTH STREAM OFFSHORE PIPELINE

Drawing Title: MARINE MAMMAL SURVEY AREA

Drawn	Checked	Approved	Date
DH	RW	MW	25 Mar 2014

URS Internal Project No.: 46369082

Scale @ A3: 1:1,100,000

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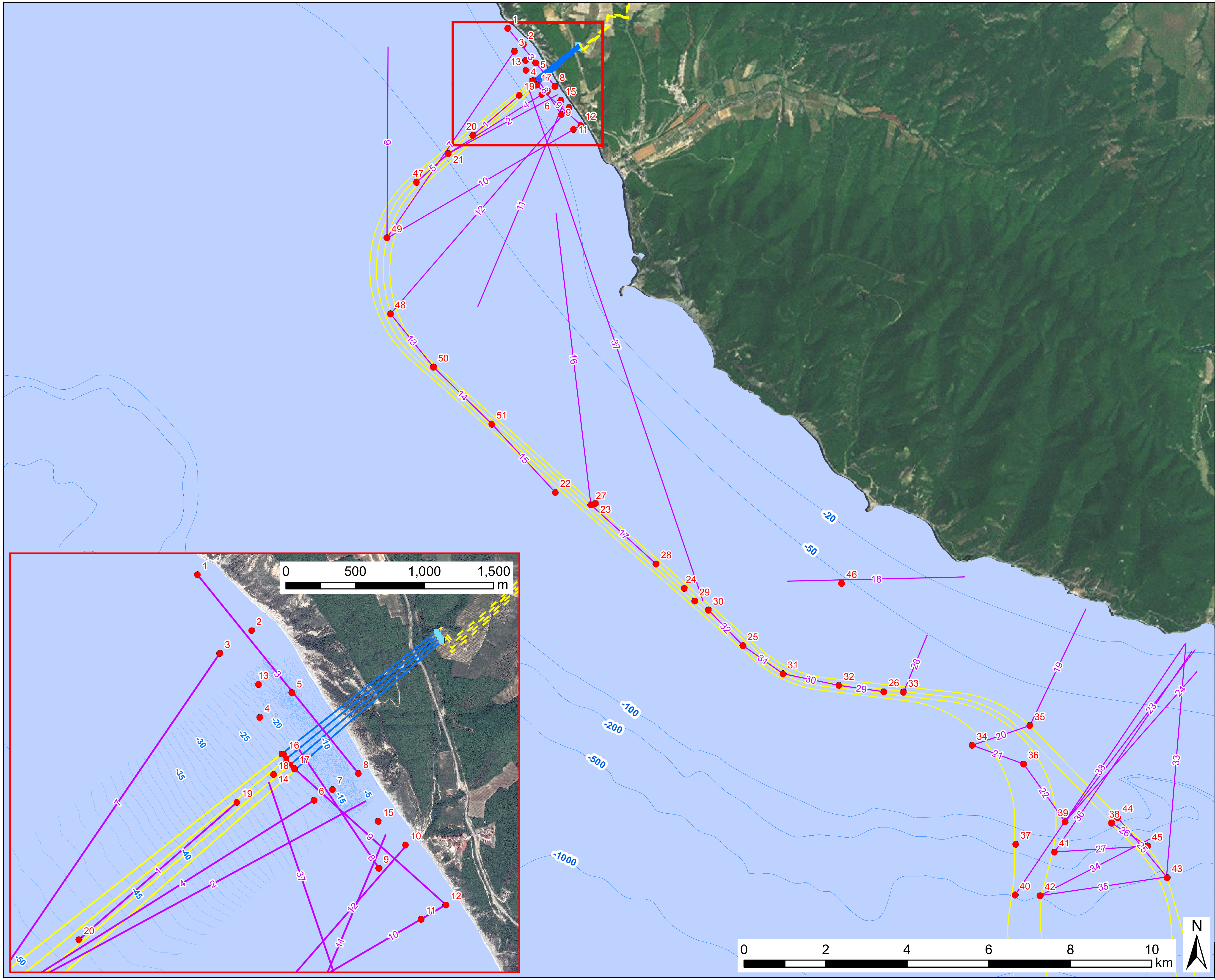
Drawing Number: Figure 12.17

Rev

Plot Date: 25 Mar 2014
File Name: I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 12 Offshore Sampling\Figure 12-17 Marine Mammal Survey Area.mxd



LEGEND
- Fixed survey stations
- Survey transects

Russian Sector of South Stream Offshore Pipeline
- Proposed landfall section pipelines
- Proposed microtunnels
- Proposed offshore pipelines
- Microtunnel entry shaft
- Microtunnel exit pit
- Isobaths

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue
For Information

Client
South Stream Offshore Pipeline — Energising Europe

Project Title
SOUTH STREAM OFFSHORE PIPELINE

Drawing Title
COASTAL MARINE MAMMAL SURVEY AREA JULY 2013

Drawn	Checked	Approved	Date
DH	RW	MW	04 Mar 2014

URS Internal Project No.	Scale @ A3
46369082	1:85,000

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Drawing Number
Figure 12.18

Rev

Plot Date: 04 Mar 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA\Offshore Sampling\Figure 12.18 Coastal Marine Mammal Survey Area July 2013.mxd

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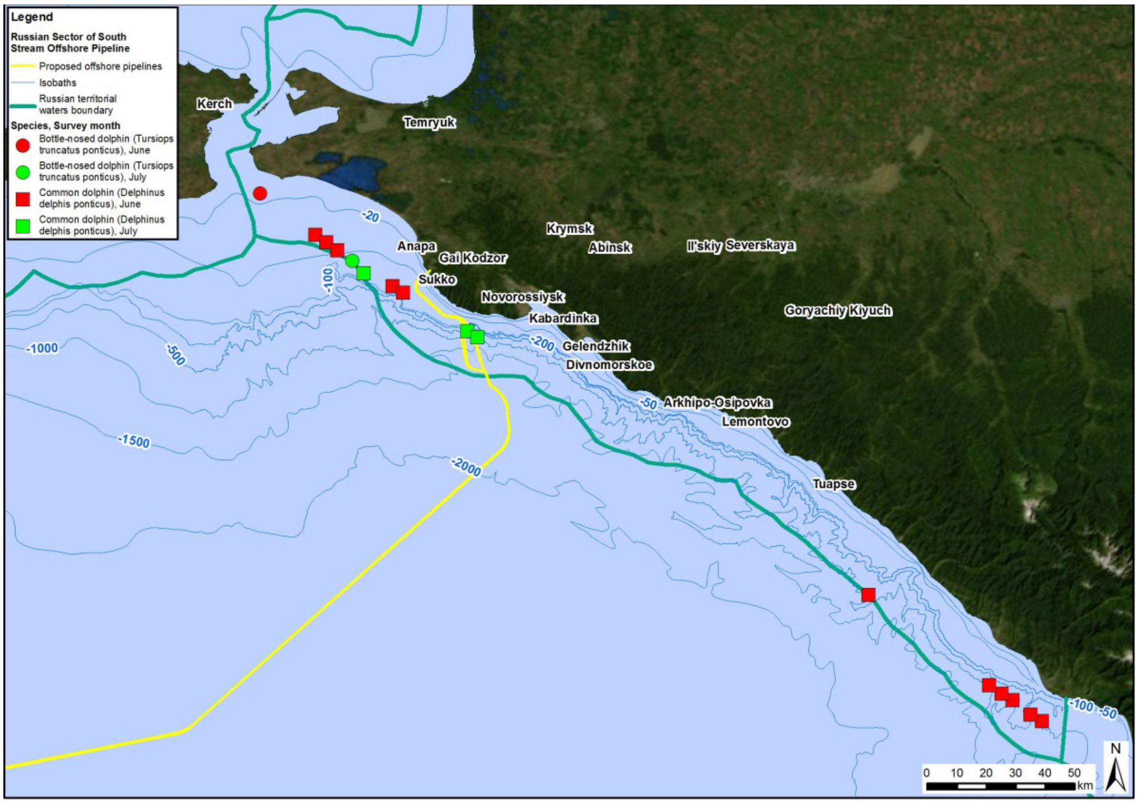
Survey Results

In surveys conducted along the Russian Black Sea coast in June 2010, the bottlenose dolphin and common dolphin were observed. The locations for these sightings are shown in Figure 12.19.

Figure 12.19 Cetaceans Observed in 2010 Surveys



In transects conducted in November 2010, the bottlenose dolphin and common dolphin were observed. The most abundant species was the common dolphin. The bottlenose dolphin was only observed during fish surveys, not during transects (Table 12.22).

Table 12.22 Abundance of Marine Mammal Observed during November 2010 transect and trawling Surveys

Species	Fish Trawling		Transects	
	Abundance	Abundance per 10 km	Abundance	Abundance per 10 km
Black Sea common dolphin (*Delphinus delphis ponticus*)	2	1.09	100	6.68
Black Sea bottlenose dolphin (*Tursiops truncatus ponticus*)	18	9.79	0	0.00
Sum total:	20	10.88	100	6.68

Note: there is a level of uncertainty regarding the sightings during this survey. It is unclear if repeat sightings of cetacean species have been accounted for or not, thus these numbers are taken as indicative.

In April 2011 surveys (see locations in Figure 12.17 and Figure 12.18), 89 cetaceans were observed from 19 transects; 9 harbour porpoise, 24 bottlenose dolphin and 56 common dolphin. Harbour porpoises were mainly observed in water depths of less than 50 m and not more than 20 km from the shore (mostly within 5 km of the shore). Four individuals and four groups of two to six harbour porpoises were recorded. Common dolphins observed during the April 2011 survey were widely dispersed in the Survey Area. The majority of individuals (95%) were observed around 40 km from the coast. Seven single individuals and 10 groups from two to 12 dolphins were recorded. Like the harbour porpoise, bottlenose dolphins were more commonly observed in shallower waters (within 15 km of the coast) but were also observed offshore. The spatial distribution of cetacean species is comparable to the data from the IUCN report (Ref. 12.27) which mentions harbour porpoise as more commonly observed in 0-200 m water depth and common dolphins observed further offshore. In total, 26 individuals were recorded, consisting of two individuals and eight groups from two to six (Ref. 12.1).

In July 2013 a total of 269 cetaceans were recorded, 96 individuals observed from 38 transects and 173 from 51 fixed stations. The higher total number of sightings reflects a more intensive survey carried out in coastal waters (all stations and transects were within 8 km of the shore). The common dolphin was the dominant species with 208 observations recorded and there were 42 bottlenose dolphin and 19 porpoise seen in the same period (Table 12.23) (Figure 12.20).

The harbour porpoise was observed in low numbers across the survey area with an average abundance of 2 animals per 10 km transect (Figure 12.20). This species is not particularly gregarious with most animals seen singly or in pairs and no groups of more than four individuals observed.

The common dolphin is the most abundant and widespread cetacean observed in the Survey Area (Figure 12.20). During transect surveys the sightings of common dolphin was an average of 5.4 individuals per 10 km. Mostly adults of the species were observed during the surveys with only two young noted during the entire survey. The common dolphin was present mostly in small groups of 3 to 6 individuals but occasional larger groups of 10 to 12 were seen, as were solitary animals.

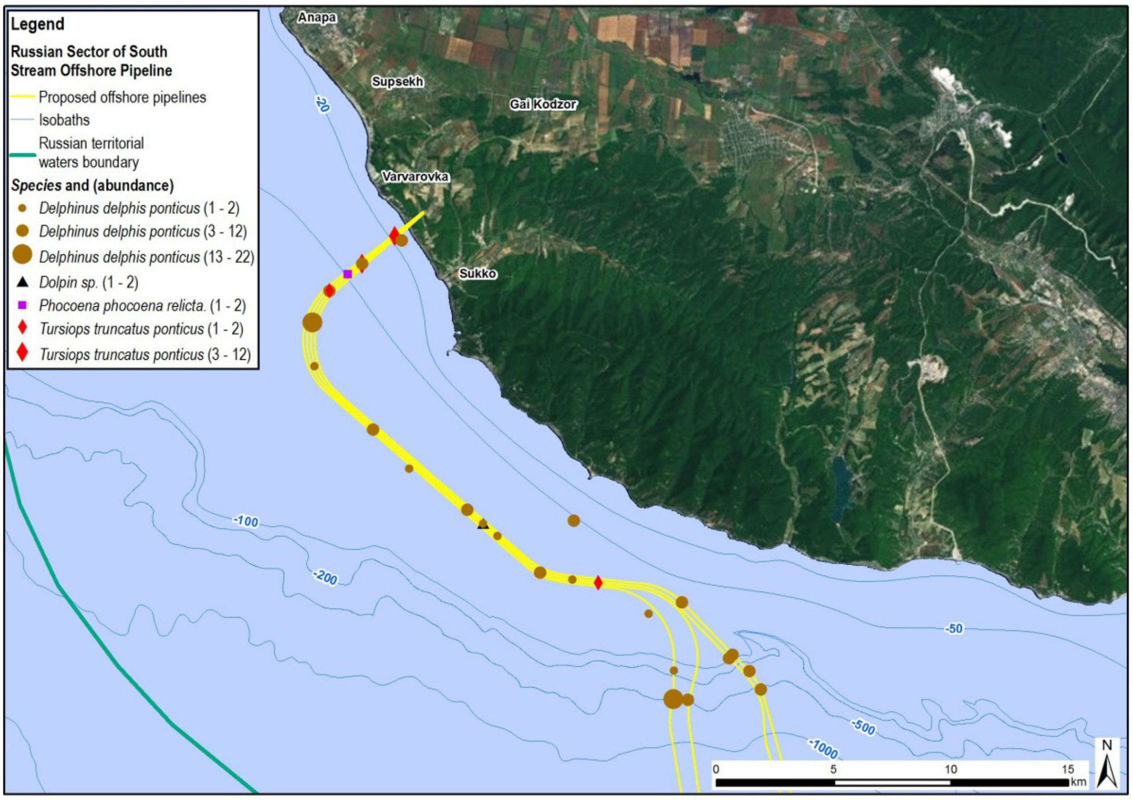
The bottlenose dolphin was also observed, but in fairly low numbers compared to common dolphin, with an average of 2 animals per 10 km of transect (Figure 12.20). They were generally present in small groupings although a group of 12 individuals, including two young, was noted, together with a group of common dolphin, next to a fishing boat.

Table 12.23 Abundance of Marine Mammals Observed during July 2013 Transects

Species	Transects	
	No. of animals observed	**Abundance per 10 km**
Black Sea harbour porpoise (*Phocaena phocaena relicta*)	17	1.6
Black Sea common dolphin (*Delphinus delphis ponticus*)	58	5.4
Black Sea bottlenose dolphin (*Tursiops truncatus ponticus*)	21	2.0
Sum total	**96**	**-**

Note: there is a level of uncertainty regarding the sightings during this survey. It is unclear if repeat sightings of cetacean species have been accounted for or not, thus these numbers are taken as indicative.

Figure 12.20 Cetaceans Observed from Stations in July 2013 Survey



12.4.7.3 Summary

There are three cetacean species known to inhabit the Black Sea; the harbour porpoise, bottlenose dolphin and the common dolphin. Harbour porpoise are more commonly observed in coastal areas within 200 m water depth. Common and bottlenose dolphin were observed further offshore than the harbour porpoise.

In coastal surveys in June 2010 and July 2013, all three species (harbour porpoise, bottlenose dolphin and common dolphin) were observed. The common dolphin was the species most likely to be observed; during all surveys in the Survey Area it was more widespread and considerably more abundant than the bottlenose dolphin and porpoise. In the offshore surveys in November 2010, common dolphins were most abundant and bottlenose dolphins were also observed. In April 2011, all three species were also observed. There were more sightings of the common dolphin, indicating it is the most abundant cetacean in the Survey Area. This species was also the most widely distributed cetacean species in the Survey Area. The majority of cetaceans were observed around 40 km from the coast and harbour porpoise and bottlenose dolphins were more commonly found in shallow waters (around 15 km from the coast).

It has not been possible to determine seasonal patterns in the distribution of these species in the Survey Area or known breeding areas or periods due to lack of data.

12.4.8 Protected Areas and Species

Although the pipeline route does not pass directly through any marine protected areas or nature reserves, it does pass within approximately 2 km of the marine part of the Utrish SPNA, and through the Anapa Bank fishery protected zone (Figure 12.21).

There is also the onshore Anapa sanitary protection area located approximately 500 m to the northeast and southwest of the onshore Project Area. Within this sanitary protection area, only works which do not adversely impact the natural resources and the sanitary conditions of the resort area of Anapa are permitted.

12.4.8.1 Protected Areas

Anapa Bank

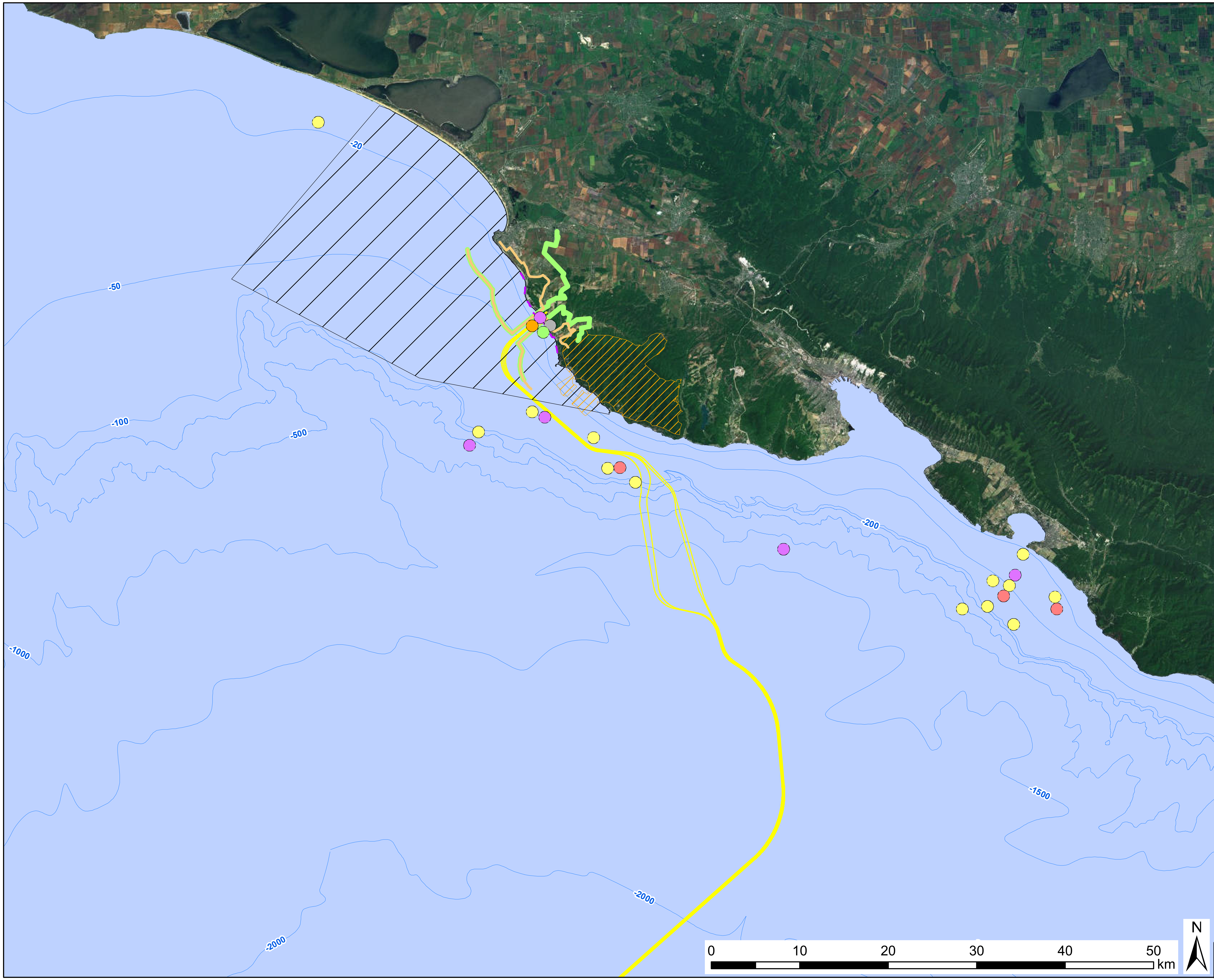
The designated [13] area known as the 'Anapskya Bank' or 'Anapa Bank' extends over approximately 730 km^2 and is located in the Kerch-Taman region (Figure 12.21). This area is designated as an important fishing ground. Fishing is seasonally restricted to allow the replenishment of fish stocks and trawl fishing and fishing with stationary nets with a cell size of more than 50 mm is forbidden. Since 2011, a section of this area has been made available for sprat and anchovy trawling under the Russian Fishery Regulations (Ref. 12.1).

The Anapa Bank fishery protected zone was initially set up to become a breeding ground for the commercially important Black Sea turbot. The Black Sea turbot can reach 85 cm and 15 kg and attain sexual maturity at the age of seven to ten years. In the summer, they keep close to the shore, where they spawn and feed. Their diet consists of whiting, sprat, gobies, Black Sea goatfish and crustaceans. Annual spawning occurs from May to July. The roe is pelagic and fertility ranges from 3 to 13 million eggs. Black Sea turbot do not undertake long migrations along the coast and only swim locally to feed and reproduce. The North Caucasus and Anapa schools swim in the north-eastern part of the Black Sea (Ref. 12.1).

Fishing for sprat is permitted between the beginning of July and the end of September at water depths of more than 40 m. Commercially exploitable populations are found from April until September and since 2011, fishing in deeper waters (over 40 m depth) has been allowed.

Anchovy fishing is allowed from the beginning of October until the 15 March annually at water depths of more than 20 m. Anchovy fattens and spawns in the Sea of Azov in the summer months and migrates to the Russian and Georgian shores of the Black Sea as waters cool until the following spring. Thus, in the Black Sea territorial waters of Russia, anchovy form commercial concentrations during the cold season from October to April.

[13] The Anapskaya Bank was initially designated in 1986 by Decree of the Ministry of Fisheries of the USSR. The area where fishing was prohibited was reduced by the Resolution of the Scientific Fishery Council of the Azov and Black Sea Basin in 1999. In 2011 the fishing ban was further reduced and it now merely consists of seasonal restrictions to enable the replenishment of fish stock.



LEGEND

- Cladophoropsis membranacea
- Cladostephus spongiosus
- Gavia arctica
- Larus melanocephalus
- Phylliphora crispa
- Tursiops truncatus ponticus
- The boundary of the first area of sanitary protection zone (exclusion zone)*
- The boundary of the second area of sanitary protection zone (limitation zone)*
- The boundary of the third area of sanitary protection zone (monitored zone)*
- Anapskaya Bank
- Boundary of the state nature reserve "Utrish"

Russian Sector of South Stream Offshore Pipeline

- Proposed offshore pipelines
- Isobaths

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: For Information

Client: South Stream Offshore Pipeline — ENERGISING EUROPE

Project Title: SOUTH STREAM OFFSHORE PIPELINE

Drawing Title: PROTECTED SPECIES AND AREAS OBSERVED IN SURVEY AREA

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File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA\Offshore Sampling\Figure 12.21 Protected Species and Areas Observed in Survey Area.mxd

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Utrish

In 1988, the Bolshoi Utrish reserve was included in the Register of State Reserves located on the territory of the Krasnodar Region[14]. The total area of the reserve is 5,112 hectares, of which 2,530 hectares is offshore (to a water depth of 40 m) (Figure 12.21). The marine sector of the reserve provides protection for a number of flora and fauna species listed in the Red Books of the Krasnodar Krai and the Russian Federation (algal species are listed in Table 12.24). The Pipeline route does not cross the offshore part of the marine reserve (Figure 12.21) but it is likely that it will host some of the protected species found in the nearby reserve. From surveys conducted on the Abrau Peninsula, some 20 km further east along the coast than the Utrish reserve, the main benthic communities present in the area have been identified. Utrish at its closest point is around 2 km from the Project Area.

The vegetated zone can be divided into three groups broadly based on water depth. In very shallow waters (up to about 2 m water depth) a low biomass mosaic algal community made up of ephemeral greens such as *Enteromorpha* together with *Ceramium ciliation*, *Cladophera* sp. *Lophosiphonia obscure*, *Padina pavonia* and *Dilophus fasciola* is found. This shallow water association is almost uniform for the whole coast (Ref. 12.4).

The mid zone, at depths from 2 to 10 m, is dominated by *Cystoseira* communities, which includes two species; *Cystoseira barbata* and *C. crinita*. Nearly all sampled stations at depths of 2 m, 5 m and 10 m show this association which is characterised by multi-layering of algae and high species richness. The highest algal biomass is observed at depths of 2 to 5 m (up to 35%). Although in some areas algal biomass it is quite high even at 10 m, it usually it drops to less than 1% at the bottom phytal zone. This is primarily due to increasing light limitation at depths of over 10 m, especially in the recent years when dense plankton blooms may attenuate light. The *Cystoseira* communities form the basis of much of the benthos of the north Caucasus region.

The final algal community, found in water depths over 10 m, is dominated by perennial red algae such as *Phyllophora nervosa,* although more recently a second species, the green algae *Codium vermilara* was also found to be equally dominant within the association. This significant change in the bottom phytal zone is a result of the restructuring of the entire ecosystem of the Black Sea due to pollution and other anthropogenic impacts, which has been observed in the latter half of the 20th century (Ref. 12.4).

Preliminary information regarding the composition of the protected species of seaweed in the Utrish reserve is listed in Table 12.24 including information on the conservation status of these species in Russia. There is potential that these species will also be recorded in the waters of the Survey Area although only three species were observed in 2011 surveys (Ref. 12.1).

The dominant *Cystoseira* associations support a diverse invertebrate fauna with high numbers of amphipod, polychaete and gastropod species. However, biomass is dominated by the mussel

[14] Annex No 2 to the Decision of the Executive Committee of the Krasnodar Regional Council of People's Deputies No 326 of 14.07.1988

Mytilaster lineatus which makes up 70 to 95% of the total community biomass. *Mytilaster* covers the *Cystoseira* thalli in a solid layer, and the older the thallus, the greater the biomass of the molluscs covering it. Thus, *Mytilaster* biomass is often a function of the mean age of the algae which results in an uneven distribution of the mussel.

On soft sediments, macroalgae are absent and fauna dominate with different associations depending on water depth and sediment conditions. On silted sands at a depth of 20 to 25 m a community dominated by the bivalve mollusc *Chamelea gallina* was observed. Other bivalves, particularly *Spisula subtruncata*, together with gastropods and crustaceans were also present in this association (Ref. 12.4).

In silted muddy habitats at depths of 25 to 35 m a more diverse community, dominated by the bivalves *Cunearca cornea* and *Pitar rudis* was observed (Ref. 12.4). These two bivalves made up 61 to 87% of the faunal biomass. Species diversity in the association was dominated by bivalve molluscs and polychaetes together with a small number of gastropods, crustaceans and other taxa.

In water depths of 35 to 50 m, a regional *Mytilus galloprovincialis* community was observed. This comparatively diverse community of 40 species was dominated taxonomically by polychaetes, bivalves and crustaceans with a small number of gastropods, ascidians and other taxa. However, biomass was dominated by bivalves, particularly the dominant bivalve *Mytilus galloprovincialis* which accounted for between 59 and 80% of the total biomass per station sampled (Ref. 12.4).

At depths greater than 50 m a *Modiolula phaseolina* (reported as *Modiolus phaseolinus*) community was observed. The three most common species in this community are the bivalve *M.phaseolina*, the polychaete worm *Terebellides stroemi* and the brittlestar *Amphiura stepanov* that collectively comprise 80 to 99% of the biomass on the stations sampled.

Thus, the distribution of benthic associations in the Utrish area was summarised as follows:

- 1 to 10 m – algal community dominated by *Cystoseira barbata* + *Cystoseira crinita*;
- 10 to 20 m – algal community of *Phyllophora nervosa* + *Codium vermilara*;
- 20 to 35 m – rocky ground – no flora or fauna;
- 20 to 35 m – soft sediments with a mosaic of primarily infaunal animals, particularly bivalves *Chamelea gallina*, *Anadara inaeqivalvis* and *Pitar rudis*;
- 35 to 50 m – an association of fauna dominated by the mussel *Mytilus galloprovincialis*; and
- 50 to 75 m – an association of fauna dominated by the bivalve *Modiolus phaseolinus*.

There were no macro-invertebrates recorded from the Utrish reserve of the Black Sea Coast included in the Russian Red Data Book, but two species of crab are listed in Annex 3 of the Red Data Book of the Krasnodar Krai Region. These are the stone crab (*Eriphia verrucosa*) which inhabits coastal waters and the spider crab (*Macropodia rostrata*) which is found in waters to 50 m.

Table 12.24 Protected Algae Observed in the Littoral Zone of the Abrau Peninsula

Taxon	Conservation status*	
	RDBRF	RDBKK
Siphonocladus pusillus	2	2
Grateloupia dichotoma		3
*Phyllophora crispa = P. nervosa***	2	2
Lomentaria compressa	3	3
Hypoglossum hypoglossoides		3
Dipterosiphonia rigens		3
Arthrocladia villosa		3
Dictyota linearis		3
Dilophus spiralis		3
*Cladostephus spongiosus***		3
Stypocaulon scoparium		3
Stilophora tenella	2	2

* Red Data Books: 2= vulnerable species and subspecies declining in number; 3=rare species and subspecies; 5 = rehabilitated and recovering
** Species observed in 2011 surveys (see Ref. 12.1)

The taxonomic constitution of the fish fauna in the marine part of Utrish is quite diverse and contains 71 species of fish, belonging to 35 families and 15 orders. This makes up nearly 37% of the fish fauna in the whole Black Sea and around 70% of fish species found in the Russian part of the Black Sea. The core of the community consists of Mediterranean migrants, the warm water species. The anadromous and semi-anadromous species that occur here consist of the sturgeon and herring families (Acipenseridae and Clupeidae), while brackish water species exist in the Clupeidae and Gobiidae families. Six species of fish listed in the Red Books of the Krasnodar Krai and Russian Federation are present in the Utrish reserve and so may also be present in the Survey Area (Table 12.25).

In terms of seabirds, Utrish is significant for the conservation of the black-throated diver which is regularly recorded as a migrating and wintering species of the western Black Sea area. The species' successful wintering is determined by the rich food reserve of the Utrish region. A further three species of bird listed in the Red Books have been observed in the Utrish reserve (Ref. 12.1) and may be present in the Survey Area; the black-throated diver, great black-headed gull and the black-headed gull.

12.4.8.2 Protected Species

A number of species of conservation concern, listed in the Red Data Books of the Russian Federation and the Krasnodar Krai or included in the IUCN Red List, have been directly observed in the Survey Area (Table 12.25) (Ref. 12.1). Some of these have also been designated as species of concern by the Black Sea Convention. These are:

- Two species of macroalgae;
- Two species of fish;
- Three species of seabirds; and
- Three species of mammals.

Table 12.25 Protected Species Recorded During Project Specific Surveys

Taxonomic group	Species name	Conservation Status		
		IUCN Global Red List	RDBRF†	RDBKK†
Macroalgae	*Phyllophora crispa = P. nervosa*	-	-	1
	Cladostephus spongiosus	-	-	3
Fish	Thornback ray (*Raja clavata*)	Near Threatened	-	-
	Leaping mullet (*Liza saliens*)	-	-	3
Seabirds	Black-throated diver (*Gavia arctica*)*	Least concern	2	2
	Mediterranean gull (*Larus melanocephalus*)	Least concern	-	3
	Mediterranean shearwater (*Puffinus yelkouan*)	Vulnerable	-	-
Marine mammals	Bottlenose dolphin (*Tursiops truncatus ponticus*)**	Data deficient	3	3
	Common dolphin (*Delphinus delphis ponticus*)**	Vulnerable	-	-
	Harbour porpoise (*Phocoena phocoena relicta*)**	Vulnerable	3	2

* Subspecies *Gavia arctica arctica*
** Black Sea Convention: Endangered
† Red Data Books: 1 = Endangered, 2= Vulnerable species and subspecies declining in number; 3=rare species and subspecies;

A number of other protected fish species and one seabird, whilst not observed directly in the survey area, have been reported from nearby areas. It is possible, therefore, that these species may be present in the survey area and have for this reason been identified in Table 12.26 (Ref. 12.1).

Table 12.26 Protected Species Observed Near Survey Area from the Utrish Reserve Data, Commercial Fisheries Stations and Incidental Observations During 2011 Surveys

Species	Conservation Status		
	IUCN Global Red List	RDBRF	RDBKK
Fish			
Beluga sturgeon (*Huso huso*)	CR	-1	1a-
Russian sturgeon (*Acipenser gueldenstaedtii*)	CR	-	-
Stellate sturgeon (*Acipenser stellatus*)	CR	-	-
Black sea salmon (*Salmo trutta labrax*)	LC	2	3
Corb or silver weakfish (*Umbrina cirrosa*)	-	-	3
Chestnut goby (*Chromogobias quadrivittatus*)	-	-	5
Tub gurnard (*Chelidonichthys lucerna*)	-	-	2
Birds			
Gull-billed tern (*Gelochelidon nilotica*)*	LC	-	2

* Black Sea Convention: Rare.
** IUCN: LC=Least Concern; CR= Critically endangered.
† Red Data Books: 1 = Endangered (1a Critical), 2= Vulnerable species and subspecies declining in number; 3=rare species and subspecies; 5 = rehabilitated and recovering.

12.4.9 Critical Habitat

12.4.9.1 Overview

The Project Area lies within some Tier 2 critical habitat as defined by the IFC[15]. It should be noted that the Project Area does not, per se, represent particular habitat that is not replicated

[15] IFC (2012) Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources.

elsewhere in the Russian Black Sea; it is merely part of a wider zone that meets the requisite criteria. Further details of the rationale for the determination of critical habitat are provided in IFC Guidance Note 6[16]. Full details of the determination of marine critical habitat in the Project Area are provided in Appendix 12.1: Marine Critical Habitat Determination.

The critical habitat assessment has based on the establishment of 'discrete management units' (DMUs). Paragraph 65 of Guidance Note 6 defines a DMU as "an area with a clearly demarcated boundary within which the biological communities and/or management issues have more in common with each other than they do with those in adjacent areas". For the purposes of this assessment, the Project has defined three DMUs:

- Coastal Zone: water depths of less than 30 m along the Russian coastal margin of the Black Sea;
- Shelf Zone: between 30 m and 200 m water depth, characterised by muddy substrates with a variety of bivalve, polychaete and burrowing anemone dominated communities; and
- Open Sea: from 200 m water depth to the edge of the Russian EEZ.

12.4.9.2 Critical Habitat for Endangered Species

Beluga, Russian, and stellate sturgeon have been observed on single occasions during surveys in the Study Area. It is unlikely that globally significant populations regularly occur here, though single individuals probably do, thus the coastal zone qualifies as Tier 2 critical habitat for these species based on criterion 1 (supports the regular occurrence of a single individual of a critically endangered species) as defined by the IFC (Ref. 12.33).

Black Sea bottlenose dolphins and harbour porpoises have been regularly observed in the Project Area and it is likely that both the coastal zone and open sea are Tier 2 critical habitat for these species, based on criterion 1 which is defined as "Habitat of significant importance to CR or EN species that are wide-ranging and/or whose population distribution is not well understood and where the loss of such a habitat could potentially impact the long-term survivability of the species" and "habitat containing nationally / regionally important concentrations of an EN, CR or equivalent national / regional listing". The Tier 2 critical habitat classification may also be based on Criterion 2 which is defined as "Habitat known to sustain ≥ 1 percent but < 95 percent of the global population of an endemic or restricted-range species where that habitat could be considered a discrete management unit for that species, where data are available and/or based on expert judgment".

12.4.9.3 Critical Habitat for Migratory and Congregatory Species

Though definitive data are not available, it is reasonable to suppose that both the coastal zone and open sea areas qualify as Tier 2 critical habitat for Black Sea turbot based on criterion 3 which is defined as "*Habitat known to sustain, on a cyclical or otherwise regular basis, ≥ 1*

[16] IFC Guidance Notes are not Project standards for the South Stream Offshore Pipeline Project. They are described in Equator Principles III as follows: 'Guidance Notes accompany each Performance Standard. Equator Principles Financial Institutions (EPFIs) do not formally adopt the Guidance Notes however EPFIs and clients may find them useful points of reference when seeking further guidance on or interpreting the Performance Standards.'

percent but < 95 percent of the global population of a migratory or congregatory species at any point of the species' lifecycle and where that habitat could be considered a discrete management unit for that species, where adequate data are available and/or based on expert judgment."

If the Project Area is considered, data suggest that it does not meet the 1% global or biogeographic population criteria, and although small dense flocks of birds are occasionally observed, they are unlikely to exceed the 20,000 bird threshold specified in IBA's criterion A4. However, the very large scale of the DMUs in this case means that it is reasonable to suppose that the 20,000 bird threshold might be exceeded for the entire coastal area and thus there is the potential for it to qualify as Critical Habitat. It should nonetheless be stressed that this is an artefact of the size of the DMU, rather than a real reflection of the conservation importance of the area to birds per se.

The coastal zone may also qualify as Tier 2 Critical habit under IBA Criterion A4 (see Appendix 12.1 for further details), in that it supports over 20,000 birds. It should be noted however, that this is largely an artefact of the size of the DMU rather than its conservation importance to birds.

12.5 Impact Assessment

12.5.1 Impact Assessment Methodology

The overall assessment methodology is detailed in **Chapter 3 Impact Assessment Methodology,** whereby receptor sensitivity and impact magnitude are used to determine the overall significance of an impact. Specific criteria relating to the sensitivity of marine species and marine habitats, and to the magnitude of marine impacts, are discussed in Section 12.5.1.1.

Impacts are presented below based on discussion according to receptor type, to give a complete picture of the effects of the Project on a given habitat or species group. However, because mitigation is mainly applied at source rather than receptor, it is more appropriate to list mitigation measures according to project activity. This allows a clearer perspective of how an activity can be managed as a whole to minimise, mitigate or manage marine ecological impacts.

This chapter demonstrates Project adherence to the 'mitigation hierarchy' as defined in IFC PS(6), i.e. impacts should be progressively avoided, minimised, and restored, with priority given to the actions which are earliest in the hierarchy. Therefore, the Project has sought and will continue to seek to avoid impacts on biodiversity. When avoidance of impacts is not possible, measures to reduce impacts to an acceptable level and to restore biodiversity, will be implemented. Given the complexity in predicting project impacts on biodiversity over the long term, the Project will adopt a practice of adaptive management in which the implementation of mitigation and management measures are responsive to changing conditions and the results of monitoring until the necessary biodiversity requirements of no net loss / biodiversity gain and fulfilment of management objectives have been achieved.

The project's mitigation strategy will be described in a Biodiversity Action Plan (BAP) and will be designed to achieve net gains of those biodiversity values for which the critical habitat was designated. Development of the BAP will take into consideration relevant industry guidance, and will allow for adaptive management and consultation with stakeholders on topics of conservation related to the Project's biodiversity interests"

The Project involves a wide range of activities that have the potential to impact the marine environment, primarily during the Construction Phase. The relevant activities are summarised in Table 12.27. Decommissioning activities are not known at this time. GIIP is usually to leave marine pipelines in situ, which would have impacts indistinguishable from those set out for the Operational Phase. However, for the purposes of this ESIA Report, wholesale pipe removal is also considered.

Table 12.27 Project Activities in the Russian Marine Environment

Phase	Activity	Offshore	Nearshore
Construction and Pre-Commissioning	Mobilisation of vessels to and from site and vessel movements within construction spread.	✓	✓
	Vessel routine operations (including propulsion, cooling water, water maker, bilges and ballast).	✓	✓
	Pre-construction route surveys, as-built ROV surveys and removal of any obstacles (e.g. wrecks, munitions, boulders).	✓	✓
	Delivery of pipe and other supplies, as well as crew changes.	✓	✓
	Night time working.	✓	✓
	Dredging of microtunnel exit pits, burial of pipeline between 23 m and approximately 26 m isobaths and seabed storage of dredged material.		✓
	Trench backfill and post lay trenching (for main pipe-lay and intervention works).		✓
	Disposal of spoil from slope / seabed intervention works.		✓
	Installation of test heads at the end of the nearshore pipeline section.		✓
	Hydrotesting, including seawater abstraction and discharge of hydrotest solution.	✓	✓

Continued…

Phase	Activity	Offshore	Nearshore
Construction and Pre-Commissioning	Pipeline tie-in, including survey of pipe ends, installation of lifting gear, raising and lowering pipe and de-rigging gear.	✓	✓
	Anchoring and dynamic positioning of pipe-lay vessels.	✓	✓
	Laying the offshore section of the pipe on seabed.	✓	✓
	Inspection, welding and weld-testing of pipe, construction of pipeline crossings, welding of recovery heads and the lowering and raising of pipe during these activities.		✓
Operational	Physical presence of the Pipeline.	✓	✓
	Pipeline inspection (including ROV surveys etc.) and maintenance that will involve some vessel movements and associated generation of small quantities of wastes associated with routine vessel operations.	✓	✓
Decommissioning (Option 1)	Pipeline cleaning by flushing with water and associated water displacement and disposal.	✓	✓
	Filling pipe with seawater and sealing.	✓	✓
	Vessel operations associated with inspection surveys.	✓	✓
Decommissioning (Option 2)	Lifting of pipeline from the seabed.	✓	✓
	Seabed intervention, including excavation of buried pipe.	✓	✓
	Associated vessel operations.	✓	✓

Complete.

12.5.1.1 Impact Assessment Criteria

Receptor Sensitivity

The receptor sensitivity criteria for marine ecological receptors have been harmonised, where appropriate, with those adopted for terrestrial ecological receptors (**Chapter 11 Terrestrial Ecology**), in order to allow for a consistent and integrated approach in assessing the Project's impact on ecology and biodiversity. However, though the approaches are harmonised they are not identical. Where the terrestrial ecological assessment focuses on conservation and protection criteria, the marine assessment includes consideration of ecological function. This is because there are marine species and communities that are important to the ecosystem that are neither rare nor protected by any designation (e.g. bivalves providing bio-filtration, or macroalgae providing habitat for other notable or commercially valuable species). This approach therefore includes consideration of flora, fauna, ecological processes and nature conservation.

It should be noted that for the purposes of this ESIA, the concept of “sensitivity” is more closely related to receptor value (importance) than receptor vulnerability (resistance to change), though elements of both are considered in the criteria. Vulnerability considerations are also incorporated into the criteria for impact magnitude set out below.

The marine environment encompasses a wide variety of ecological receptors as detailed in the baseline section above. At the highest level, these can be divided into habitats and species, for which it is appropriate to derive separate assessment criteria. The main habitat types that occur in the Project Area are:

- Soft substrate benthic habitats;
- Seaweed stands; and
- Deep sea microbial communities.

Potential critical habitat has been identified in the baseline Section 12.4.9, encompassing wide areas of the sea (Appendix 12.1). Because the Project does not have the scope or scale to impact such extended areas, the assessment of impacts relating to critical habitats has focussed on the species for which that habitat is considered critical rather than the habitat itself.

Species are broadly classified into the following groups (though consideration is given to individual named species where they are of particular conservation concern or known to be particularly vulnerable to specific impact):

- Plankton;
- Benthic fauna;
- Fish;
- Seabirds; and
- Marine mammals.

Sensitivity criteria have been developed separately for habitats and species, as set out below in Table 12.28 and Table 12.29 respectively. Where possible both international and national criteria and standards have been applied. It should further be noted that on occasion a receptor is assigned a sensitivity range. This is to allow the adoption of a precautionary approach to highlight specific potential vulnerabilities within a wider context (e.g. the presence of species of conservation interest in an assemblage that is otherwise less sensitive) but where the impacts can be managed by the same set of Project design controls and mitigation measures.

Table 12.28 Receptor Sensitivity Criteria for Marine Habitats

Sensitivity	Description	Applicable Legal Standards
High	A site, habitat or assemblage of species which has designated conservation status at an international and national scale; or Areas of particular biodiversity importance, that my support populations of restricted range, endemic or endangered species, or is in itself unique or threatened*; or Areas that support large populations (in a national or international context) of migratory species**; or Habitats that provide key ecosystem functions.	International: Designated areas or habitat under IUCN category Ia to IV (Habitat / Species Management Area and above). Russia: Designated habitat in Russian law on "On Specially Protected Natural Areas" No. 33-FZ.
Moderate	A site, habitat or assemblage of species which has designated conservation status at a National scale; or 'Natural Habitat' IFC classification: Areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary ecological functions and species composition.	Designated habitat in Russian law on "On Specially Protected Natural Areas" No. 33-FZ.
Low	Habitats occurring outside of any designation; or 'Modified Habitat' IFC classification: Areas that may contain a large proportion of plant and/or animal species of non-native origin, and/or where human activity has substantially modified an area's primary ecological functions and species composition. Modified habitats may include areas managed for agriculture, forest plantations, reclaimed coastal zones, and reclaimed wetlands.	None applicable
Negligible	Habitats that are either appreciably degraded or disturbed by human activity or have high proportions of invasive / non-native species; or Do not support any key ecosystem functions.	None applicable

* As listed on the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species
** There criteria are similar to those used by the IFC to determine "Critical Habitat". It should be stressed however, that designation of critical habitat is not in itself a criterion, rather the result of applying conservation criteria. Either modified or natural habitats may be considered critical if they support the appropriate species or processes. A marine critical habitats appraisal has been carried out in parallel to this ESIA and presented in Appendix 12.1.

Table 12.29 Receptor Sensitivity Criteria for Marine Species

Sensitivity	Description	Applicable Standards
High	A species population that has designated conservation status at an international and national scale; A species that is globally rare; or A keystone species fundamental to the functioning of the ecosystem.	International: Listed in Black Sea Red Data Book (Black Sea Environment Programme) categories 'Vulnerable' and above. Listed in IUCN red data book category 3 to 6 (Vulnerable and above). Listed under the Bucharest Convention. Russia: Listed in Red Data Book of the Russian Federation or Krasnodar Krai.
Moderate	A species population that has designated conservation status at a national or regional scale; A species common globally but rare locally; Important to ecosystem functions; or Under threat or population in decline.	Listed in Red Data Book of the Russian Federation or Krasnodar Krai.
Low	A species not protected by law; Not critical to other ecosystem functions (e.g. as prey to other species or as predator to potential pest species); or Common nationally.	None applicable
Negligible	Common / abundant locally; or Not important to other ecosystem functions.	None applicable

Habitats

Soft substrate benthic habitats include sandy and silty seabed at a variety of depths. This habitat type supports a diversity of benthic communities and infaunal species. The precise composition of the flora and fauna depends on several physico-chemical variables such as water depth, sediment particle size and organic content. This mosaic of different communities includes areas dominated by the mussel *Modiolula phaseolina* and other bivalves. The significance of this is that such communities provide an important ecological service due their bio-filtration capacity when present in high abundance. The mobile nature of soft seabed means that soft substrate benthic communities are often able to withstand physical perturbation and to re-establish disturbed areas relatively quickly. Despite their abundance and wide distribution, the important ecological roles these communities serve (as, inter alia, structural species, prey and bio-filters), means they are considered generally only moderately sensitive.

Seaweed-dominated communities exist on hard substrates. Most notable of these are algae of the genera *Phyllophora* and *Cystoseira*. *P. brodiaei* and *P. nervosa* are listed as vulnerable in the Black Sea Red Data Book while *Cystoseira barbata* and *C. crinata* are both listed as endangered in the Black Sea Red Data Book. *P.crispa* (=*P.nervosa*) is listed as vulnerable in the RDBKK. Macroalgal stands are known to exist in the Project Area and a dense *Cystoseira* community is present at a water depth of approximately 10 m, becoming sparser at depths between 10 m and 20 m. *P. crispa* was also recorded in the Survey Area (though not in discrete stands) and is thought to be present in the Utrish nature reserve which is located, at its closest point, around 2 km from the Project Area. These habitats are considered highly sensitive.

Very little is known about the offshore deep water seabed of the Black Sea abyssal plain. Anoxic conditions and the presence of H_2S mean that only sulphur metabolising bacteria and one infaunal species of microscopic metazoan have been observed to survive in these zones. It is thought that such communities are widespread in the deep sea, but the specific diversity and abundance of organisms in this habitat is not known. In some circumstances deep sea bacterial communities can form reef structures or microbial mats, though such communities were not observed along the Pipeline alignment (Ref. 12.15; Appendix 7.1) and in the Black Sea they are thought to be confined to the northwest shelf. On the basis of available survey data, deep sea microbial communities are considered to be low sensitivity.

Species

Plankton are not particularly sensitive to the impact of pipe-laying activities. Their dispersed nature, very high numbers and relatively short generation time means the populations themselves are resilient, even though some sensitive and rare species, e.g. sturgeons, have planktonic larvae. Project Activities alone have relatively little scope to impact the water column, and thus plankton are generally considered of moderate to low sensitivity. The reason the sensitivity is not assessed purely as low is due to the possible presence of the larvae of endangered species in the ichthyoplankton.

Although some benthic invertebrates are mobile, their generally small size gives them a restricted ability to avoid large scale impacts. Because of this, and the fact that they can be important in overall ecosystem functions and services (e.g. biofiltration, food for fish), benthic invertebrates are considered of moderate sensitivity.

Several protected fish species have been recorded in the Project's ecological surveys, most notably two species of sturgeon that are critically endangered (Russian sturgeon, *Acipenser guldenstaedtii* and Stellate sturgeon, *A.stellatus*). Two other protected species; the thornback ray (*Raja clavata* listed under IUCN as Near Threatened), and leaping mullet (*Lisa saliens* listed in the RDBKK), were recorded in the Survey Area. Records from Utrish also suggest the presence (albeit occasional) of the critically endangered beluga sturgeon (*Huso huso*). Despite the ability of many fish to avoid some areas of impact, the presence of endangered species means the fish community is considered to be of moderate to high sensitivity.

A wide variety of shore and seabirds inhabit the Russian nearshore at different times of year. Birds are most vulnerable to disturbance when nesting or moulting and their ability to avoid sources of impact is reduced. Three locally endangered species are present in the Project Area; the black-throated diver *Gavia arctica*, the Mediterranean gull *Larus melanocephaus* and the Mediterranean shearwater *Puffinus yelkouan*. The latter is also globally vulnerable. Despite the limited scope for the Project to interact with seabirds, the presence of endangered species in the Survey Area for at least part of the year means their sensitivity as receptors is considered moderate to high.

Whilst highly mobile and generally able to avoid areas of adverse impact, the sensory acuity of marine mammals means they have the potential to be impacted by high levels of unnatural sound in the ocean. Two of the three cetacean species that occur off the Russian coast, namely harbour porpoise (*Phocaena phocaena relicta*) and bottlenose dolphin (*Tursiops truncatus ponticus*) are globally endangered and included in the RBDs of the Russian Federation and Krasnodar Krai. The third species, the common dolphin (*Delphinus delphis ponticus*), is globally vulnerable and listed in the Black Sea (Bucharest) Convention Annex III, but is not in the Russian RDB. Because of their protected status, marine mammals are considered highly sensitive receptors.

A summary of the receptors considered within this chapter and their associated sensitivity ranking is provided in Table 12.30 below.

Table 12.30 Marine Ecology Receptors

Receptor	Sensitivity Ranking
Species	
Plankton	Moderate to Low
Benthic invertebrates	Moderate
Fish	Moderate to High
Seabirds	Moderate to High
Marine mammals	High
Habitats	
Soft substrate benthos	Moderate
Seaweed stands (*Cystoseira* communities)	High
Deep sea microbial communities	Low

Impact Magnitude

Consistent with the approach outlined above, common impact magnitude criteria have been developed for marine and terrestrial ecological receptors as shown in Table 12.31 and Table 12.32. As the magnitude of potential impacts upon habitats and species is highly variable and difficult to quantify these definitions have been developed, in line with **Chapter 3 Impact Assessment Methodology**, to provide case specific flexibility based on professional judgement and experience in GIIP. These criteria, as previously mentioned, include consideration of the degree of change as well as the ability of receptors to withstand that change. Furthermore, in assigning magnitude, environmental controls built into the design of the project are considered.

Table 12.31 Marine Habitat - Impact Magnitude

Magnitude	Description
High	The project may adversely affect the integrity of an area or region, by substantially changing in the long term its ecological features, structures and functions, across its whole area, that enable it to sustain the habitat, complex of habitats and/or population levels of species that makes it important.
Moderate	The area's integrity will not be adversely affected in the long term, but the Project is likely to affect some, if not all, of the area's ecological features, structures and functions in the short or medium term. The area or region may be able to recover through natural regeneration and restoration.
Low	Neither of the above applies, but some minor impacts of limited extent, or to some elements of the area, are evident but easy to recover through natural regeneration.
Negligible	Indiscernible from natural variability.

Table 12.32 Marine Species - Impact Magnitude

Magnitude	Description
High	Impact on a species that affects an entire population causing a decline in abundance and/or change in distribution beyond which natural recruitment (reproduction, immigration from unaffected areas) would not return that population or species, or any population or species dependent upon it, to its former level within several generations*, or when there is no possibility of recovery.

Continued…

Magnitude	Description
Moderate	Affects a portion of a population and may bring about a change in abundance and/or a reduction in the distribution over one or more generations[22], but does not threaten the long-term integrity of that population or any population dependent on it. The size and cumulative character of the consequence is also important. A moderate magnitude impact multiplied over a wide area would be regarded as a high magnitude impact.
Low	Affects a specific group of localized individuals within a population over a short time period (one generation or less), but does not affect other trophic levels or the population itself.
Negligible	Indiscernable from natural variability.

* These are generations of the animal or plant species under consideration not human generations

Complete.

Determining Impact Significance

As outlined in **Chapter 3 Impact Assessment Methodology** of this document, the significance of an impact on an identified and valued receptor is determined as a relationship between the sensitivity of the receptor and the magnitude of the predicted impact. The relationship between receptor sensitivity and impact magnitude, and the resultant significance of an impact (positive or negative), is presented in Table 12.33 and definitions of the impact significance ratings are given in Table 12.34.

Table 12.33 Impacts Significance Matrix

		Receptor Sensitivity (Vulnerability and Value)			
		Negligible	*Low*	*Moderate*	*High*
Impact Magnitude (Extent, Frequency, Reversibility, Duration)	*Negligible*	Not significant	Not significant	Not significant	Not significant/Low*
	Low	Not significant	*Low*	Low/Moderate†	Moderate
	Moderate	Not significant	Low/Moderate	Moderate	High
	High	Low	Moderate	High	High

* Allows technical discipline author to decide if impact significance is Not Significant or Low.
† Allows technical discipline author to decide if impact significance is Low or Moderate.

Table 12.34 Impact Significance Definitions

Adverse Impacts	**High**	Significant. Impacts with a "high" significance are likely to disrupt the function and value of the resource / receptor, and may have broader systemic consequences (e.g. ecosystem or social well-being). These impacts are a priority for mitigation in order to avoid or reduce the significance of the impact.
	Moderate	Significant. Impacts with a "moderate" significance are likely to be noticeable and result in lasting changes to baseline conditions, which may cause hardship to or degradation of the resource / receptor, although the overall function and value of the resource / receptor is not disrupted. These impacts are a priority for mitigation in order to avoid or reduce the significance of the impact.
	Low	Detectable but not significant. Impacts with a "low" significance are expected to be noticeable changes to baseline conditions, beyond natural variation, but are not expected to cause hardship, degradation, or impair the function and value of the resource / receptor. However, these impacts warrant the attention of decision-makers, and should be avoided or mitigated where practicable.
	Not significant	Not Significant. Any impacts are expected to be indistinguishable from the baseline or within the natural level of variation. These impacts do not require mitigation and are not a concern of the decision-making process.

12.5.1.2 Modelling Undertaken

While no specific ecological modelling has been undertaken, this section draws on the results of sediment dispersion modelling with respect to benthic impacts, and on the results of acoustic modelling with respect to the impacts of underwater noise on fish and cetaceans. Details of the sediment dispersion and underwater noise modelling are provided in Appendix 12.2: Sediment Dispersion Study and Appendix 12.3: Underwater Noise Study respectively.

12.5.2 Assessment of Impacts: Construction and Pre-Commissioning

12.5.2.1 Introduction

Compared to other Project phases, construction and pre-commissioning activities have the greatest scope to impact the marine environment, and all the receptors discussed above may be impacted at some stage. However, the Project has been designed to reduce a number of impacts at source. Design controls have been categorised by potential impact from a given Project activity. These design controls attempted to firstly either avoid or minimise the risk of an impact considering the IFC mitigation hierarchy as discussed in **Chapter 3 Impact Assessment Methodology**. Potential construction and pre-commissioning impacts are assessed on this basis. Additional mitigation and monitoring measures are then identified that can further reduce impacts to as low as possible, and the residual impact is assessed. The design controls included in Table 12.35 relate to Construction and Pre-Commissioning, Commissioning and Operational and Decommissioning Phases and have been included in the pre-mitigation impact assessment in Section 12.5.2.2, 12.5.3.2 and 12.5.4.2.

Table 12.35 Design Controls

Design Controls in Project Description
A Seabed Intervention Construction Management Plan (CMP) will be prepared including measures for minimising turbidity, managing overspill etc.
Open trench dredging will be minimised.
Microtunnelling will be performed at the shore approach / landfall instead of open cut trenching.
Rock placement will be kept at the practical minimum to ensure pipeline stability and safety and in accordance with detailed design.
The appointed pipeline installation contractor will be required to develop anchor patterns and procedures and undertake a risk assessment to minimise impact to areas of concern.
Implement a Dredging Management Plan to ensure careful spoil handling and minimise release of material to the water column.
To reduce the risk that stored dredge spoil may be dispersed during winter storms, storage of dredged materials in winter will be restricted within the deepest half of the temporary storage area where practicable.
An anchor handling survey to identify areas in which anchoring will be permitted will be carried out within the Project Area (including the pipeline corridor where anchoring will take place), the area of which will be calculated by the contractor and agreed with South Stream Transport.
Chemical additives in the hydrotest solution will be sodium bisulphite, which is of low acute toxicity in the marine environment and does not bioaccumulate. Sodium bisulphite is included by OSPAR on the list of chemical that Pose Little or No Risk (PLONOR) to the environment.
The microtunnelling drilling fluid will be a mixture of drill cuttings and a slurry made of water and bentonite (a natural, inert, non-toxic clay)) which is pumped through hoses to the tunnel boring machine (TBM) cutting head to lubricate the cutting head. Bentonite is listed in OSPAR's PLONOR list of additives that Pose Little or No Risk to the environment (PLONOR). OSPAR refers to the Oslo and Paris Conventions for the Protection of the marine Environment of the North-East Atlantic (OSPAR Conventions).
The exit point for the hydrotest solution will consist of either a four or six inch diffuser positioned approximately 1 m above the seabed and which will reduce the speed of water flow exiting the pipe, thereby reducing turbidity, scour and sediment plumes. The diffuser also acts as an aerator, improving the oxygen concentration in the water and compensating for the scavenging effect of the sodium bisulphite.
The suction hoses for the hydrotest will be equipped with suitable strainers (2 mm screen mesh). Water will be collected in a break tank (water tank fitted with filter systems) on board the supply vessel. From the break tank, water will be pumped through a filtration skid to remove all particles larger than 50 microns.

Continued...

Design Controls in Project Description
After a successful hydrotest, the Pipeline will be dewatered and chemically conditioned (dried) using Monoethylene Glycol (MEG). MEG will not be disposed into the sea but will be pumped from the subsea test head to the support vessel via a down line, received and stored in suitable secure tanks to be disposed or recycled by an approved waste handling company.
All bunkering activities will be undertaken in accordance with the Vessels and Marine Transport activity-specific CMP, which will be developed as part of South Stream Transport's Construction Phase ESMP. The CMP will contain activity-specific requirements, to be met by both South Stream Transport and the appointed contractors (and sub-contractors).
All vessel discharges and wastes will be compliant with Marine Pollution (MARPOL) Convention, Bucharest Convention and national regulations, cognisant of the Black Sea's status as an IMO special area with respect to garbage and wastes containing hydrocarbons. Compliance with national regulations and Bucharest Convention. For information on the regulations governing the discharges of grey / black waste, sewage, garbage, bilge and oily water that will be adopted by the Project (refer **Chapter 18 Waste Management).**
If a Trailing Suction Hopper Dredger (TSHD) is used, the dredged material will be deposited directly onto the seabed to reduce the dispersion of sediments. It is anticipated that the dredged material will be temporarily stored for approximately two to three months.
Wastes to be offloaded at suitable port / harbour facilities and collected and transferred by appropriately licenced hauliers to licenced disposal sites suitable for the wastes being received.
A project integrated waste management plan will be drawn up to ensure wastes are minimised at source, recycled / re-used where possible and otherwise managed responsibly. Adherence to vessel-specific Waste Management Plans which will include provisions for segregating waste on board, having secure areas for storage of hazardous waste and recycling / reuse where practicable. Any waste water arising from operational maintenance activities (e.g. pigging of pipelines) will be collected on site in tanks and transported from site by an appropriately approved waste haulier to an appropriate waste treatment site in accordance with current waste management regulations.

Complete.

12.5.2.2 Assessment of Potential Impacts (Pre-Mitigation)

Receptors and their associated sensitivity have been identified above. This section provides an assessment of potential impacts to these receptors using the impact magnitude and receptor sensitivity matrix discussed in **Chapter 3 Impact Assessment Methodology**. A summary of the impacts identified and their pre- and post-mitigation significance ranking is provided in Table 12.38.

Plankton

Vessel operations will generate waste that may affect plankton as follows:

- Cooling water discharges may cause localised changes in water quality relating to excess heat and the presence of biocides. This may cause thermal and /or chemical stress to biota in the immediate vicinity, though it will be a highly localised effect; and

- Vessel wastes discharges, if highly turbid, may locally reduce light levels and temporarily affect phytoplankton photosynthesis. Suspended solids may also interfere with the filter feeding mechanisms of some zooplankton species and affect the behaviour of visual predators that eat zooplankton.

Vessel wastes will be managed in line with MARPOL and national regulations, thus these impacts are of negligible magnitude to a receptor of moderate to low sensitivity and are therefore assessed as **Not Significant**.

Plankton may be affected by the re-suspension of sediments (particularly associated with dredging and nearshore storage of dredged spoil) that reduces photosynthesis, interferes with filter feeding and alters the rate of visual predation on plankton.

Dredging or dumping at the microtunnel exit pits results in the formation of a sediment plume after dredging works start. The sediment plume drifts in the direction of the ambient currents along the Russian coastline. When assessing the impact to plankton of suspended solids, a threshold of 10 milligrams per litre (mg/l) is usually applied[17]. Plume modelling (see Appendix 12.2) using conservative criteria predicts that the impact area for this threshold is 16.2 km^2. It should be noted that this is very much a worst case scenario, as it does not allow for flocculation and other processes that will tend to remove material from suspension rapidly. In reality, sediment in water tends to form density flows that sink rapidly. A range of studies conducted since the 1990s have shown that sediment discharges into the marine environment will tend to form a density current and flow near-instantaneously to the seabed (convective descent), carrying most of the turbid body rapidly to the seabed. There, it dynamically collapses to form a horizontally moving turbid near-bed layer from which the solids content reconsolidates onto the seabed. A percentage of this descending flow (of the order of a few per cent of the solids by weight) will mix with the ambient water mass during the descent and form a more slowly dispersing far-field plume. Another factor that increases the settling rate of suspended sediments and reduces the extent of surface plumes is the tendency for fine material to flocculate. When factoring in these mechanisms of flocculation and convective descent, the extent of the surface plume is very significantly decreased. The area encompassed by the plume (at concentrations over 10 mg/l) is predicted to be in the order of 0.22 km^2 and will extend approximately 700 m from the source. The significance of this is that, because of natural flocculation processes, the plume will not impinge on the Utrish SPNA marine reserve.

The maximum area of the surface plume for offshore seabed interventions is predicted at 4.7 km^2 while, because of the tendency of most suspended particles to sink, the near bed plume is significantly larger, possibly covering an area of 150 km^2.

Despite the fact that sediment plumes may extend for an appreciable extent, they are transitory phenomena, and most dense near the seabed, that will only affect a very small proportion of the plankton, negligible in the context of natural population variability and predation. This is likely to be a short-term negligible magnitude to a receptor of moderate to low sensitivity, generating a **Not Significant** impact.

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[17] 10 mg/l is the recommended Maximum Permissible Concentration (MPC) for suspended solids for Russian seawater shelf zones.

Hydrotesting the Pipeline will involve seawater abstraction and discharge of hydrotest solution, containing oxygen scavenger. The discharge will comprise approximately 8,000 m^3 of seawater containing 250 parts per million (ppm) of sodium bisulphite, which is a non-toxic substance and on the OSPAR List of substances used and discharged offshore which are considered to Pose Little Or No Risk to the environment (PLONOR). The discharge will be essentially non-toxic and take place approximately 1 m above the seabed. Subsequent cleaning and drying may also involve the discharge of solid wastes and drying agents, although these will be recovered and disposed of on land. This impact is likely to be a short term negligible magnitude to a receptor of moderate to low sensitivity, leading to an impact that is **Not Significant**.

Seawater abstraction may result in the entrainment of plankton. These will be subject to physical stresses and may result in mortality. However, as only a very limited number of localised individuals will be affected this is a short term negligible magnitude to a receptor of moderate to low sensitivity. The impact is thus **Not Significant**.

Light from night-time works may result in changes in the vertical distribution of plankton however, as this is localised, it will be of negligible magnitude to a receptor of moderate to low sensitivity. The impact is thus **Not Significant**.

Benthos

Vessel wastes may affect benthic communities in a variety of ways:

- Suspended solids in vessel wastes may locally reduce the photosynthetic ability of marine macrophytes. Particles may also interfere with the filter feeding mechanisms of some invertebrates. Settling material, if present in appreciable quantities, may smother benthos in shallow water. The volume of suspended material from vessel waste is likely to be low so that the magnitude of the impact is low; and
- Decomposition of organic material in kitchen wastes, grey water etc. may locally reduce dissolved oxygen levels, causing physiological stress, displacement and/or behavioural changes in benthos.

Vessels must be compliant with the requirements of MARPOL when discharging wastes to the marine environment and are prohibited from discharging within 3 NM of the shoreline.

The above are negligible magnitude events to a receptor of moderate to high sensitivity (in the case of seaweed stands) that will generate, at most, **Low** significance impacts prior to mitigation.

Seabed disturbance may occur through several different activities, including surveys and inspections, obstacle removal ("pre-sweeping"), dredging, pipe-laying, post-lay trenching and rock placement / seabed intervention. This is the most significant aspect associated with the Project, potentially affecting large areas of the seabed and associated species and habitats, as detailed below. Impacts to benthos are significant not only from the perspective of biodiversity, but also the ecological processes that benthos provides, namely primary production, nutrient cycling and biofiltration.

The Project may generate dredged spoil from offshore trenching and profiling. Dredged spoil in the nearshore (i.e. from the dredging of the microtunnel pits and transition trenches) will be temporarily stored in designated offshore storage areas. This material will be subsequently re-dredged and used for trench backfill following pipe installation. A certain amount of offshore dredged material (estimated volume of 42,500 m^3) may be disposed of at an existing underwater disposal site (no. 923, located on the Russian continental slope, see Figure 12.2 for location). In the event that any dredge spoil is identified as contaminated or requires disposal on land, the spoil will be treated as construction waste and appropriately stored, transported and disposed of (see **Chapter 18 Waste Management**). However, baseline studies undertaken to date do not indicate that this is likely.

When the TBM emerges into the microtunnel exit pit, there will be a small discharge of slurry into the marine environment, comprising rock particles and a natural clay mineral, bentonite. Bentonite is listed in OSPAR's PLONOR list of additives that Pose Little or No Risk to the environment. However, this will be carefully controlled by reducing the pressure of slurry supplied to the TBM on nearing emergence to the exit pit and immediate shutdown of the TBM slurry circuit when the TBM emerges into the exit pit. Since bentonite is denser than seawater, the slurry will tend to settle on the seabed rather than mix with the surrounding water column. Furthermore, the depth of the exit pit (approximately 6 m below the natural seabed surface) will reduce the exposure of the slurry to seabed currents and will capture the majority of slurry discharged from the tunnel. It will therefore not have any significant impact on benthos.

Benthos will be directly impacted by substrate loss that will cause some direct mortality in the nearshore dredged area. Approximately 0.85 ha of seabed will be dredged for the microtunnel exit pits and short lengths of buried pipeline to approximately 26 m isobaths. Temporary storage of dredged spoil will occupy a nominal 10 ha (based on a dredged volume of approximately 100,000 m^3). This will impact a coarse sediment community characterised by burrowing bivalves such as *Gouldia minima* and *Chamelea gallina.* Further offshore, 5.3 ha of seabed will be pre or post trenched for stability reasons, and another 13.1 hectares (ha) subject to rock backfill and dumping for protection, in an area of mud dominated by bivalves such as *Parvicardium similis* and *Modiolula phaseolina*. The total area directly affected by these activities is thus estimated at approximately 29.25 ha. The unburied pipeline will also impact approximately 1,350 ha (13.5 km^2) of seabed (assuming a 60 m bundle width over 225 km), causing disturbance and re-suspending sediments, the majority of which will be in the anoxic deep sea and not affect any macrobenthic communities.

Disturbance from pipe-lay vessel anchors and chains is predicted to affect approximately 6.3 ha per kilometre of laid pipeline in deeper water (up to 600 m water depth). For each anchoring point, it has been assumed that a conventional anchor spread of twelve 20 to 25 tonne anchors will be used with an average chain length of 200 m. The total seabed affected by anchoring will therefore be approximately 190 ha (1.9 km^2) affecting soft substrate benthic habitats and deep sea microbial benthic communities. Given the limited extent of the seabed disturbance and the ability of soft benthic habitats and associated fauna to withstand and recover from physical perturbation, the magnitude of the impact is assessed as low on a receptor of moderate sensitivity, resulting in an impact of **Low** significance prior to mitigation. Deep sea microbial communities are of low sensitivity, and there is a limited seabed footprint so impacts are considered of **Low** significance prior to mitigation. However, the Project is committed to undertaking an anchor corridor survey with the aim of identifying and avoiding or minimising disturbance to sensitive habitats including establishing exclusion zones where practicable.

In addition to direct seabed loss, resettling of suspended solids and increased turbidity may cause some smothering resulting in direct mortality as well as impairing the ability of some organisms to feed, respire and photosynthesise.

Modelling has been carried out to assess the extent of the plume from seabed intervention works. As previously described, the flocculation of material and the formation of density flows tends to make sediment plumes sink rapidly, thus the seabed impacts may be greater than the near-surface impact. Seabed works associated with dredging and storage of material at the microtunnel exits are predicted to cause a plume in excess of 10 mg/l that covers approximately 0.2 km^2. Plumes will disperse to background levels in 60 to 120 hours depending on wind and current direction. In the context of seaweed photosynthesis, this is considered a negligible level impact on a high sensitivity receptor, generating impacts of **Low** significance prior to mitigation.

Convective descent of turbid plumes carries most of the material rapidly to the seabed forming a horizontally moving turbid near-bed layer from which the solids reconsolidate onto the seabed. Typically the bulk of the material accumulates in an annular area on the seabed with a diameter 1 to 3 times the water depth. The deposit is lenticular, with decreasing deposition thickness at the edge. From the perspective of ecological impacts, different organisms can tolerate various levels of smothering. Seaweed stands are sensitive to relatively thin layers of sediment reducing their photosynthetic ability, though as they grow in shallow water, re-suspension by wave action tends to limit the build-up of sediments. Dense algal cover in the Project Area is generally confined to water approximately 10 m deep or shallower, with sparse cover between approximately 10 and 20 m and burrowing bivalve communities beyond this depth. At 10 m water depth, waves 1 m high and 5 m long will generate near-bed orbital velocities of 0.15 metres per second (ms^{-1}), sufficient to re-suspend fine sand and recently deposited muds (Ref. 12.34). Such conditions occur regularly and wave maxima generated by storm events are even capable of initiating motion in fine sediments to 40 m depth, thus resettling sediment will not persist or accumulate.

Modelling shows that the area of seabed likely to experience more than 5 mm of deposition is limited to approximately 35 to 46 ha depending climatic conditions, approximately half of which will be landward of the tunnel exits where seaweed communities are prevalent (see Appendix 12.2 for further details). Much of this will be rapidly re-suspended and transported away by wave action. The region's overall integrity in terms of community structure and the ecological processes that benthic communities provide will not be impacted, though some ecological features will be affected on a local scale. Given the temporary nature and relatively limited areal extent of seaweed beds affected, this is considered a low level impact on a high sensitivity receptor, generating impacts of **Moderate** significance prior to mitigation.

Infaunal benthic invertebrates in soft substrate habitats are generally better able to tolerate sediment deposition and a threshold of 5 cm is commonly applied (Ref. 12.35). Tunnel exit works are predicted to cause this level of deposition over approximately 5 ha. The maximum deposition thickness for offshore seabed interventions is not predicted to exceed this threshold and there are no changes to sediment type expected. Because of the very small area impacted, this is considered a low level impact on a moderate sensitivity receptor, generating impacts of **Low** significance, prior to mitigation.

Minor disturbance associated with pre-construction route surveys, crossings etc. are negligible magnitude activities that will have a **Not Significant** impact prior to mitigation.

Hydrotest discharge may result in localised deterioration of water quality (due to low dissolved oxygen concentration), alteration of hydrodynamic regime and resultant seabed disturbance. However the discharge will only contain sodium bisulphite which is classified by OSPAR as PLONOR (poses little or no risk), thus no chemical effects are anticipated. The discharge structure itself will be elevated at least 1 m above the seabed to reduce re-suspension of sediments and will take place beyond the depth where sensitive seaweed communities are present. Effects will therefore be temporary and localised, and no appreciable long or medium changes will accrue to benthic communities as a result. This is thus considered a short-term and negligible magnitude impact to a receptor of moderate sensitivity, which means a **Not Significant** impact prior to mitigation.

Fish

Vessel operations have the following potential impacts on fish:

- Decomposition of organic material in uncontrolled disposal of kitchen wastes etc. may locally and temporarily reduce dissolved oxygen levels, causing physiological stress, displacement and/or behavioural changes in fish; however as the Project will comply with MARPOL discharge controls this will not arise in reality. Conversely, kitchen wastes may attract some species to feed though the scale of this effect is likely to be trivial; and
- Cooling water discharges may cause localised changes in water quality relating to excess heat and the presence of biocides. This may cause thermal and/or chemical stress to biota in the immediate vicinity, though it will be a highly localised effect.

The above effects are considered negligible therefore any associated impact is **Not Significant** to fish.

Light from night-time works may affect fish, either by direct attraction or through alterations in the distribution of planktonic prey. Because of its highly localised nature, this is a negligible magnitude impact to a moderate to high sensitivity receptor, thus at most of **Low** significance prior to mitigation.

The impact of dredging, pipe-laying and seabed intervention on fish will be variable depending on their habit, habitat and life stage. Open water pelagic species will be essentially un-impacted as they can readily avoid noise sources and are not prone to the effects of near bed sediment plumes or seabed deposition, while small, benthic dwelling species may be more severely impacted (on a localised scale) through habitat loss, loss of food resource and smothering. High concentrations of suspended solids associated with dredging plumes may cause damage to gills in some cases, while in others may help avoid predation, though the latter is a more transient effect. As previously mentioned, sediment plumes generated by seabed intervention will be of limited extent (relative to the overall habitat and distribution range) and duration, as will areas of significant seabed deposition. In some cases, seabed disturbance is attractive to fish as it exposes infaunal prey that might otherwise be inaccessible. Moderate levels of turbidity are also beneficial to some species in avoiding visual predators, though the scale of such effects will be small. The impact of seabed disturbance to fish is likely to affect a localised proportion of the population for less than one generation at any given location and is thus a negligible to low magnitude impact to a receptor of moderate to high sensitivity resulting in, at most, **Moderate** significance impacts prior to mitigation. With respect to pelagic fish offshore, the impacts will be **Not Significant**.

Noise and vibration will be generated by several Project Activities, including the passage of vessels, microtunnelling in the nearshore, dredging, trenching, pipe-laying and rock placement (see Appendix 12.3). Low levels of noise may also be generated during commissioning, testing and operational flow. Fish may be either hearing specialists or hearing generalists; the former are usually species with swimbladders that are connected to the ear and are more sensitive to noise. Black Sea shad (*Alosa maeotica*), Caspian shad (*A.caspia*), sprat (*Sprattus sprattus*), kilka (*Clupeonella cultriventris*) and anchovy (*Engraulis enccrasicolus*) possess specialised gas ducts extending to the inner ear and are hearing specialists. Hearing generalist fish (such as sturgeon, turbot, and skate) are less sensitive both in terms of sound level and frequency range.

Acoustic impact analysis showed that sound levels generated by pipe-laying and trenching in the Black Sea are insufficient to cause mortality or injury to fish. The approach used is based on criteria developed by Stadler and Woodbury from hearing studies of fish exposed to airgun sounds (see Appendix 12.3 for further details). This is most commonly applied to pile driving injury range estimation but can be reasonably applied to continuous sound. Exposure to a few loud sounds is more damaging to fish that exposure to a larger number or longer duration of quieter sounds therefore, the use of the Stadler and Woodbury criterion (187 dB re $\mu Pa^2 s$) is precautionary when applied to exposure to continuous sound and yields very conservative estimates of effect range and area.

Modelling results show a theoretical maximum injury effect range of 0.9 to 1.6 km, corresponding to an effect area of 5 to 6.8 km^2 (Appendix 12.3). It should be noted that this is a very conservative estimate, as much vessel noise is high frequency and fish generally have no sensitivity to high frequency sound with the exception of some fish specialised in hearing very high frequency sound, such as cod which are not present in the Black Sea. In addition, fish will move away from loud noises and their actual exposure in reality will be significantly less.

Weighted metrics, specifically the dB_{ht} technique, are based on the hearing sensitivity of the target species and the loudness of the noise as experienced by the animal. Using weighted thresholds, it was found that behavioural effects (given by the 75 dB_{ht} threshold) may be apparent in some hearing specialist fish such as sprat or kilka in some situations[18] (though not shad or anchovy). Anchor handling is the activity most likely to generate such responses, and in shallow water may extend up to 260 m from activity, with an affected area of approximately 0.2 km^2. In deepwater, where anchor handling will not take place, the pipe-laying vessel itself may generate similar impacts at a lesser range of approximately 140 m (area of effect approximately 0.06 km^2). No impacts are predicted to hearing generalist species.

[18] Audiograms for sprat and kilka were not available for use in the modelling exercise and herring, a close relative, was used as an analogue. Given that anchovy are also closely related and no impacts are predicted based on the anchovy audiogram, the use of herring in the model may have resulted an over-estimation of impact ranges.

Because noise will affect a localised group of individuals over a short time period, and because there are no protected species that are hearing specialists, the generation of noise is considered a medium term, low magnitude impact on a receptor of moderate sensitivity of **Low** significance. Additional detail of the acoustic modelling is provided in Appendix 12.3.

Seawater abstraction for hydrotesting may result in the entrainment of small fish. These will be subject to physical stresses and some mortality. Larger fish may also be impinged in the intake structure, undergoing physical trauma, but only a very limited number of localised individuals will be affected. This is likely to be a short term low magnitude impact on a receptor of moderate to high sensitivity. The significance of the impact is thus **Moderate** significance prior to mitigation.

Hydrotesting will involve the limited discharge of seawater containing no more than 250 ppm sodium bisulphite, which is classed by OSPAR as PLONOR. While not toxic, this water may have reduced oxygen content and thereby result in some respiratory stress to fish in the immediate vicinity. Effects will nonetheless be highly localised and restricted to only a few individuals within the population. No appreciable changes will accrue to the community as a whole. This effect is thus considered short term impact of negligible magnitude on a receptor of moderate to high sensitivity. The significance of the impact is thus **Not Significant** prior to mitigation.

Seabirds

Vessel movements during mobilisation, surveying and pipe-laying activities have the potential to temporarily disturb seabirds. However, these are highly mobile animals generally able to avoid areas of disturbance, and the density of seabirds at sea is generally low, though occasional dense flocks of both Mediterranean shearwaters (*Puffinus yelkouan*) and great crested grebe (*Podiceps cristatus*) have been observed near the coast. This will thus be a low magnitude impact to a receptor of moderate to high sensitivity, leading to impacts of **Moderate** significance prior to mitigation.

Seabirds will not be directly affected by trenching etc. Indirect, short term effects may occur to a localised part of the population as a result of displacement or loss of prey in the nearshore. This is considered a negligible magnitude impact to a receptor of moderate to high sensitivity, leading to **Low** significance impacts prior to mitigation.

There will be occasions where night-time works are required necessitating the use of floodlights. Light can affect migrating birds and cause mortality from bird strikes on highly illuminated offshore installations. The source of illumination (the pipe-laying vessel spread) will be transient at any given location and have limited scope to interact with night-flying birds. Because only a small number of localised individuals will be affected, this is considered a short term low magnitude impact to a receptor of moderate to high sensitivity, resulting in impacts of **Moderate** significance at most prior to mitigation.

Marine Mammals

Vessel movements during mobilisation, surveying and pipe-laying activities have the potential to temporarily disturb marine mammals. Collisions may also occur. However, these are highly mobile animals with acute sensory perception and are generally able to avoid areas of disturbance and only a few individuals are likely to be affected, if any. This will therefore be a medium term, low magnitude impact to a high sensitivity receptor, leading to impacts of **Moderate** significance prior to mitigation.

Cooling water discharges and other effluent streams from vessels may cause localised changes in water quality relating to excess heat and the presence of biocides. This may cause thermal and/or chemical stress to animals in the immediate vicinity, though it will be a highly localised effect and easily avoided by cetaceans, thus this is a negligible magnitude impact to a high sensitivity receptor, leading to impacts of **Low** significance.

Light from night-time works may affect marine mammals through alterations in the distribution of prey. Because of its highly localised nature and its potential to only impact a very limited number of individuals, this is a negligible magnitude impact to a high sensitivity receptor, likely to be **Not Significant** prior to mitigation.

Marine mammals are less impacted by seabed changes or sediment suspension than fish or benthos, as they are air breathing and do not rely exclusively on sight for navigation or feeding. However, indirect effects from the displacement of their food resource may occur. The effects of seabed disturbance on marine mammals are short term and will only affect a few individuals thus it is a negligible magnitude impact to a high sensitivity receptor, of **Low** significance prior to mitigation.

Noise from vessel movements, pipe-laying and trenching can negatively impact marine mammals as it influences their ability to echolocate, communicate and can cause physical harm (through risk of disorientation leading to beaching, as well as in extreme cases, trauma to the auditory apparatus). Noise can cause certain cetacean species to vacate feeding areas, as it interferes with acoustic prey location.

A number of activities involve the generation of man-made sound underwater and this has the potential to impact cetaceans. The noise-generating activities associated with the Construction and Pre-Commissioning Phase have been identified as:

- Pre-lay sonar surveys;
- Vessel movements;
- Microtunnelling,
- Trenching;
- Rock placement;
- Pipe-laying; and
- Pre-commission testing.

Detailed noise modelling has been carried out to assess the potential impact underwater noise will have on cetaceans. The noise modelling has included consideration of single sources, combined sources (from vessel spreads) as well as cumulative exposure over time (24h). The potential of noise to cause injury or behavioural alterations has been assessed and is summarised below. Full details are provided in Appendix 12.3.

In keeping with the latest scientific approaches, injury effects assessment has been based on the cumulative sound exposure level (SEL) over a period of 24 hours. The pipe-laying operation (loudest among any possible activities at the three representative sites) has been modelled including realistic motion of pipe-lay vessel and support vessels such as pipe carrier ships shuttling to resupply (Appendix 12.3). Two sets of criteria are available and currently considered valid for the assessment of ranges to injury[19] from continuous noise: the Southall *et al.* criteria and the Finneran and Jenkins criteria (also referred to as the "US Navy criteria"):

- The former uses a single threshold of 215 dB re μPa2-s SEL weighted according to the hearing class of the subjects using Type 1 weighting curves (M-weighting); and
- The latter uses variable thresholds and newer Type 2 weighting functions that take into account subjective loudness and some additional data collected since the Southall et al. study. For Mid Frequency cetaceans (MFC) such as dolphins the threshold is 198 dB re μPa2-s SEL with Type 2 MFC weighting. For High Frequency cetaceans (HFC) such as porpoises the threshold is 187 dB re μPa2-s SEL with Type 2 HFC weighting.

The results of the SEL based assessment have been presented in terms of the modelled area exposed to cumulative levels above the threshold over a 24 hour period (area of effect), as well as a range of effect that provides a linear "width" of the footprint relative to the main pipe-lay vessel. Because of the irregular and elongated shape of the cumulative footprint along the pipe-lay route, the effect range cannot be computed as a radius for equivalent area and is instead measured from the swath width of the footprint with suitable consideration of its shape. The injury footprint of the operations is estimated to be very limited. Porpoise in close proximity to pipe-laying (20 to 60 m) may experience PTS, corresponding to an impact area of 0.6 to 1.3 km^2.

Various criteria are available to assess the potential impacts of underwater noise on cetacean behaviour. Traditionally an un-weighted criterion for behavioural effects onset at 120 dB re μPa has been used commonly referred to as the "Level B Harassment" criterion. This approach, in use in the USA since 1997, has several acknowledged shortcomings, most importantly that marine species vary widely in their sensitivity to sound, and especially to the frequency range which they hear. Thus this "one size fits all" criterion is considered inappropriate in some specific instances and the approach is currently under review by NOAA/NMFS[20] (Ref. 12.36). It should not be totally ignored or dismissed out of hand however, due to its current widespread use. It is therefore included here for completeness and reference to common practice. It is also a criterion still cited as the only acceptable approach for the harbour porpoise by studies as recent as 2012[21] that explicitly exclude the use of weighted metrics criteria for that species because of its unique susceptibility and reaction to sound stimuli.

Weighted metrics behavioural criteria for species other than harbour porpoises could be considered, but their applicability in the case of continuous sounds such as those from vessels is

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[19] Defined as the onset of permanent threshold Shift (PTS); i.e. the point at which hearing may become impaired and from which the animal cannot recover.
[20] The new approach, currently undergoing peer review, is an attempt to create a more nuanced scientific set of criteria. It is likely to result in either an increase in the Level-B threshold, based on the understanding that animals will tend to avoid noise sources thereby reducing their exposure, or to be related more closely to ambient noise levels in the marine environment. These new guidelines are due to be issued in the near future.
[21] Criteria And Thresholds For U.S. Navy Acoustic And Explosive Effects Analysis

not confirmed and the relatively high reaction thresholds that arise from their use would be difficult to defend by comparison with empirical evidence.

Audiogram based behavioural effect were chosen as the most defensible criteria given the availability of reliable audiograms for dolphins. There remains a degree of uncertainty in the use of audiogram referenced levels (dB relative to hearing threshold, or dB_{ht}) regarding which threshold to adopt for the onset of behavioural disturbance. A commonly used set of criteria are the fixed thresholds of 75 and 90 dB_{ht} for all species as onset of mild and pronounced behavioural reactions respectively. However validity especially of the higher threshold has been questioned and evidence can be found for reaction at significantly lower levels. Taking the different elements into account, the 75 dB_{ht} threshold is considered a reasonably conservative and defensible estimator of the onset of behavioural disturbance in cetaceans and has been used for this assessment.

Based on audiogram weighted criteria, behavioural effect ranges for individual vessel operations are only estimated to be significant for dolphins and porpoises with effect ranges never exceeding 1.5 km at any modelled location. A summary of the predicted ranges and areas of effect is presented in Table 12.36.

Table 12.36 Predicted Behavioural Impact Ranges for Cetaceans Based on 75 dBht

Activity	Season	Bottlenose dolphin		Harbour porpoise	
		range (km)	area (km^2)	range (km)	area (km^2)
Dredging: Microtunnel Exit and Transition Trench	February	0.35	0.35	0.81	2.04
	August	0.38	0.44	0.98	2.16
Pipe-Pull Stationary	February	0.28	0.01	0.28	0.01
	August	0.28	0.01	0.28	0.01
Pipe-Laying with Active Anchor Handling; Shallow water	February	0.15	0.01	0.20	0.05
	August	0.15	0.01	0.18	0.05
Pipe-Laying (DP)	February	0.70	0.02	0.57	0.06
	August	0.70	0.02	0.57	0.06
Pipe-Laying with Active Anchor Handling, mid-depth	February	0.57	0.01	0.55	0.04
	August	0.57	0.01	0.55	0.04

Continued...

Activity	Season	Bottlenose dolphin		Harbour porpoise	
		range (km)	area (km^2)	range (km)	area (km^2)
Crew Change (for pipe-laying operation) mid-depth	February	0.68	0.68	1.17	3.37
	August	0.72	0.60	1.48	3.80
Rock-Dumping: Cable Crossing, Equipment Delivery	February	0.11	0.05	0.30	0.27
	August	0.11	0.05	0.32	0.30
Pipe-Laying (J-Lay)	February	0.50	0.06	0.40	0.19
	August	0.50	0.06	0.40	0.19
Crew Change: (for pipe-laying operation) - deepwater	February	0.60	0.49	0.91	1.67
	August	0.63	0.56	1.01	2.28

Complete.

Unweighted metrics predict behavioural impacts over a wider range; up to 46.7 km for a pipe-laying spread with anchor handling vessels in shallow water, but as previously discussed, this is considered highly conservative and actual impact ranges may well be less than this.

In addition, cetaceans may be exposed to sonar noise during pipeline inspection. There are well accepted impact criteria for sonar sources that are based on the instantaneous root-mean-square sound pressure level metric (rms SPL). For injury, a generic (NMFS) standard threshold of 180 dB re 1 µPa un-weighted is commonly used. For behaviour effects, there are US Navy criteria specifically for sonar sources. Their criteria for mid-frequency and high-frequency cetaceans are based on Type I weighting of the SPL and do not provide a single threshold value but rather refer to a Behavioural Response Function (BRF) that assesses the probability of a behavioural impact from a given SPL. Accordingly, a reasonably precautionary 25% probability of response to a weighted SPL of 160 dB re dB re 1 µPa has been used as the principal criterion. However, as previously explained, harbour porpoises are excluded from this criterion due to the high susceptibility to disturbance of this species and the recommend NMFS standard threshold of 120 dB re 1 µPa un-weighted is used. In all cases, cetaceans would need to be closer than 10 m to the source for any possibility of injury. The longest range predicted impacts are approximately 1 km from the source, specifically to porpoises in mid-depth waters. Behavioural impact ranges to other cetaceans from sonar are consistently less than 250 m. The ranges over which behavioural impact might be observed are summarised in Table 12.37.

Table 12.37 Predicted Behavioural Impact Ranges for Sonar Source

Threshold	Season	Shallow water		Mid-Depth		Deep water	
		range (km)	area (km^2)	range (km)	area (km^2)	range (km)	area (km^2)
Generic (NMFS) threshold (120 dB re 1 µPa rms SPL un-weighted) Porpoise	February	0.98	0.46	0.95	0.23	0.90	0.18
	August	0.99	0.47	1.01	0.23	0.90	0.18
Mid-Frequency cetacean behaviour threshold (160 dB re 1 µPa SPL) Dolphin	February	0.22	0.0011	0.14	0.0007	0.12	0.0005
	August	0.22	0.0011	0.14	0.0007	0.12	0.0005

The analysis shows that sound levels generated by pipe-laying, trenching and associated activities are unlikely to cause significant injury to marine mammals. Though there is the potential for PTS very close to vessel spreads, in reality it is unlikely that cetaceans will approach loud sound sources. Noise will affect a group of localised individuals over a short time without affecting the overall population, thus the generation of noise is considered a medium term, low magnitude impact to a high sensitivity receptor, of **Moderate** significance prior to mitigation.

Additional details of the quantitative underwater noise assessment can be found in Appendix 12.3.

Cetaceans may be exposed to hydrotesting discharge, but as it is non-toxic, the only impact will be secondary due to possible localised displacement of prey. This is a short term negligible magnitude impact to a high sensitivity receptor, giving a **Not Significant** to **Low** significance prior to mitigation.

12.5.2.3 Mitigation and Monitoring

A wide variety of mitigation measures can be applied to minimise or otherwise reduce the construction and pre-commissioning impacts of the Pipeline. Mitigation will be applied at different stages in the Project to minimise impacts and to reflect GIIP. A significant part of the mitigation is achieved through design (e.g. nearshore microtunnelling, see Table 12.35 for design controls) to prevent impacts occurring.

Additional management measures will be implemented as necessary to reduce the impact to a level of a practical minimum. These are discussed below and are grouped by each potential impact arising from the Project Activities in Table 12.27.

It is important to note that impact categories may cover a broad range. For example a moderate impact could be relatively localised and affect a limited set of receptors, or approach the threshold of breaching a regulatory limit. Clearly to design an activity so that its effects only just avoid a major impact is not good practice thus the emphasis for mitigation is on demonstrating that the impact has been reduced to practical minimum, rather than necessarily be reduced purely in terms of its rating.

Disturbance / Injury of cetaceans, seabirds and fish

- Vessel speed will be reduced where seabirds on the water surface and/or marine mammals are known to be present, and vessels will not approach animals unless it is not possible to avoid doing so;
- Specific protocols for mammal and bird interactions will be drawn up in a contractor's management plan and qualified (e.g. Joint Nature Conservation Committee registered course or equivalent) Marine Mammal Observers (MMO) will be present during pipe-laying operations to assist in managing such interactions on a case by case basis. This plan will specify the number, location, deployment and procedures to be used;
- Vessel engine power will be "ramped" up where practicable, to allow cetaceans that may be nearby to move away from sources of loud underwater noise and vibration;
- Appropriate lighting design during night-time works will be implemented, including use of directed illumination, screens, shades, timers, actuators, etc. as required. Skyward and seaward light projection will be eliminated as far as safe and practicable, by removing unnecessary illumination, reduction of light intensity and shielding of light sources during the night, and in low visibility and bad weather conditions. This will apply particularly during the most active migration period for migrating birds (between the end of March and the end of May, as well as mid of September to the end of October);
- Intake screens for water abstraction will be used to prevent ingress of fish and large invertebrates. The design of screens should be optimised to minimise injury and/or mortality;
- Water intakes will be designed to minimise seabed disturbance and impingement or entrainment of marine organisms by appropriate positioning and reduction of the velocity of the intake;
- The hydrotest water intake will be fitted with appropriate screens to minimise entrainment of organisms;
- Limit activities to be carried out within the "coastal offshore environment" defined as the continental shelf out to 25 km along the pipeline route during May in order to avoid any disturbance to fish spawning;
- Preparation of a Biodiversity Action Plan (BAP) and a Biodiversity Management Plan (BMP)[22]; and
- Use of modern vessels and plant and undertaking of regular maintenance checks.

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[22] According to IFC guidance (GN6), a BAP consists of any number of biodiversity-related actions that need to be carried out by a company to fulfil the needs of a particular requirement, request or expectation (e.g., Lender compliance, legal requirement, stakeholder concerns), particularly if the EISA process has identified information gaps that need to be filled. A BMP should be developed when the baseline, impact assessment and proposed mitigation measures are complete and the only remaining issue is to collate such information into one implementable and auditable Management Plan.

Changes to Water / Sediment Quality

- A Project integrated waste management plan will be drawn up to ensure wastes are minimised at source, recycled / re-used where possible and otherwise managed responsibly (see **Chapter 18 Waste Management);**
- If biocides or other additives are required in the cooling water system, or for general cleaning purposes any chemical additives should be selected on the basis of least risk to the environment and will not contain carcinogenic, mutagenic or reprotoxic components;
- Intakes will be positioned or oriented to minimise seabed disturbance;
- Intake screens will be used to prevent entrainment of fish and large invertebrates. The design of screens should be optimised to minimise injury and/or mortality;
- Where dredging is required, the choice of dredger will be made to minimise sediment re-suspension (within engineering constraints). A chute, to deposit sediment close to the seabed to minimise turbidity will be used. Additional turbidity reduction measures will be used where practical, particularly where sediment is to be temporarily re-deposited in nearshore storage areas; and
- Implement a Dredging Management Plan.

Seabed disturbance / Habitat Loss

- Dredging areas are contained within the maritime safety exclusion zone, and variables such as dissolved oxygen, suspended solids, and/or accretion rates will be monitored at defined distances from the dredging activities to verify that excessive sediment suspension is avoided;
- Overspill from dredgers or barges will be avoided;
- Cooling water discharges from the pipe-laying vessel should be operated to achieve maximum dispersion;
- Dewatering pipe orientation, diffuser design and discharge velocity will all be optimised to achieve maximum dispersion and minimal seabed disturbance from pipeline dewatering. Discharge will be through a four or six-inch diffuser positioned approximately 1 m above the seabed, to reduce the speed of water flow as it exits the pipe in order to reduce turbidity and possible creation of sediment plumes;
- Pumped discharge of sediment back in to the trenches will be carefully targeted with the outlet as close as practicable to the trench bottom to ensure the majority of sediment is contained within the trenches; and
- Rock placement and seabed intervention will be kept at the practical minimum to ensure pipeline stability and safety. This also has the benefit of minimising impacts to sensitive biotopes.

Monitoring

Ecological monitoring is necessary to verify the predicted impacts of pipeline installation, to demonstrate the efficacy of mitigation and to document the recovery of impacted receptors from temporary impacts. Monitoring programmes will be designed to interface with surveys carried out for the Project, to ensure inter-comparability of pre and post-construction data.

An environmental monitoring plan has been developed for the Russian national EIA process, as required by Russian regulations, comprising construction and post construction monitoring of water, sediments, plankton (including phytoplankton, zooplankton and ichthyoplankton), benthos, fish, birds and mammals. The precise details (e.g. location of sampling stations etc.) may need to be revised in future, but in principal, this will form the basis for monitoring in the Russian sector. If impacts are detected during construction, additional post-construction monitoring will be developed by the Project. Monitoring may be required not only for the receptor but also the Project aspects that have the potential to generate impacts. Monitoring will therefore comprise:

- In-field monitoring of relevant receptors; and
- Monitoring of the implementation (and therefore effectiveness) of mitigation measures and management controls.

The ESIA Report has identified the following key components for which monitoring will be required.

- Water column monitoring: In order to verify the predicted impacts of sediment re-suspension, a variety of physical and chemical parameters, including but not limited to suspended solids and pollutants, will be monitored during and post-construction;
- Sediment monitoring: Key sediment characteristics will be monitored during and post construction to verify the predicted seabed impacts. Parameters will include geological and ecological variables such as particle size distribution and the presence of hydrocarbons and heavy metals;
- Plankton: Plankton monitoring is stipulated in the Russian EIA Report, though this ESIA Report has determined there is no scope for significant impacts. Nonetheless, such monitoring may have some value in better understanding the variability of the receiving environment;
- Benthic communities: Monitoring of benthic communities is fundamental to the Project's Overarching Environmental and Social Monitoring Programme, as this is the principal marine ecological receptor. Monitoring during and post-construction will allow verification of predicted impacts and an assessment of the degree and speed of recovery of impacted areas. Monitoring will also be designed to account for seasonality and be of sufficient duration to allow for longer term variations;
- Fish: Monitoring of fish populations during and post-construction will be carried out to determine the state of local populations. Species of conservation importance, including rare and endemic species and subspecies are of particular interest in this regard;
- Seabirds: Monitoring of seabird distribution during and post-construction will be carried out to determine the state of local populations and their distribution. While the Russian EIA Report stipulates monitoring during construction, additional longer term research will deliver a greater understanding of the status of seabird populations and the importance of the Project Area to them; and

- Marine Mammals: Monitoring of cetaceans during and post-construction will be carried out to verify the extent of impacts, particularly with respect to underwater noise. Because of their conservation status, additional research –based monitoring is appropriate (see below).

Biodiversity monitoring will be integrated into the Project's overall Environmental and Social Management System (ESMS). In this way, the results of the program can be clearly linked to management actions and the results used to evaluate the effectiveness of its mitigation strategy. This is in line with IFC Performance Standard 1, which emphasizes a "plan, do, check and act" management system. Further detail is provided in the Project's Environmental and Social Management Plan (ESMP) described further in **Chapter 22 Environmental and Social Management**.

In addition, because critical habitat has been identified for certain pelagic fish, seabirds and cetaceans, there is an additional requirement for biodiversity monitoring. South Stream Transport's mitigation strategy, which will be designed to comply with IFC PS6 and to achieve net gains, must be described in a Biodiversity Action Plan (BAP). Once a sufficient Biodiversity (or Ecological) Management Plan (BMP) is in place, that adequately describes on-site mitigation measures, the BAP need only describe the plans to achieve net gains. One of the common ways in which projects deliver biodiversity benefits is the use of offsets. However, in this instance, where a biodiversity offset is not part of the mitigation strategy (partly due to the absence of significant residual impacts, and partly due to the difficulty in securing a marine offset), net biodiversity gains will be obtained by identifying additional opportunities to enhance habitat and protect and conserve biodiversity. The implication of this for the Project's Overarching Environmental and Social Monitoring Programme, particularly for fish, birds and mammals, is that it must be appropriately designed to meet research objectives that enhance knowledge to the point that conservation measures can be tangibly improved. The scope of such programmes will be developed in consultation with relevant parties to ensure the maximum benefit is delivered.

The Project will produce a Biodiversity Action Plan (BAP) which will include the mitigation strategy for identified critical habitats. The BAP is currently being produced and will include all relevant parties and stakeholders identified to help achieve net gain. Further information on the likely scope and implementation of the monitoring programme is provided in **Chapter 22 Environmental and Social Management**.

12.5.2.4 Residual Impacts: Construction and Pre-Commissioning

The residual impacts of the Project Construction and Pre-Commissioning phases are detailed in Table 12.30. Mitigation designed into and applied to the Project will reduce the majority of impacts to marine ecological receptors to **Low** or **Not Significant**. Not significant impacts relate either to very localised and infrequent activities, or to those impacts that are within the limits of the natural variability of the system and thus effectively undetectable. These impacts, which are not considered further, comprise the following:

- Seawater abstraction for cooling water purposes will have no appreciable impact on sensitive receptors;

- Any disturbance arising during inspection surveys etc. is of a very small spatial extent and duration and is thus insignificant. The same holds true for maintenance inspections of the operational Pipeline;
- Installation of test heads is a brief activity of very limited spatial extent and involves no appreciable discharges or disturbance;
- Turbulence from dynamic positioning of vessels will be localised to such a degree that the impact will be insignificant; and
- Disturbance and waste generation from a series of small scale, brief construction activities such as welding of well heads, raising pipe ends for tie-ins etc. are not significant.

A conservative and precautionary approach has been adopted in this assessment leading to some possible exaggeration of the significance of potential impacts, in order to ensure that sensitive marine ecological receptors are protected as far as practicable. Nonetheless, residual impacts to key benthic receptors are assessed as low:

- Excavating the nearshore approach trench and tunnel exit pit will lead to the loss of benthic habitat of different types and potentially generate suspended solids. Benthic habitats and their associated biota will experience a **Low** significance impact, as a result of their regenerative ability and the limited extent of the impacts; and
- Pipe-laying (and the associated anchor footprint of the pipe-laying vessel) will have a **Low** significance impact on soft substrate benthic habitats. No highly sensitive habitats exist along the pipeline alignment seaward of the tunnel exit.

Similarly, trench backfill, post-lay trenching and seabed intervention will have a **Low** significance impact on soft substrate.

Because underwater noise is above background levels, it is considered a low magnitude (as opposed to negligible) impact. The impact to highly sensitive cetaceans from underwater noise has therefore been assessed as of **Moderate** significance before mitigation, based on strict application of the significance matrix (Table 12.33). Because noise cannot be attenuated to negligible levels, the residual impact on cetaceans, after mitigation is still of **Moderate** significance according to the matrix. However, this is not compatible with the definition of "moderate impacts" in Table 12.34, i.e. *"result in lasting changes to baseline conditions, which may cause hardship to or degradation of the resource / receptor, although the overall function and value of the resource / receptor is not disrupted*." As previously described, modelling of the acoustic impact of the construction spread has shown that sound is unlikely to cause mortality or injury to marine mammals and likely to only affect a group of localised individuals over a short time without affecting the overall population. This degree of impact is consistent with the definition of **Low** significance because, though changes are detectable, they are very short term (no more than a few days duration) and *"not expected to cause hardship, degradation, or impair the function and value of the resource / receptor."* It is therefore considered appropriate to rank the significance of the impact as **Low**.

A summary of the potentially significant impacts (i.e. those other than **Low** or **Not Significant**), showing receptor sensitivity, impact magnitude, proposed mitigation and residual impact significance is given in Table 12.38.

Table 12.38 Assessment of Impacts: Construction and Pre-Commissioning

Activity	Potential Impact	Receptor(s)	Receptor Sensitivity	Impact Magnitude/ Likelihood	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Mobilisation of vessels to/from site and vessel movements within construction zone. Delivery of pipe and other supplies by supply vessel, including crew changes. Vessel routine operations (including propulsion, cooling water, water maker).	Physical disturbance of animals at sea surface (as distinct from acoustic effects) and possible collision risk.	Marine mammals	High	Low	Moderate	Trained MMO and specific protocols for mammal and bird interactions in the contractor's management plan. Will include: • Minimise unnecessary vessel movements. • Reduce vessel speed where mammals may be present. • Avoid aggregations of birds and mammals.	Low, direct, short term
		Seabirds	Moderate to High	Low	Moderate		Low, direct, short term
Inspection, welding and weld-testing of pipe.	Birds (particularly those that migrate at night) may be attracted to lights and suffer damage as a result of collisions with vessels.	Seabirds	Moderate to High	Low	Moderate	Remove unnecessary illumination, reduce light intensity and shield light sources during the most active migration period for birds.	Low, direct, short term

Continued...

Activity	Potential Impact	Receptor(s)	Receptor Sensitivity	Impact Magnitude/ Likelihood	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Dredging of microtunnel exit pit/nearshore pipeline trench and storage of dredged material Trench backfill and post lay trenching (for main pipe-lay and intervention works) Rock dumping (for main pipeline and seabed intervention works)	Seabed disturbance and rock placement will lead to direct displacement or loss of benthic communities as well as changes in the physical nature of the seabed that affect the distribution of benthos. Resettling material may smother benthos, affecting the ability of invertebrates to feed.	Soft substrate benthos	Moderate	Low	Moderate at worst	Where dredging is required, the choice of dredger will be made to minimise sediment re-suspension (within engineering constraints). A chute, to deposit sediment close to the seabed to minimise turbidity, will be used. Additional turbidity reduction measures will be used where practical, particularly where sediment is to be temporarily re-deposited in nearshore storage areas. Avoid overspill from dredgers. Post-lay trenching techniques will be used that will minimise disturbance to the seabed Seasonal restriction (May) on coastal works to protect spawning fish.	Low, direct and indirect, medium term
Laying pipe on seabed, including by S-Lay method (30-600 m water depth), including abandon pipeline to seabed at 600 m water depth and recovery to J-Lay vessel Laying pipe on seabed by J-Lay method (over 600 m water depth)		Benthic invertebrates	Moderate	Low	Low		Low direct and indirect, medium to short term

Continued…

Activity	Potential Impact	Receptor(s)	Receptor Sensitivity	Impact Magnitude/ Likelihood	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
	Suspended material may temporarily and locally reduce the light available to macrophytes.	Macrophyte stands	High	Low	Moderate		Low direct and indirect, medium term
	Resettling material may smother benthos, reducing photosynthesis.						
	Suspended material may temporarily and locally affect fish respiration as well as predator/prey interactions, particularly for fish that rely on sight to feed or avoid predation.	Fish	Moderate to High	Negligible to Low	Moderate at worst		Low, direct and indirect, medium term, some possible positive impacts of habitat creation

Continued…

Activity	Potential Impact	Receptor(s)	Receptor Sensitivity	Impact Magnitude/ Likelihood	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
	Rock placement may create artificial reef which may provide suitable habitat for fish. Dredging may expose otherwise inaccessible prey to fish.						
	Noise may cause behavioural changes over a limited area	Fish	Moderate	Low	Low	Trained MMO and specific protocols for mammal and bird interactions in the management plan. Will include: Minimise unnecessary vessel movements. Reduce vessel speed where mammals may be present. Avoid aggregations of birds and mammals.	Low direct, short term
	Noise may cause low level behavioural changes over a wide area. Possible temporary auditory impairment in direct proximity to activity (within 20 m).	Marine Mammals	High	Low	Moderate		Low (see text in Section 12.5.2.4) direct, short term

Continued…

Activity	Potential Impact	Receptor(s)	Receptor Sensitivity	Impact Magnitude/ Likelihood	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Seawater abstraction for hydrotesting	Entrainment of animals with water intake	Fish	Moderate to high	Low	Moderate	Water intakes will be designed to minimise seabed disturbance and impingement or entrainment of marine organisms by appropriate positioning and reduction of the velocity of the intake. Use of intake screens	Low, direct, short term

Complete.

12.5.3 Assessment of Impacts: Commissioning and Operational Phase

12.5.3.1 Introduction

Because the scope of activities associated with the operational and commissioning impacts is small in comparison with the Construction and Pre-Commissioning Phase, the number of receptors is limited to those that might be affected by the continued presence of the Pipeline on the seabed or be disturbed by inspection and maintenance activities. Essentially this comprises the seabed communities in deeper water where the pipe will not be trenched and the fish associated with those benthic communities, as well as seabirds and marine mammals.

Inspection activities may generate small amounts of ship wastes as described in Section 12.5.2, though to a lesser degree. All vessel discharges and wastes will be compliant with MARPOL and national regulations thus will have a negligible impact and are not considered further.

12.5.3.2 Assessment of Potential Impacts (Pre-Mitigation)

Benthic Habitats

The physical presence of the Pipeline may alter local hydrodynamics and sediment transport, with secondary impacts to benthic communities (similar in nature to those described above but much reduced in extent). This will be a highly localised effect, and will decrease over time as the seabed reaches its new equilibrium. The fact that seaweed stands are confined to the area where the Pipeline will be buried eliminates the possibility of impact to highly sensitive benthic communities.

The pipelines and associated seabed intervention will provide hard substrate in areas where such is absent and act as an artificial reef that will be colonised by sessile biota. This may therefore increase the habitat and species diversity locally and have a limited positive effect.

It is thus considered that the effects of the presence of the operational Pipeline on benthic communities is long term and of low magnitude and **Low** significance prior to mitigation and may provide localised benefits.

Fish

The pipelines and associated seabed intervention will provide hard substrate in areas where such habitats are absent and so will act as an artificial reef and/or fish aggregation device. This is partially due to the shelter provided by the pipe structures themselves and partially due to the colonisation of the concrete coated pipe and seabed intervention by epifauna on which fish feed. This phenomenon has been observed on numerous pipelines and is exploited by fishermen in some parts of the world (e.g. the North Sea).

However, because most of the Pipeline will be in areas where fish do not occur, the effects of the presence of the operational Pipeline on fish will be long term and of negligible magnitude and **Low** significance prior to mitigation.

Seabirds

Pipeline inspection and maintenance will involve some vessel movements. The limited frequency and extent of such activities means that any interaction with seabirds will be minimal. This therefore considered a negligible magnitude impact of **Low** significance at worst prior to mitigation.

Marine Mammals

As with seabirds, vessel movements (including vessel noise) associated with Pipeline inspection and maintenance is a low magnitude impact of **Moderate** significance prior to mitigation.

Alien Species

As with construction, vessel movements during the Operational Phase have the potential to inadvertently introduce non-native species, though this is exceptionally unlikely given the limited duration and frequency of vessel deployment for inspection and maintenance. Despite its low probability of occurrence, the possibility of population or community wide effects makes this a **High** significance impact prior to mitigation, for all marine ecological receptors.

12.5.3.3 Mitigation and Monitoring

Given the limited scope of operational impacts of the Pipeline compared with those identified in association with the Construction and Pre-Commissioning Phase, mitigation is limited to a subset of the measures described above for management for vessel movements and operations etc. during inspection and maintenance, specifically:

- A qualified MMO will be present to assist in managing mammal interactions;
- Vessel movements during inspection and maintenance will be kept to a practical minimum to minimise disturbance to marine mammals and seabirds;
- Vessels will not approach animals unless it is not possible to avoid doing so;
- Vessel wastes will be managed as per the construction phase, compliant with MARPOL, Bucharest Convention and National regulations (see Section 12.5.2.3); and
- Similar vessel management and controls will apply to inspection and maintenance boats as for construction vessels, to minimise the risk of accidentally introducing non-native organisms.

Operational monitoring will be integrated into the Project's Overarching Environmental and Social Monitoring Programme, as developed for the Russian national EIA previously outlined and detailed in the Project's ESMP.

12.5.3.4 Residual Impacts: Commissioning and Operational Phase

The limited scope of operational and commissioning impacts compared to those identified for the Construction and Pre-Commissioning Phase means that no significant residual impacts are expected following the implementation of the above mitigation measures. The potential operational effects, their mitigation and residual impacts are summarised in Table 12.39.

Table 12.39 Assessment of Impacts: Commissioning and Operational Phase

Activity	Potential effect	Receptor	Sensitivity	Magnitude	Pre-mitigation impact significance	Mitigation measures	Residual Impact significance
Maintenance / repair to pipelines (including span correction, etc.)	Physical and acoustic disturbance and possible collision risk.	Marine mammals	High	Low	Moderate at most	Trained MMO and specific protocols for mammal and bird interactions in the contractor's management plan. Will include: • Minimise unnecessary vessel movements. • Reduce vessel speed where mammals may be present. • Avoid aggregations of birds and mammals.	Low, direct, short term

12.5.4 Assessment of Impacts: Decommissioning Phase

12.5.4.1 Introduction

Decommissioning of the South Stream Pipeline will be carried out according to prevailing international and national legislation and regulations and best practices regarding environmental and other potential impacts.

A review, and relevant studies if necessary, will be undertaken during the Operational Phase to confirm that the planned decommissioning activities utilise GIIP and are the most appropriate to the prevailing circumstances and future land use. The review will outline management controls and demonstrate that the decommissioning activities will not cause unacceptable environmental and social impacts. The decommissioning activities will also require all relevant approvals and authorisations from the Russian Government departments responsible at the time.

It must be therefore stressed that the assessment of decommissioning impacts set out below is provisional, based on current practices and technologies. It is not intended to be definitive, but may serve as a high level comparison between broad strategies.

Essentially two options are available; namely in situ decommissioning or pipe removal.

- In situ decommissioning involves cleaning the Pipeline and filling it with seawater. The receptors that might be impacted are thus the same as those for the operational Pipeline, with the additional possibility that some fish or swimming invertebrates may be entrained during pipeline flooding; and
- Removal of the Pipeline is essentially a similar operation to pipe-laying, but in reverse. The receptors and degree of impact will thus be similar to those identified for the construction phase.

The generic significant impacts that may be associated with decommissioning are summarised below, though pending the Project’s decommissioning studies at the appropriate time, these are not fully assessed here.

12.5.4.2 Assessment of Potential Impacts (Pre-Mitigation)

Plankton

As with construction, it is highly unlikely that either decommissioning option will result in any appreciable effects on plankton or planktonic systems.

Benthic Habitats and Organisms

If the Pipeline is to be decommissioned and abandoned in situ, the discharge of cleaning water may result in local deterioration of water quality, alteration of hydrodynamic and resultant seabed disturbance potentially affecting the benthic community on a localised scale. Effects will be localised and no appreciable changes will accrue to ecological features.

Benthos will be disturbed by rock removal and excavation of the Pipeline in the nearshore and in some limited parts of the offshore area where seabed intervention has been required. In addition, resettling of suspended solids may cause some smothering resulting in direct mortality as well as impairing the ability of some organisms to feed, respire and photosynthesize.

Importantly, less resilient seaweed communities are predominantly confined to the area landward of the tunnel exit and may experience less severe impacts. Different areas of seabed will be impacted to differing degrees, but as with Pipeline installation it is highly unlikely that the region's overall integrity will be impacted.

Fish

The impact to fish of pipeline recovery will be variable. Small, benthic dwelling species are likely to be more severely impacted through habitat loss, loss of food resource and smothering. Re-suspension of sediments may cause damage to gills in some cases.

Noise and vibration will be generated during excavation and pipe lifting. Sound levels are likely to be similar to those generated by trenching and pipe-laying (see Section 12.5.2), thus are unlikely to cause mortality or injury to fish.

Seabirds

Seabirds may be disturbed and displaced from feeding areas by vessels, or if pipe needs to be removed from the shore crossing tunnel. Additional indirect, short term effects may occur to a localised part of the population as a result of displacement or loss of prey in the nearshore area.

Marine Mammals

Vessel movements during pipe recovery may disturb marine mammals. Collisions may also occur. However, as discussed on Section 12.5.2, these animals are generally able to avoid areas of disturbance and only a few individuals are likely to be affected.

Noise and vibration generated during excavation and pipe lifting will have similar impacts to those generated by trenching and pipe-laying (see Section 12.5.2).

12.5.4.3 Mitigation and Monitoring

In the event that the Pipeline is to be abandoned in situ, the following mitigation will reduce adverse impacts to marine ecological receptors. It must be stressed that this is an indicative list of the types of mitigation that may be applied. Evolving technology and regulatory frameworks will mean that the actual management methods may differ by the time the Pipeline needs to be decommissioned:

- Non-toxic chemical additives to be used for pipe cleaning;
- The discharge of cleaning waters will all be optimised to achieve maximum dispersion and minimal seabed disturbance;
- Seawater intakes during pipe flooding will be designed to minimise impingement and entrainment of marine organisms by appropriate positioning and minimising the velocity of the intake, as well as to minimise seabed disturbance; and

- If the pipe is to be flooded, intake screens will be used to prevent entrainment of fish and large invertebrates and minimise injury and/or mortality.

If the Pipeline is to be removed, the mitigation required will be similar in essence to that for pipe-laying described and seabed interventions, in summary:

- Where excavation of the pipe is required, the choice of equipment will be made to minimise sediment re-suspension (within engineering constraints). Additional turbidity reduction measures may also be used, particularly in more sensitive areas;
- Dynamically positioned (DP) vessels will disturb the seabed less than anchored barges, (though there is likely to be a trade off with respect to noise, as DP vessels are often noisier);
- All vessel discharges, wastes and ballast will reflect GIIP and be compliant with any international and national regulations pertaining at the time; and
- Monitoring will be required whichever decommissioning option is selected. In the event that the Pipeline is removed, a comprehensive suite of monitoring comprising decommissioning and post decommissioning monitoring of water, sediments, plankton, benthos, fish, birds and mammals will be required consistent with that developed for the Construction and Pre-Commissioning Phase.

A detailed scope for appropriate monitoring will be developed at the time of decommissioning, taking into account prevailing environmental conditions, GIIP and available technology.

12.6 Unplanned Events

The potential impacts associated with unplanned events are discussed in **Chapter 19 Unplanned Events**.

During the Construction and Pre-Commissioning Phase of the Project, unplanned events in the marine environment may occur as a result of maritime accidents involving one of more vessels. The resultant effects of these unplanned events will be limited to accidental pollution incidents involving fuel and oils which could result in a significant adverse ecological impact. The design controls that will be in place to reduce the risk of occurrence of the above potential events, as well as the mitigation measures that will be enforced to minimise the consequences associated with the events, are discussed in **Chapter 19 Unplanned Events**.

Vessel operations also have the potential to inadvertently introduce invasive alien species, either in ballast water, on the biofilm inside ballast tanks or carried as fouling organisms on the hull.

During the Operational Phase of the Project unplanned events at sea may occur as a result of accidental leakages of natural gas from the subsea Pipeline. This could be incurred by third-party vessel interaction with the Pipeline by events including sinking, grounding and anchor or dropped object (such as a container) damage to the Pipeline.

12.7 Cumulative Impacts

The cumulative impacts associated with the Project relating to marine ecology are assessed in **Chapter 20 Cumulative Impact Assessment**.

12.8 Conclusions

The Construction and Pre-Commissioning Phase of the Project has the greatest potential to impact marine ecological receptors, particularly benthic communities. Many impacts are reduced to **Low** or **Not Significant** through project design and mitigation measures, principally by careful routing and choice of dredging and trenching technology that minimises impact to the seabed and sensitive benthic communities.

Operational and commissioning impacts relate to the presence of the Pipeline on the seabed directly and indirectly affecting habitat structure, as well as disturbance due to inspection and maintenance activities. These impacts are all potentially moderate at most, prior to mitigation. Operational impacts are largely mitigated through ensuring the stability of the pipe on the seabed and through control of vessel activities during inspection and maintenance. These mitigation measures will reduce operational and commissioning impacts to marine ecological receptors to **Low** significance.

While it is not possible to fully assess decommissioning impacts at this stage, it is possible to contrast two broad strategies; namely in situ abandonment and pipe recovery. The former generates impacts broadly similar to those of the Pipeline Operational Phase, while the latter generates impacts broadly similar to the Construction and Pre-Commissioning Phase, and are thus amenable to similar mitigation strategies.

The key residual impacts to marine ecological receptors are thus as follows:

- The nearshore approach trench will lead to the loss of benthic habitat of all types and generate plumes of suspended solids. Benthic habitats and their associated biota will experience a **Low** to **Moderate** significance impact, as a result of their regenerative ability and the limited extent of the impacts;
- Pipe-laying (and the associated anchor footprint of the pipe-laying vessel) will have a **Low** to **Moderate** significance impact on benthic habitats;
- Trench backfill, post-lay trenching and seabed intervention will similarly have **Low** to **Moderate** significance impact on both shallow water and deep water seabed habitats; and
- Acoustic impacts are likely to be of **Low** significance to fish and cetaceans.

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Chapter 13: Landscape and Visual

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13 Landscape and Visual

13.1 Introduction

This chapter presents the process and findings of the Landscape and Visual Impact Assessment (LVIA) for the South Stream Offshore Pipeline – Russian Sector (the Project).

There are two elements to the LVIA; first, the actual physical changes to the landscape (impacts on landscape character and quality) and second, the perceived changes and the impacts that those have on a visual receptor (impacts on views and visual amenity). For the purpose of the ESIA process, a clear distinction is drawn between landscape and visual impacts as follows:

- **Landscape Impacts**: These relate to the degree of change to physical characteristics or components of the landscape, which together form the character of that landscape, e.g. landform, vegetation and buildings; and
- **Visual Impacts**: These relate to changes to elements of existing views and the amenity of visual receptors, e.g. residents of dwellings, users of public footpaths or motorists passing through the area.

An understanding of the nature of any project is vital to the LVIA process, including all Project activities that could affect landscape and visual amenity during a project's lifecycle, from construction through to decommissioning.

The baseline information, obtained through comprehensive desk and field studies, includes description, classification and analysis of the landscape and visual resource. Due to the nature of the Project and the fact that it entails operations on both land and sea, an assessment of the seascape resource is included in addition to the landscape resource.

Whereas this chapter assesses the character and visual amenity of the landscape and seascape in the vicinity of the Project, details of their ecological make-up are assessed in **Chapter 11 Terrestrial Ecology** and **Chapter 12 Marine Ecology**. The perceptions of people living and working locally, as well as visiting the area, are fundamental to the assessment and, as visual receptors, are identified in this chapter; details of the communities and population are provided in **Chapter 14 Socio-Economics**. The combination of human activity and natural processes are fundamental to the evolution of landscape, and heritage aspects are covered in **Chapter 16 Cultural Heritage**.

The assessment process establishes the sensitivity to change of each receptor, identifies likely landscape and visual impacts and determines the magnitude and significance of those impacts. Mitigation measures designed to avoid, reduce or remedy adverse impacts, are identified and their likely effectiveness also assessed.

13.2 Scoping

The anticipated scope of the LVIA was set out in the 'South Stream Offshore Pipeline – Russian Sector: Scoping Report'.

The scope of the LVIA for the Project was defined through a scoping process which identified receptors and potentially significant impacts related to the Project. Baseline information which informed the scoping process largely drew on satellite imagery, topographical data and photographic records. Key steps in the scoping process for landscape and visual assessment comprised the following:

- A review of relevant national and international legislative requirements and lender requirements was undertaken to ensure legislative and policy compliance;
- The Project description was reviewed to identify activities with the potential to significantly affect receptors;
- Receptors within the Project Area of Influence were identified for landscape character and visual amenity. This was done through a process of secondary data review (Section 13.4.2), previous studies undertaken for the South Stream Offshore Pipeline and professional expertise; and
- Discussions were held with South Stream Transport representatives and project engineers to establish which activities were expected to interact with receptors, and whether this would result in a positive or negative impact.

The assessment has been informed through this process of impact and receptor identification.

The consultation undertaken as part of the ESIA process is provided at **Chapter 6 Stakeholder Engagement**. Comments were made during the consultation process by local communities about potential significant adverse impacts on landscape and visual amenity of an area that attracts large numbers of tourists and visitors (written comments from local communities 20th November 2012 to 31st January 2013). Several of these comments relate to the key objective of the LVIA which is to identify and assess the significance of potential adverse impacts on the landscape and visual amenity. Appropriate management and mitigation measures will then be identified and implemented to address these impacts on potentially sensitive visual receptors. Consultation with stakeholders is recognised as an effective way to better understand the receptor sensitivity and more accurately use professional judgement to assess the significance of residual impacts.

13.3 Spatial and Temporal Boundaries

The Project Area is described within **Chapter 5 Project Description**, a brief description of the elements pertinent to potential landscape and visual impacts are summarised below. The Project Area is subdivided into three sections of the Pipeline: the landfall, nearshore and offshore. It also includes proposed transport access routes from the existing M25 highway at Rassvet; these include bypass roads around Gai Kodzor and Varvarovka, and then further access roads to the Project. Access roads are proposed to be used for deliveries and worker transportation associated with the Project. Some of these access roads are temporary and are only required for the Construction and Pre-Commissioning Phase. Details of the access roads and associated construction are provided within **Chapter 5 Project Description**.

For the purpose of this LVIA the following areas have also been defined and are referred to within this chapter:

Study Area

The landscape Study Area has been defined to include the landfall, the nearshore and offshore sections of the Project Area, and the access roads leading from the Project to the M25 junction at Rassvet. This has been selected to encompass the area where there is potential for impacts on landscape character and/or visual amenity. It includes areas where views of the Construction and Pre-Commissioning and Operational Phases of the Project could potentially be perceived, including areas with views of vehicles on land (including on the access roads) and the movement of construction vessels up to 10 km from the shore (including potential sea delivery routes to Novorossyisk Port). A 10 km limit has been chosen as that is considered to be the furthest distance that views of vessels could potentially be perceived, based upon their size and an assumed level of visual acuity.

The location of the Study Area is shown in its regional context in Figure 13.1, in particular with reference to two key geographical features: the Azov-Kuban lowland and the Greater Caucasus Main Range Mountains. The Study Area itself is shown in greater detail on Figure 13.2.

Survey Area

Within the Study Area, a smaller area has been defined where it is considered, based on previous experience of similar development projects, that there is greatest potential for significant direct or indirect impacts on landscape character and visual amenity arising from the Construction and Pre-Commissioning and Operational Phases. This area extends between the proposed microtunnel entry shafts and the proposed connection point with the upstream United Gas Supply (UGS) System. The determining factor in the extent of this area is the topography and vegetation in the vicinity, which influences intervisibility [1] and encloses the proposed development. This was verified by a combination of desktop study, Zone of Theoretical Visibility [2] (ZTV) analysis and field reconnaissance. The boundary for this Survey Area is therefore limited to 4 km radii from both the microtunnel entry shafts and landfall facilities (as illustrated on Figure 13.3).

The Survey Area includes the following:

- Areas of land and sea from which the landfall section (between the proposed microtunnel entry points and the proposed connection with the Russian gas network) could potentially be visible based on landform only (i.e. without taking account of woodland or built-up areas); and
- Areas of land and sea from which the landfall facilities (including above ground structures and the stack) could potentially be visible based on landform only (i.e. without taking account of woodland or built-up areas).

[1] Intervisibility is defined by the state of being mutually visible

[2] ZTV: The Zone of Theoretical Visibility represents the geographical area (zone) within which the landscape and/or seascape where the Project is theoretically visible, based upon a 'bare-earth' digital model of the Study Area.

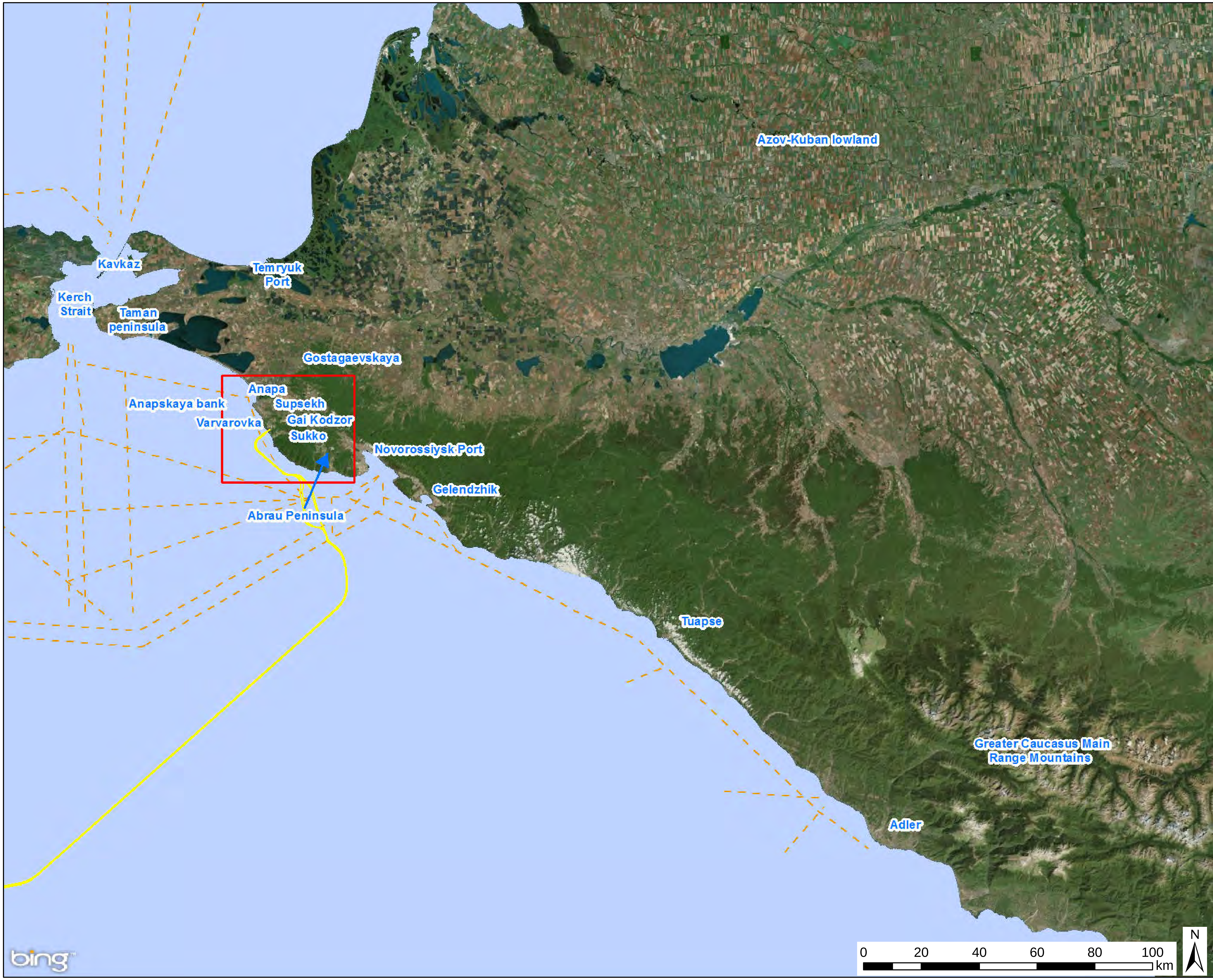
Potential indirect impacts are also considered in this assessment, such as impacts of construction vehicles using the access roads on settlements outside of the Survey Area.

Zone of Theoretical Visibility

The Zone of Theoretical Visibility drawings (ZTVs), referred to above, were generated using computer modelling using ESRI ArcGIS software with a Spatial Analyst extension (refer to Section 13.4.2 for further detail of the data used). These images depict the area within which the Project would theoretically be visible and as such has potential to influence or impact on visual amenity. However, it should be noted that the ZTV is calculated using a *bare earth model*, i.e. one which does not reflect the screening effect of intervening structures such as buildings, or vegetation. As such, it is subject to further on-site verifications to verify actual visibility on the ground.

The ZTV is used primarily for identifying the location of potential visual receptor groups which are then subject to an on-site verification process to determine the context and extent of actual views, and potential views, of the Project.

Further details of the modelling undertaken to determine the ZTVs of the offshore and nearshore sections, the landfall facilities, and the landfall section are provided in Section 13.5.4.1.



LEGEND

Russian Sector of South Stream Offshore Pipeline

- Proposed offshore pipelines
- Study area (see Figure 13.2)
- Town/settlement
- Shipping lanes (current)

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue

For Information

Client

South Stream Offshore Pipeline ENERGISING EUROPE

Project Title

SOUTH STREAM OFFSHORE PIPELINE

Drawing Title

MAP OF WIDER AREA

Drawn	Checked	Approved	Date
DH	RW	MW	25/02/14

URS Internal Project No.	Scale @ A3
46369082	1:1,200,000

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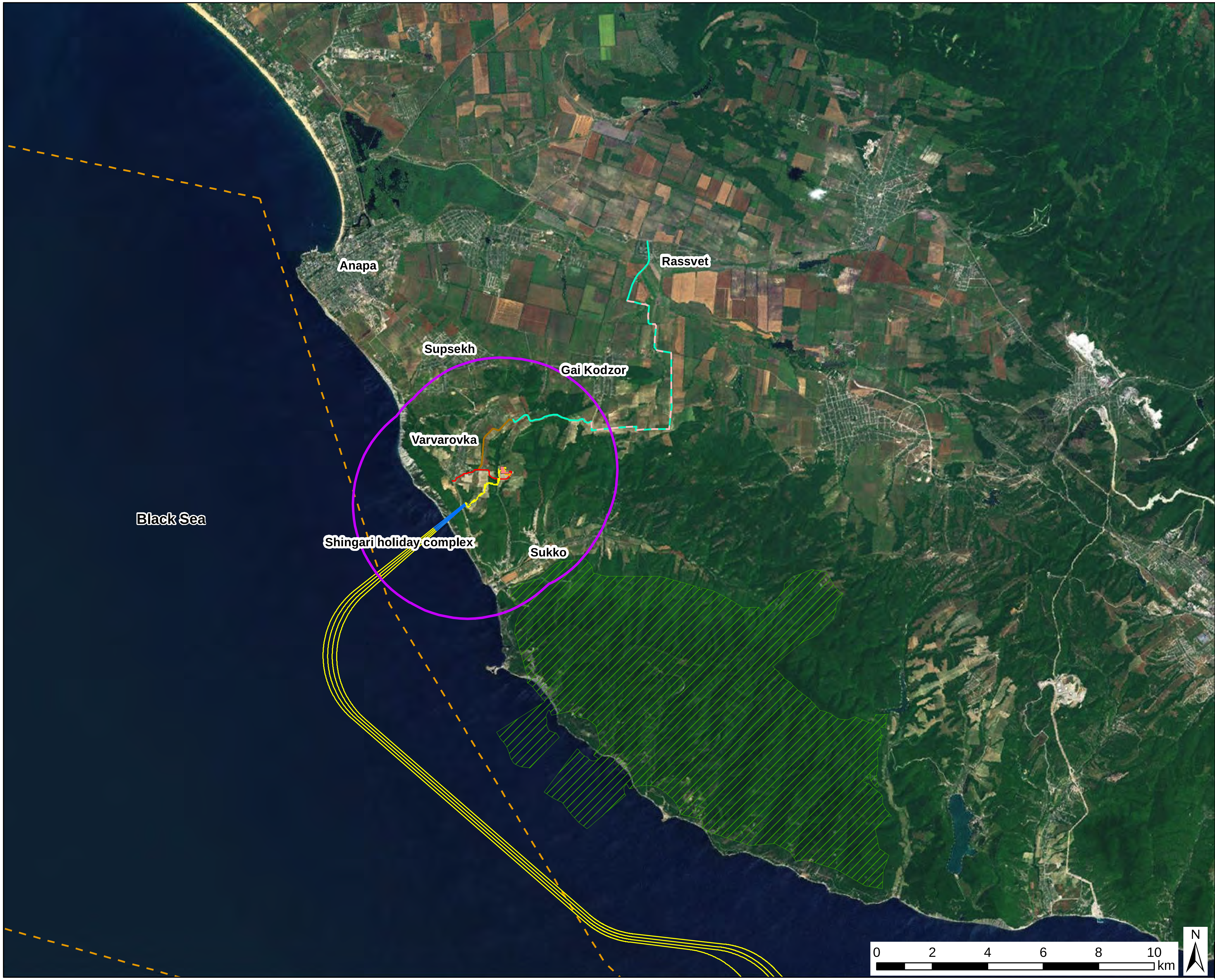
Drawing Number	Rev
Figure 13.1	

Plot Date: 25 Feb 2014
File Name: I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 13 Landscape\Figure 13.1 Map of Wider Area.mxd



LEGEND

4 km survey area
Shipping lanes (current)
Boundary of the state nature reserve "Utrish"

Russian Sector of South Stream Offshore Pipeline

Proposed landfall section pipelines
Landfall facilities
Proposed microtunnels
Proposed offshore pipelines
Proposed access roads from M25
Permanent access road to be constructed by SSTTBV
Varvarovka bypass road (used by Project during construction only)

United Gas Supply System

Permanent access road to be constructed by Gazprom Invest
Gazprom Invest temporary bypass road to be utilised by SSTTBV

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue
For Information

Client
South Stream
Offshore Pipeline · ENERGISING EUROPE

Project Title
SOUTH STREAM
OFFSHORE PIPELINE

Drawing Title
LANDSCAPE STUDY AREA

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DH	RW	MW	27/02/14

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Drawing Number
Figure 13.2

Rev

Plot Date: 27 Feb 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 13 Landscape\Figure 13.2 Landscape Study Area.mxd

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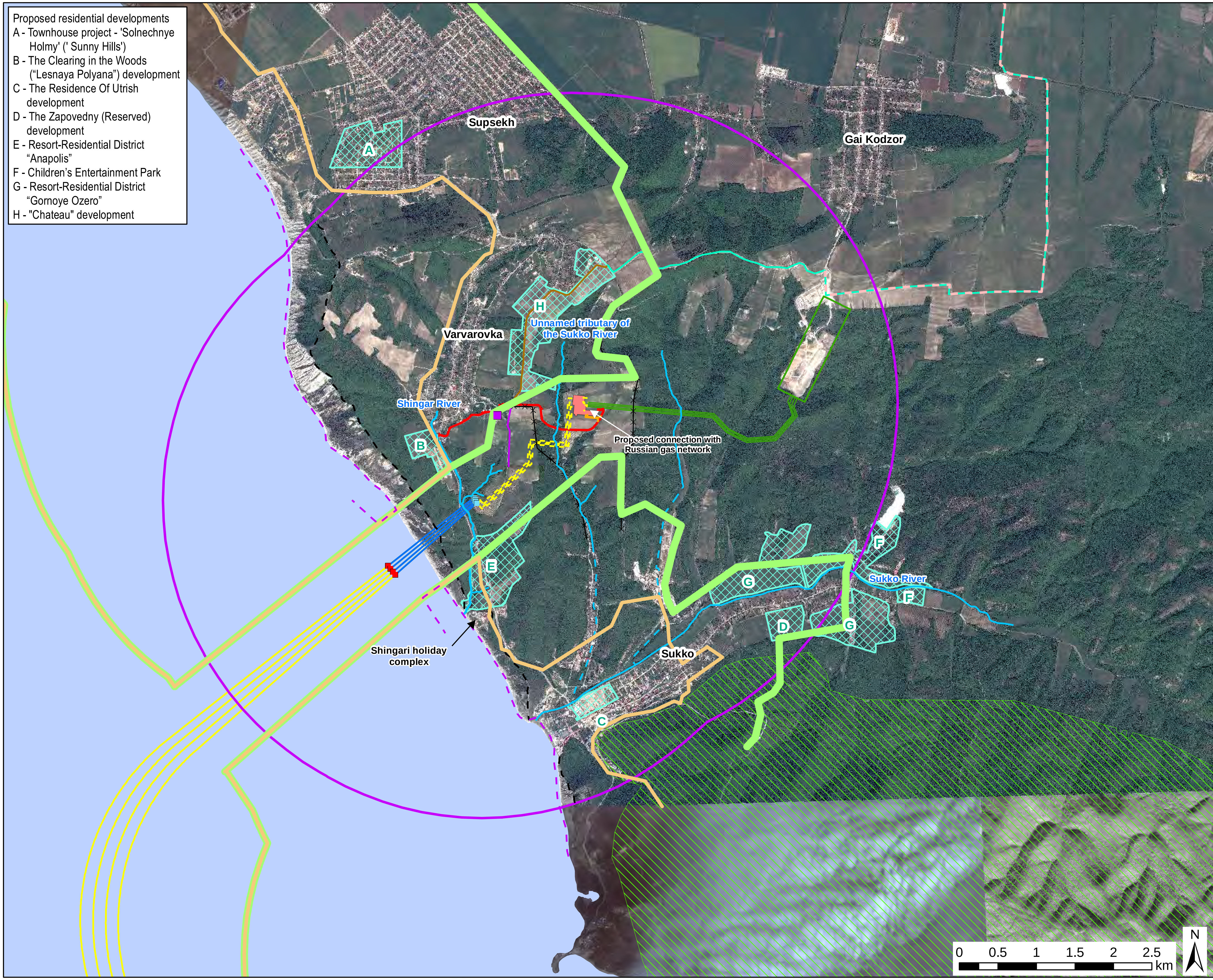

LEGEND

- The boundary of the first area of sanitary protection zone (exclusion zone)
- The boundary of the second area of sanitary protection zone (limitation zone)
- The boundary of the third area of sanitary protection zone (monitored zone)

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Landfall facilities
- Proposed microtunnels
- Proposed offshore pipelines
- Microtunnel entry shaft
- Microtunnel exit pit
- 4 km survey area
- Varvarovka Russian Orthodox & Armenian cemetery
- Coastal path
- Proposed delivery routes from Ports
- Permanent access road to be constructed by SSTTBV
- Temporary access road to be constructed by SSTTBV
- Varvarovka bypass road (used by Project during construction only)
- Rivers
- Inferred watercourses
- Power lines (mapped within a 1km radius of Project)
- Boundary of the state nature reserve "Utrish"
- Proposed residential development

United Gas Supply System

- Russkaya compressor station
- United Gas Supply System pipelines
- Permanent access road to be constructed by Gazprom Invest
- Gazprom Invest temporary bypass road to be utilised by SSTTBV

NOTE:
SPZ GIS layer provided by Peter Gaz, taken from Complex engineering surveys at the phase "design documentation" within the framework of "the south stream" gas pipeline marine sector project implementation. Technical documentation volume 5. Environmental survey and archaeological studies. Part 1 environmental survey. The Russian sector. Report produced by Peter Gaz.
Date: 2012-08-08

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue
For Information

Client
South Stream
Offshore Pipeline
ENERGISING EUROPE

Project Title
SOUTH STREAM OFFSHORE PIPELINE

Drawing Title
LANDSCAPE AND VISUAL SURVEY AREA – LANDFALL SECTION

Drawn	Checked	Approved	Date
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URS Internal Project No.	Scale @ A3
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Drawing Number
Figure 13.3

Rev

Plot Date: 30 Apr 2014
File Name: I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 13 Landscape\Figure 13-3 Landscape and Visual Survey Area.mxd

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13.4 Baseline Data

13.4.1 Methodology and Data

A desk study of secondary data available including reports on designated Protected Areas in the vicinity of the Project, satellite imagery, topography, site layouts and photographs was initially undertaken to inform the assessment of landscape and visual amenity. In particular, existing topographic data was used as the basis for a Geographical Imaging Systems (GIS) terrain model; known elevations of the various parts of the Project were then overlaid onto this to determine the ZTVs associated with the Project and hence, to estimate the locations from which elements of it would be visible. Following this, a gap analysis was undertaken to inform the need for primary data sources to fill the data gaps. Field work was then undertaken to obtain primary data relating to landscape character and visual amenity. The secondary and primary data used to inform this LVIA is detailed in the following sections.

13.4.2 Secondary Data

The following sources of secondary data have been reviewed as part of this assessment:

- ESRI High resolution satellite imagery;
- ASTER 30 m resolution Digital Terrain Model;
- ASTER 10 m resolution Digital Terrain Model; and
- Photographs.

13.4.3 Data Gaps

Following the collation of the above data, the following gaps were identified:

- Condition of existing landscape;
- Classification of landscape and seascape character at a regional and local scale; and
- Condition of existing views experienced by sensitive visual receptors.

13.4.4 Primary Data and Baseline Surveys

Visual receptors are specific individuals or groups who are expected to have views of the Project and therefore may experience effects on their amenity. In order to identify visual receptors, a combination of computer-generated ZTV models and assessment work in the field is required.

Landscape and visual surveys of various parts of the Survey Area (Figure 13.3) were undertaken in June and December 2012, April and August 2013, and April 2014. The purpose of the surveys was to understand the existing landscape character, to verify the ZTV and identify potential visual receptors, and to confirm that the available secondary data was representative of the Survey Area. A photographic record of landscape types and views from publicly accessible vantage points has been collected during the course of the surveys including recording the

Geographically Positioning System (GPS) location data of individual images. The work carried out during each visit is summarised in Table 13.1.

Table 13.1 Site Survey Summary

Survey Date	Survey Work Undertaken
19 and 20 June 2012	Two daytime visits were undertaken at the potentially affected settlements in the local area. The immediate area around the landfall section was also observed on foot, observing land use, footpaths, access routes etc. GPS measurements were taken when possible of towns, paths, roads and features of importance. Photographs were taken of all locations visited and notes taken on views of the landfall section from the local settlements and roads. The following areas / towns were visited: landfall section, Varvarovka, the Shingari and Don holiday resorts, Supsekh, Gai Kodzor, Bouzhor, Sukko and Anapa.
10 December 2012	Single daytime visit undertaken to confirm all the publicly accessible points and private dwellings and settlements from which the landfall section is visible and collect photographs for each viewpoint looking towards the Project site, along with GPS coordinates. These results were compared to the results gathered in June 2012.
03 April 2013	The following further information was gathered during a site visit to fill gaps previously identified in data: • Views out to sea from the residential receptors. • Views of the landfall section from areas in the surrounding area. • Views of potential construction traffic through Sukko.
August 2013	Field work and photography for photomontages – all viewpoint and photomontage baseline photographs taken.
April 2014	Field work and photography – updating baseline viewpoint photographs 6 and 7, and confirming no notable change to other viewpoint locations.

13.4.5 Data Assumptions and Limitations

It has not been possible to ascertain the full extent of recreational paths or tracks within the Survey Area, although it is acknowledged that during summer months, recreational activities, such as horse riding may take place. However, the Study Area has widespread forest cover with pockets of open land utilised for agriculture and viticulture. Since views within the forested areas would naturally be screened by the trees it is assumed that the receptors would be confined to locations within the open agricultural landscape, on the coastal paths and on local beaches etc.

Assumptions on the extent of some views have been based upon satellite imagery, topographical data, desktop analysis and professional judgement alone, due to inaccessibility. This has been used to determine the likely views towards the nearshore and offshore sections of the Project and effects on landscape character for locations which are not publicly accessible, such as private residences in Sukko, holiday complexes and private beaches at Shingari and Don, and the 'Utrish' state nature reserve.

Assumptions on the proposed Russkaya compressor station (currently under construction) have been made for inclusion in the cumulative assessment in **Chapter 20 Cumulative Impact Assessment**. In that chapter it is noted that the scale of the Russkaya compressor station is far greater than that of the Project, it has been assumed that the proposals for the Russkaya compressor station will be similar in character and style, including similar appearance of Right of Way (RoW), infrastructure and fencing, etc. It is also assumed that a landscape restoration plan, including the management requirements, and all other mitigation would be applied similarly to those proposed for the Project; effectiveness of these measures in mitigating adverse impacts from the Russkaya compressor station would be reduced due to the larger scale of that development in comparison to the Project.

13.5 Baseline Characteristics

13.5.1 Context

This section presents a description of the existing landscape and visual characteristics within the Study Area (Figure 13.2), with particular emphasis on the landscape character and visual amenity of the Survey Area (Figure 13.3).

The Study Area contains two key landscapes, the foothills of the Caucasus mountain range (to the south) and Abov-Kuban (lowland to the north and east), and the Black Sea makes up the western area.

Within the Study Area is the city of Anapa, a popular holiday destination in Russia noted for its beaches, warm climate and the presence of sites of historical and natural interest. Of particular note is the state nature reserve “Utrish”, protected for its rare flora (refer to Section 13.5.2.5 for more detail). The land throughout the Study Area is mostly used for viticulture with the majority of grapes used for local wine production. Tourism activities are associated with Anapa, and the surroundings within the Study Area are also well known for its onshore and offshore cultural heritage (refer to **Chapter 16 Cultural Heritage** for more information).

The Study Area (Figure 13.2) shows the Project within the surrounding landscape context, including access roads. Figure 13.2 also identifies the two small settlements located along these roads which may experience potential impacts.

The key focus of this LVIA is the Survey Area; this encompasses a 4 km radius around the area of the landfall section, and any activity in the nearshore and offshore sections including vessels on the open sea surrounding the coast. The Survey Area itself is largely dominated by agriculture but also contains small settlements and pockets of development. The Survey Area is characterised by the wooded, undulating topography in the vicinity of the landfall section, comprising the land generally defined by the Black Sea coastline to the west, Supsekh to the north and Sukko to the south, with the wide expanse of open sea extending to the west. Photographs indicating the baseline can be seen in Section 13.5.4.3, Viewpoints 1b, 2a, 5a, 6, 7 and 8.

The landfall section of the Project, which includes the proposed microtunnels, passes through a landscape of potentially sensitive character and visual amenity, comprising a pattern of woodland, fields, coastal slopes, cliffs and foreshore. It does not, however, lie within or close to any protected landscapes, although, as noted, the state nature reserve “Utrish” lies approximately 4 km southeast of the landfall section, extending just to within the Survey Area beyond Sukko. A number of vineyards and areas of state forest are located within the Survey Area on the proposed Pipeline route.

Based on the visual quality of the woodland and agricultural landscape, the scoping exercise identified that the local landscape within the Survey Area is important for both residents and tourists who visit the region.

13.5.2 Existing Landscape and Seascape of the Survey Area

The landfall section lies in an approximately south-western direction approximately 0.5 km southeast of Varvarovka and 2.5 km northwest of Sukko. The four pipelines are proposed to be microtunnelled beneath the coastal cliffs to the Black Sea, as shown in Figure 13.3. The pipelines will be laid on the seabed in the offshore section. The Black Sea is frequently crossed with commercial shipping vessels, shipping and tourist boats. Within the Survey Area the coastline is formed largely of cliffs with a few small bays and beaches to the south.

The location of the landfall section has been driven primarily by the need to connect with the location of the proposed Russkaya compressor station and the four connecting pipelines which form part of the “Expansion of the UGS to provide gas to South Stream pipeline” that is being developed separately by Gazprom. The Project’s landfall facilities would be located immediately adjacent to these four Gazprom pipelines, approximately 2.5 km west of the Russkaya compressor station.

13.5.2.1 Landscape Setting

The landscape is largely characterised by woodlands and open fields across the undulating topography of the Shingar River valley to the northwest and Sukko River valley to the south and southeast. The landscape is also defined by cliffs of the Black Sea coastline to the West (Figure 13.3).

The onshore part of the Survey Area is characterised by gently rolling hills with a combination of agricultural fields, principally viticulture, and forest sloping down towards the south and southwest. The microtunnelled section (where the Pipeline transitions from the sea onto land) runs beneath the coastal cliffs and the Shingar River.

There are only a few man-made features within the onshore part of the Survey Area; the most significant built features are the urban areas of Varvarovka and Sukko. The area is therefore considered to have a relatively high natural amenity value. However, the landfall section is fairly secluded from views from the surrounding settlements and the local limited road network, as it is intermittently screened by forest and topography. The Project’s nearshore and offshore sections are, however, visible from parts of the shoreline across the open water.

Panoramic views within the lower reaches of the valleys are limited. However, areas of more open land in the upper catchments allow lines-of-sight across the valleys, chiefly from elevated locations, for example, at Southern Sukko and Eastern Varvarovka with distant hills forming the horizon to the South and East.

13.5.2.2 Topography

The Survey Area is located in foothills between the Greater Caucasus Main Range Mountains and the Azov-Kuban lowland (Figure 13.1) at an approximate elevation of 200 m. The majority of the onshore Survey Area comprises an undulating plateau extending northeast from a steep coastal slope with the shoreline of the Black Sea at its base (as shown in Figure 13.4). This topography forms valleys to the watercourses in the Survey Area include the Shingar River (1.5 to 2.5 m wide), the Sukko River and an unnamed tributary of the Sukko River (as shown in Figure 13.3).

The plateau has been eroded with gullies in places, as described in more detail in **Chapter 7 Physical and Geophysical Environment**. Further information on watercourses, including valley and water channel features associated with intermittent waterways that flow during periods of high rainfall, can be found in **Chapter 8 Soils, Groundwater and Surface Water**.

13.5.2.3 Land Use and Vegetation

Land use in the Survey Area is a combination of forest, viticulture, residential development, tourism facilities and road infrastructure. Viticultural activity consists primarily of the cultivation of grapes for wine production. There is a mix of mature and young vineyards, as well as large areas where vines have been previously planted but are currently abandoned or left as fallow fields. These fields are often divided with narrow tree belts and hedges, or edged (unfenced) by roads and unsealed tracks (refer to **Chapter 14 Socio-Economics**).

A broad range of naturalistic land cover is present within the Survey Area including forest, juniper woodland, meadow, tomillyar (areas of herbaceous species associated with dry, hot environments), rocky outcrops, coastal shingle and vast areas of scrub and tall shrubs known as shiblyak. Shiblyak covers the greatest of this land area. Steppefied meadow consisting of grasses and herbaceous species is also a prevalent and characteristic land cover, typically resulting from derelict agricultural land. Agriculture is widespread and dominated by vineyards. As such, the linear parallel rows of grapevines are a key component of the landscape character. Juniper woodland and scrub occurs on the rocky south-western exposed slope along the coastline. A more detailed description of the forest vegetation is included in **Chapter 11 Terrestrial Ecology**.

The distribution of land use is mainly agricultural fields located around the outskirts of the residential developments i.e. in greater concentrations in the north-east and south-west of the Survey Area; and woodland further afield i.e. to the east, and centrally within the Survey Area (Figure 13.3).

The agricultural lands vary in appearance through the changing seasons, creating a green, lush and vegetated appearance during the summer and a more sparse, earthen, brown-coloured appearance during the winter, due to the extent of this land use, this has an impact on the character and visual amenity of these areas.

There are two lines of overhead power cables within the Survey Area, one of which crosses the landfall section (Figure 13.3).

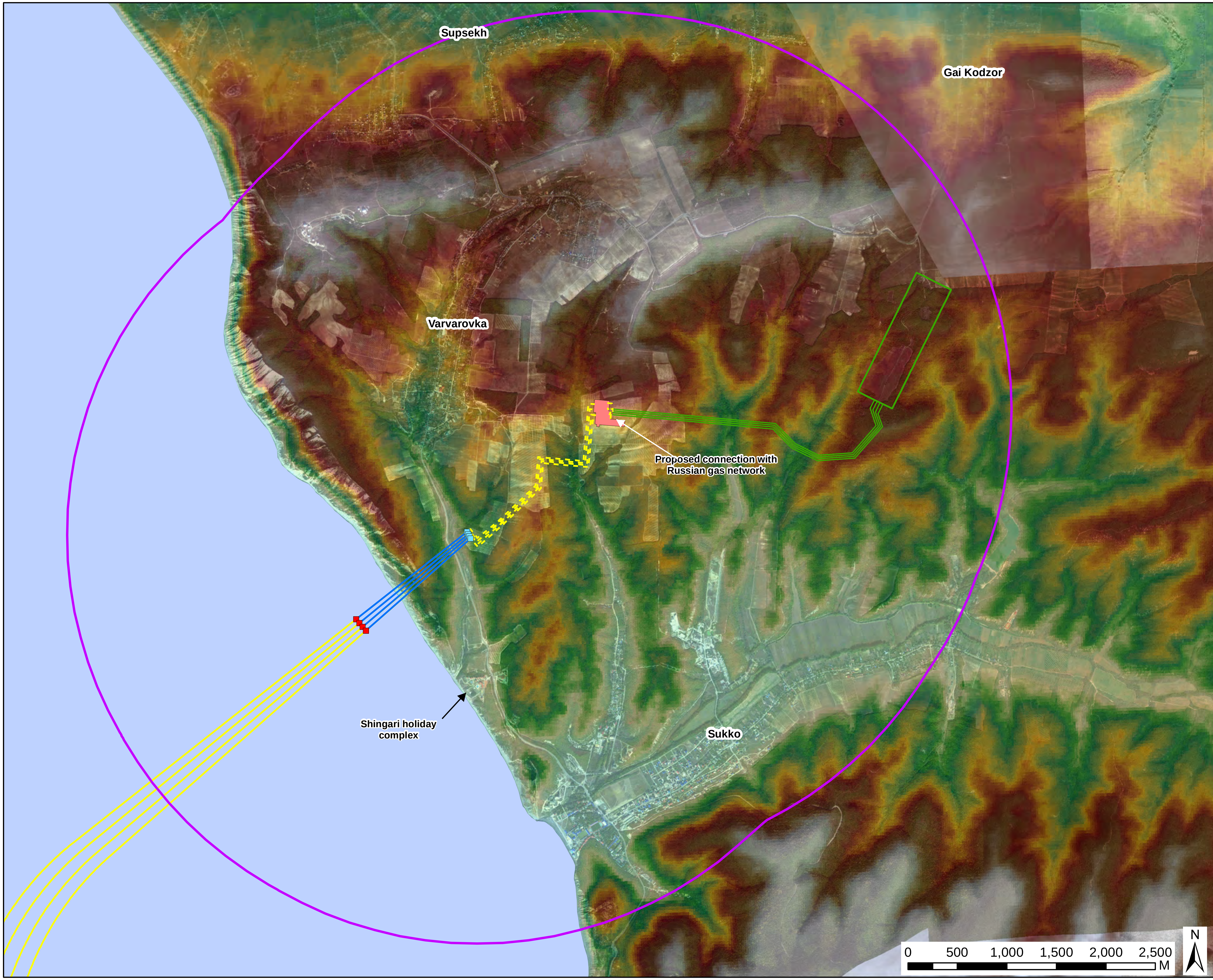
13.5.2.4 Settlements

The landfall section of the Project is located approximately 10 km southeast of Anapa. With the exception of Anapa, the surrounding area is largely rural and typified by small to medium-sized settlements near the landfall section, set amongst rolling hills behind the cliffs on the shore of the Black Sea. The term ‘settlements’ is used here to represent the geographical features and not the communities which live within them, descriptions of the communities within these settlements can be found in **Chapter 14 Socio-Economics**.

The two main settlements within the Survey Area are Varvarovka and Sukko. The southern edge of Supsekh also falls within the Survey Area to the north but is visually separated by the intervening topography; the small settlement of Gai Kodzor is located just outside of the Survey Area, to the northeast (Figure 13.3).

The nearest main settlement to the landfall section is Varvarovka; a town with a population of approximately 2,300, typified by its built form and infrastructure being spread along the well-treed hill which slopes through the settlement. The settlement pattern of Varvarovka is predominantly linear, formed between high undulating ridges to the east and west, low-lying to the south and elevated to the north, with the main road forming the central axis for development.

The nearest existing buildings are located approximately 800 m north of the proposed microtunnel entry points; however, “Lesnaya Polyana” - the Clearing in the Woods – a proposed extension to Varvarovka, which is located approximately 500 m to the north-west, is currently under construction although no structures have yet been built on the property. In the north-eastern area of Varvarovka there are several elevated modern properties with long distance panoramic views across the adjoining landscape to the south, east and west. To the east of Varvarovka is the location of the proposed ‘Chateau’ residential development. Varvarovka consists of two main streets (one sealed) connected by a number of dirt roads, most houses being single- or two-storey detached structures arranged along the hill which slopes through the town. Varvarovka has a number of amenities such as a nursery and a general school, a community centre and a sports centre along with a few small shops. The Kavkaz Winery, a grape producer and wine maker, is located on the main sealed road. Varvarovka is also the headquarters of Briz, one of two small commercial fishing organisations in the Anapa area. There is a Russian Orthodox and Armenian cemetery located on the edge of the settlement (Figure 13.3), from which there are wide spreading panoramic long distance views which include parts of the landfall section.



LEGEND

4km survey area

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Landfall facilities
- Proposed microtunnels
- Proposed offshore pipelines
- Microtunnel entry shaft
- Microtunnel exit pit

United Gas Supply System

- Russkaya compressor station
- United Gas Supply System pipelines

Elevation (m)

High : 736

Low : -1

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: For Information

Client: South Stream Offshore Pipeline — Stream ENERGISING EUROPE

Project Title: SOUTH STREAM OFFSHORE PIPELINE

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Rev

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Residential properties on the northern outskirts of the town of Sukko are located 2 km southeast of the landfall section, with the intervening land consisting of dense woodland. Sukko is a town with a population of approximately 1,700 organised along a single, long road that runs through the middle of the town with the western end leading to the beach, which is the main, easily accessible public beach between the town of Anapa and the state nature reserve “Utrish”. The development is also broadly linear restrained by the Sukko River to the north and therefore lies on the southern valley side. Sukko has a kindergarten, a sports centre and a health-care facility, as well as many restaurants, shops and kiosks catering for visiting tourists. Many of the buildings are four to five storeys high and appear to be hotels. Most other buildings are one to two storey detached houses, similar to those found in Varvarovka. Next to the public beach, Sukko also has a children’s holiday camp, called Smena or ‘Time Off’, which is well known in the area.

13.5.2.5 Protected Areas

An overview of policy relevant to the Project is provided in **Chapter 2 Policy, Regulatory and Administrative Framework**. The following Krasnodar Krai legislation is, however, relevant to landscape aspects of the Project. These allocations are not statutory designations and furthermore, are not based on the protection of landscape character or visual amenity specifically.

Utrish Nature Reserve

Federal law ‘On Specially Protected Natural Areas’ 14.03.1995, No. 33-FZ establishes a system of specially protected natural areas, specifies conditions of their use and protection of natural resources (Figure 13.2). The protected area ‘Utrish’ is located approximately 4 km southeast of the landfall section of the Project. The establishment of state nature reserve “Utrish” is required for the preservation of ancient Mediterranean ecosystems, their biota and landscapes. The establishment of the nature reserve is considered to be the only appropriate measure to stop the destruction of the Mediterranean landscapes, in particular flora and fauna, resulting from the haphazard development of recreational facilities. These woodland areas provide functions including habitat formation, water conservation, soil protection and erosion control value (Ref. 13.1). Whilst this protection is predominantly ecological based, the reserve and the associated flora and fauna contribute to the landscape character of the Survey Area and it is therefore considered further in this assessment.

Sanitary Protection Area of Anapa

The Resort Town of Anapa (see Figure 13.2) was assigned the status of a federal resort by President Decree No. 1954 dated 22 September 1994. It was given this status due to its recreational value as a ‘health improving’ (spa) resort area.

Although the Project does not fall within any part of the Sanitary Protection Area, the Survey Area does contain the sanitary protection area of Anapa exclusion zones, limitation zones and monitored zones (refer to Figure 13.3 for locations, and **Chapter 2 Policy Regulatory and Administrative Framework** for further detail on these zones), the quality of the environment within this area attracts high visitor numbers and as such it is considered sensitive to changes in views and landscape character. Due to the relative close proximity to the Project and potential for views of vessels along sea delivery routes, it is considered relevant to this chapter.

13.5.2.6 Tourism

Anapa is an area recognised for its importance for tourism (it was formalised by a presidential decree in 1994 and Russian Government Executive Order in 1996, No. 591-p.) the main resort is located 10 km to the north of the microtunnel entry points.

Tourism is also well established in Sukko and marine activities include recreational scuba diving, yachting, paragliding, recreational fishing, ferries and beach activities.

Shingari holiday complex and Don holiday complex are located approximately 1.3 km south of the microtunnel entry points (the closest element of the Project to these tourist areas), built on the cliff-top with a private beach accessible by stairs from the former, and by a path from the latter. For further information about these complexes, refer to **Chapter 14 Socio-Economics**.

13.5.2.7 Roads and Paths

The main Varvarovka-Sukko road and the coastal path along the cliff top, running approximately parallel with the coast in a north to south alignment, both cross the landfall section (Figure 13.3). There are numerous other unsealed (dirt) tracks along field boundaries associated with agricultural access.

The settlements of Rassvet, Gai Kodzor and Varvarovka are located in close proximity to the proposed access roads between the M25 and the landfall section (Figure 13.2). These settlements are connected by sealed (hard surfaced) roads. Within the Survey Area, the majority of other roads and access points are unsealed (dirt tracks). Within this Chapter, consideration is given to Project-related traffic from the M25 junction at Rassvet and along the access routes towards the construction sites. Where Project-related traffic uses the major existing highway network (from the M25 junction and beyond) it is not considered relevant to potential landscape character and visual amenity impacts within this assessment.

13.5.2.8 Offshore and Nearshore Activities

Passengers and crew on commercial shipping and fishing boats are the closest receptors in Russian coastal waters to the offshore and nearshore areas.

Tourism is well established in Anapa and Sukko where water-based activities, principally during summer months, include recreational scuba diving, yachting, water-skiing and passenger / tourist transport (including ferries) close to the shorelines of these towns. Beach users and recreational fishing would also gain views of the offshore and nearshore areas.

13.5.3 Landscape and Seascape Character

Landscape and seascape character assessments are used to assist in understanding and articulating the character of the landscape. It helps to identify the features that give a locality its sense of place and elements that contribute to the landscapes distinctiveness, to make it different from neighbouring areas.

Landscape is defined as an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors (Ref. 13.2). Seascape is used to indicate landscapes with views of the coast or seas, and coasts and the adjacent marine environment.

Landscapes and seascapes are experienced as a combination of elements (physical features and perceptual qualities) and which are ascribed value by human receptors. Typical landscape components include landform, land cover and land use. The aesthetic and perceptual aspects of the landscape and seascape include such aspects as scale, openness / enclosure, form, pattern, unity, colour, movement etc.

Landscape and seascape resources in the Survey Area have been classified into landscape character areas (LCA) and seascape character areas (SCA) and are categorised according to sensitivity, determined essentially by the quality and value of the LCA / SCA, and its ability to accommodate change.

The majority of the onshore part of the Survey Area is covered with mixed native forest and interspersed with varying amounts of open ground. No published assessments have been identified within the secondary data which characterise the landscapes or seascapes within the entire Study Area, as such, and therefore for the purpose of this assessment, the following LCA and SCA have been defined in line with the Guidance on Landscape Character Assessment (Ref. 13.3), namely:

- Undulating Plateau LCA; and
- Black Sea Coastal SCA.

These are shown on Figure 13.5. Also shown on Figure 13.5are the urban areas of Supsekh, Varvarovka and Sukko (photograph viewpoint 8 in Section 13.5.4.3), which are separate from their surrounding LCA, exhibiting different characteristics, development, resources and setting. They are too extensive to be accommodated as features within that LCA and are therefore excluded from the character assessment. Both the LCA and the SCA comprise constituent character types, as described below. These correspond with the habitat types described in **Chapter 11 Terrestrial Ecology**.

13.5.3.1 Undulating Plateau LCA

The Undulating Plateau LCA, being the rolling, extensively wooded, rural landscape extending inland away from the coast, comprises three main character types (photograph viewpoint 6 and as shown in **Chapter 11 Terrestrial Ecology**), as follows:

- **Forest** – typically characteristic of Krasnodar Krai, undersized, arid woodland known as shiblyak, being diverse in structure and floristically rich;
- **Wooded valleys** – linear relief depressions created by the watercourses and intermittent waterways, chiefly wooded (mesophilic forest) but interspersed with open areas (mesophilic meadow); and
- **Cultivated land** – open vineyards, orchards and meadows (steppefied secondary meadows); some herbaceous vegetation typical of colonised disturbed ground (Photograph viewpoints 2a, 4, 5b and 7 in Section 13.5.4.3).

13.5.3.2 Black Sea Coastal SCA

The Black Sea Coastal SCA, being the open sea and the line of landscape along the Black Sea coast made up of a combination of characteristically coastal geomorphology and vegetation, typically shoreline and cliffs, comprises three main character types, (refer to photograph viewpoints 1c and 2b in Section 13.5.4.3 and in **Chapter 11 Terrestrial Ecology**), as follows:

- **Coastal slope** – steep earth banks with primarily juniper woodland and some scrub (tomillyar), steepening at several points to become rocky outcrops and high coastal cliffs. The slope is interrupted in places where watercourses discharge into the sea, for example the Sukko River. Elevated views out over the sea are a key feature contributing to the character of this type (photograph viewpoints 1a-c and 2b in Section 13.5.4.3);
- **Shoreline** – gravel beach and rocky outcrops along the seashore (photograph viewpoint 1c in Section 13.5.4.3); and
- **Open sea** – extending beyond the Survey Area to the horizon. The open sea comprises the open water beyond the shoreline with its expansive skies and light conditions constantly changing with the season, time of day and weather. The water can be flat calm on still days and constantly moving on windy days, with the sound and motion of waves greatly adding to its drama. The sea is crisscrossed by shipping lanes (refer to Figure 13.1), so at times vessels form temporary features within the otherwise empty seascape and during the summer, pleasure craft are present.

13.5.4 Visual Amenity

Existing views within the Survey Area are comprised mainly of open gently undulating landscapes, with panoramic views across the woodland canopies and fields, and vast open flat panoramic views of the Black Sea. The sequential views, such as those experienced by road users, vary from open to restricted views caused by the intervening hills and woodlands. Within urban locations views are more restricted by buildings and only elevated residences gain long distance views. Key visual elements are formed of the brightly coloured built form within the settlements, the seasonal bare earth on agricultural fields, and the elevated extent of the northern ridge beyond Varvarovka and along the North-Western coast.

13.5.4.1 Zone of Theoretical Visibility

Visual receptors have been identified through a combination of computer-generated ZTV models and assessment work in the field. Individual receptors within the ZTV are categorised into receptor groups and assigned sensitivity, relating primarily to the receptors’ activities and value of existing view.

A series of ZTVs have been defined to demonstrate a range of scenarios, as illustrated in the following figures:

- Figure 13.6 Offshore Construction – areas on land where offshore Pipeline construction work could theoretically be visible (generated using data points along the offshore Pipeline route at sea level;

- Figure 13.7 Landfall Section – areas on land and sea where the landfall section could theoretically be visible (generated using data points along the onshore Pipeline route at ground level); and
- Figure 13.8 Landfall Facilities – areas on land where the landfall facilities could theoretically be visible (generated using a 30 m high data point at the location of the proposed vent stack to provide a worse-case scenario; however a height of 21 m has now been confirmed for the vent stack – refer to **Chapter 5 Project Description** – and would produce a slightly reduced ZTV).

On-site field reconnaissance survey work undertaken to validate the ZTVs has identified that, because the landfall section is in a dip enclosed by woodland, it is substantially screened from dwellings within the Survey Area, including most parts of Varvarovka and Sukko. However, the landfall section is partially visible from upper storeys of some properties in Sukko, notably on the north-facing slope on the south-eastern side of the town, and from “Lesnaya Polyana”, the extension of Varvarovka currently under construction.

For the most part, residents would be unable to see any of the proposed landfall facilities, as potential views are screened by the surrounding topography and woodland.

The landfall section is visible from the Russian Orthodox and Armenian cemetery on the eastern edge of Varvarovka and from the coastal path which crosses the landfall section. The number of users is likely to vary depending on weather conditions and time of year.

There are also views towards the landfall section from the Varvarovka-Sukko road, which crosses above the microtunnels in the landfall section, and depending on the height of the proposed facilities at the microtunnel entry points, they would be likely to be visible from the road.

Elsewhere, the proposed landfall section is only visible from the tops of the ridges in the surrounding landscape, where, with the exception of agricultural workers, no visual receptors are present because, as far as it has been possible to ascertain, there are no formal public footpaths. However, this situation is considered to be different during summer months when recreational activities, such as horse riding take place across private land and in the vicinity of the coast.

Views of the nearshore and offshore sections are possible from pleasure craft, passenger ferries and commercial vessels, as well as the coast path and much of the coastline.

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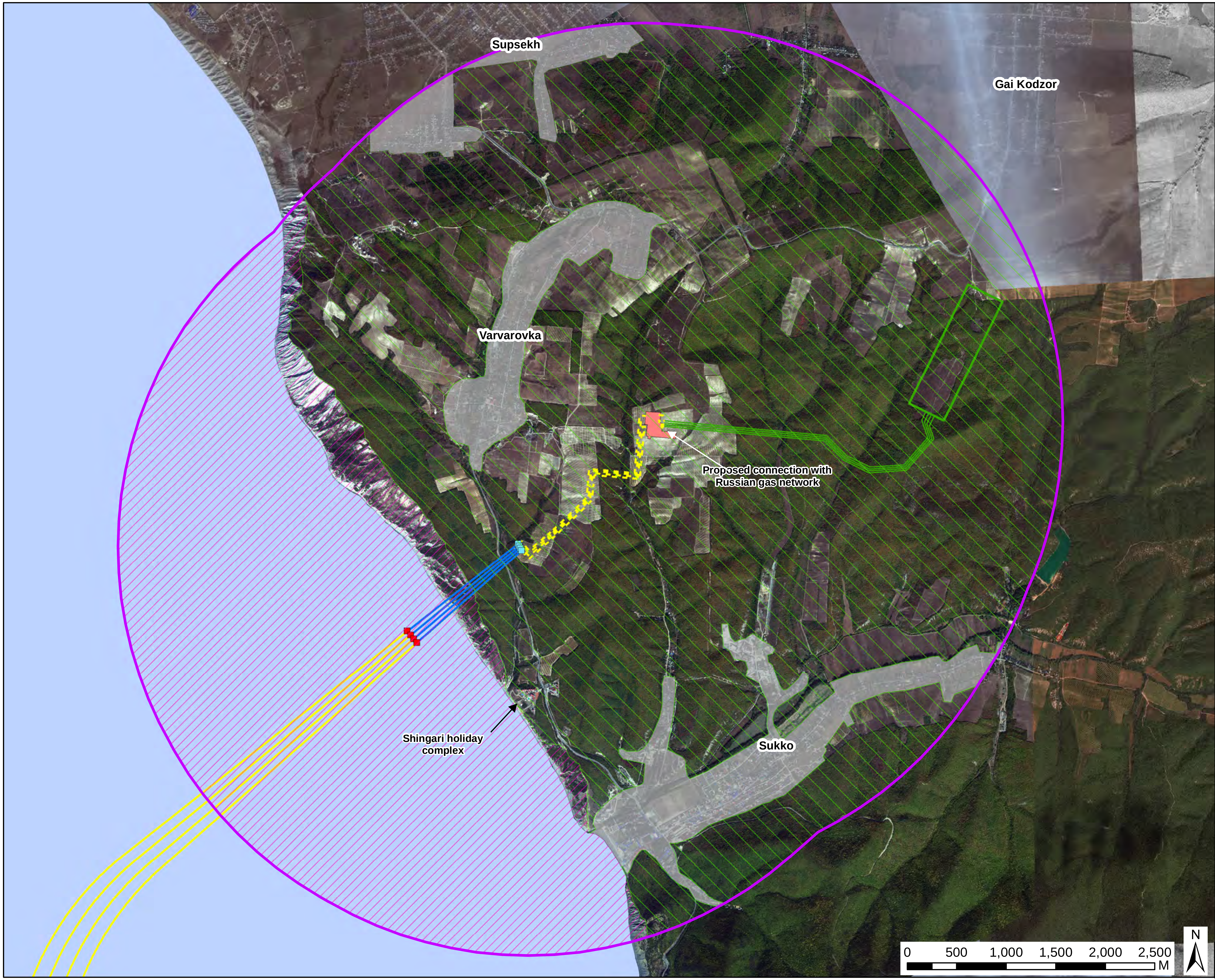

LEGEND

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Landfall facilities
- Proposed microtunnels
- Proposed offshore pipelines
- Microtunnel entry shaft
- Microtunnel exit pit
- 4km survey area
- Black Sea Coastal seascape character area
- Undulating Plateau landscape character area
- Urban area

United Gas Supply System

- Russkaya compressor station
- United Gas Supply System pipelines

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: For Information

Client: South Stream Offshore Pipeline — Energising Europe

Project Title: SOUTH STREAM OFFSHORE PIPELINE

Drawing Title: LANDSCAPE AND SEASCAPE CHARACTER AREAS

Drawn	Checked	Approved	Date
DH	RW	MW	06/11/13

URS Internal Project No.	Scale @ A3
46369082	1:35,000

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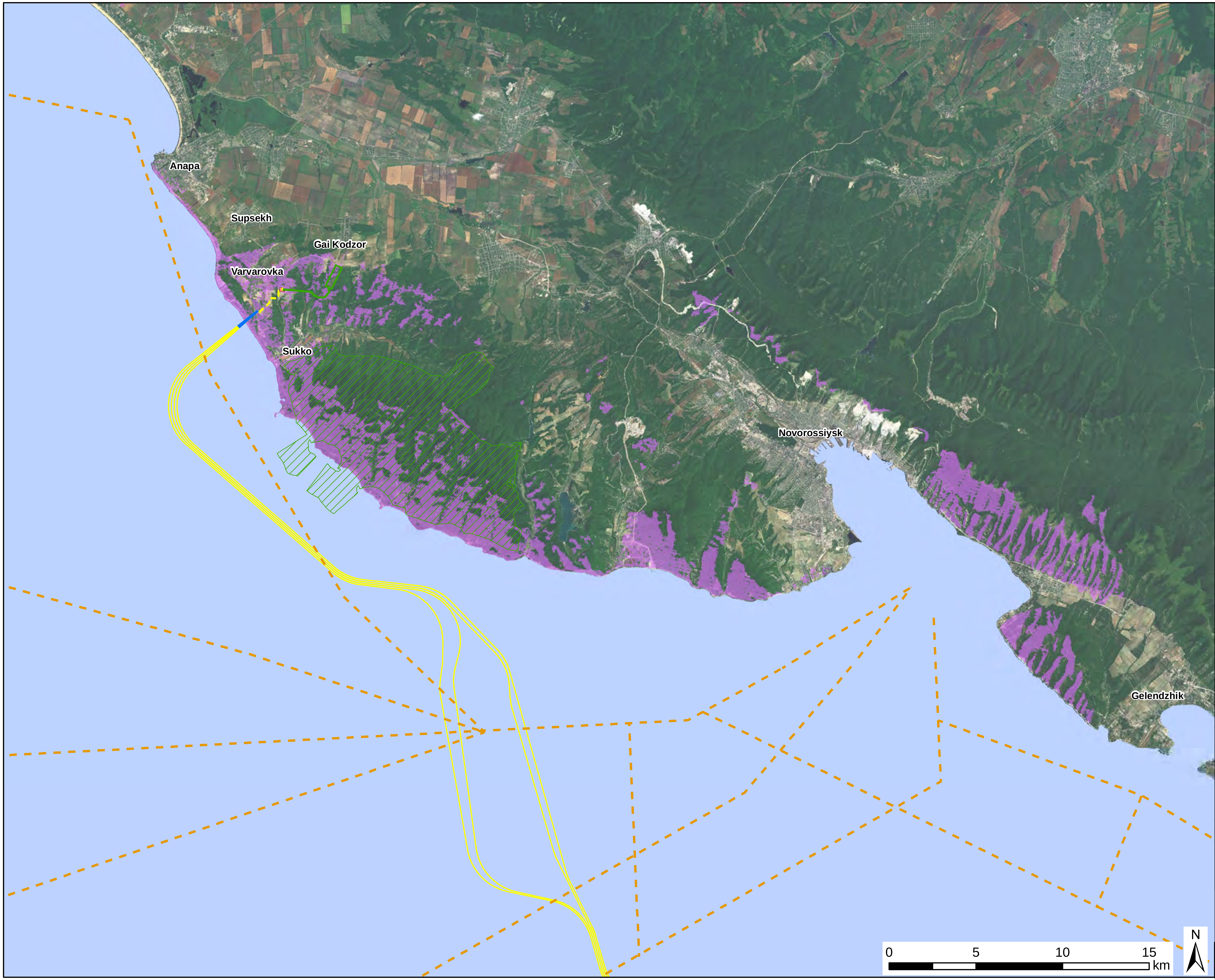
Drawing Number: Figure 13.5

Rev

Plot Date: 06 Nov 2013
File Name: I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA\Chapter 13 Landscape\Figure 13.5 Landscape and seascape character areas.mxd



LEGEND

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Landfall facilities
- Proposed microtunnels
- Proposed offshore pipelines
- Areas where offshore pipeline works could be visible
- Shipping lanes (current)
- Boundary of the state nature reserve "Utrish"

United Gas Supply System

- Russkaya compressor station
- United Gas Supply System pipelines

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: For Information

Client: South Stream Offshore Pipeline — Stream ENERGISING EUROPE

Project Title: SOUTH STREAM OFFSHORE PIPELINE

Drawing Title: ZONE OF THEORETICAL VISIBILITY - OFFSHORE CONSTRUCTION

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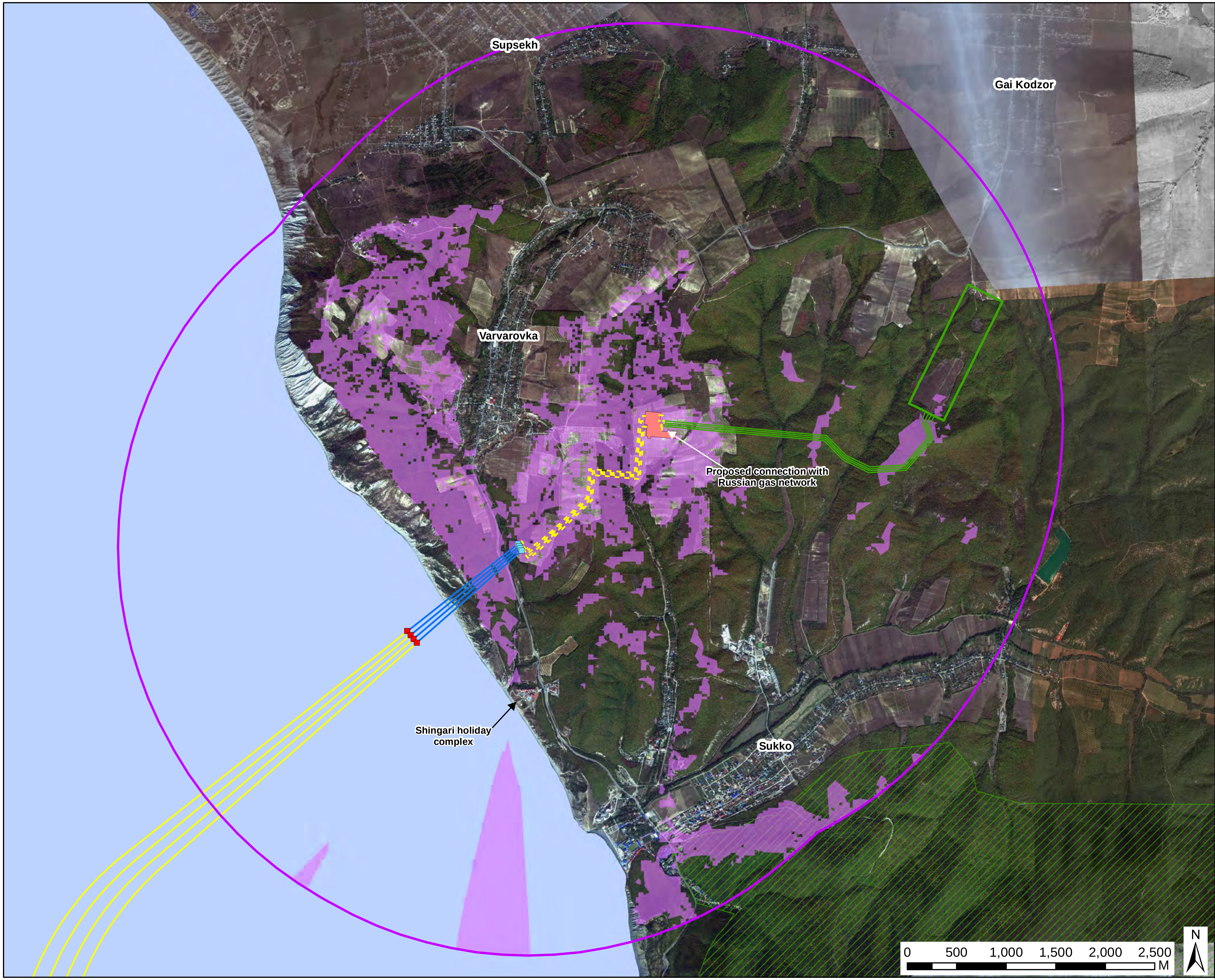

LEGEND

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Landfall facilities
- Proposed microtunnels
- Proposed offshore pipelines
- Microtunnel entry shaft
- Microtunnel exit pit
- 4km survey area
- Areas where landfall section could be visible
- Boundary of the state nature reserve "Utrish"

United Gas Supply System

- Russkaya compressor station
- United Gas Supply System pipelines

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check / Date	Suffix

Purpose of Issue: For Information

Client: South Stream Offshore Pipeline — Energising Europe

Project Title: SOUTH STREAM OFFSHORE PIPELINE

Drawing Title: ZONE OF THEORETICAL VISIBILITY - LANDFALL SECTION

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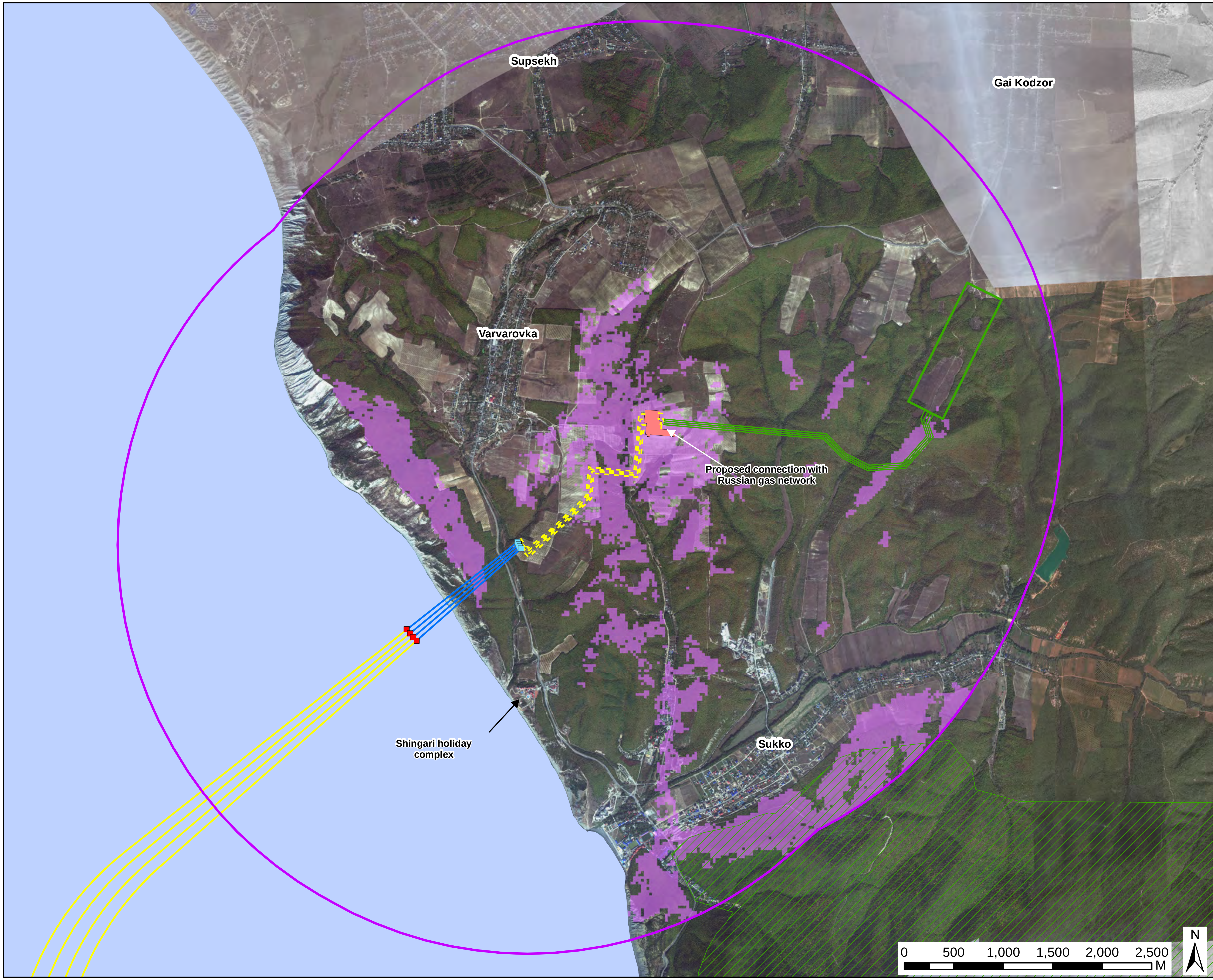
Drawing Number: Figure 13.7

Rev

Plot Date: 06 Nov 2013
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA\Chapter 13 Landscape\Figure 13.7 Zone of Theoretical Visibility - Landfall Section.mxd



LEGEND

- Areas where proposed landfall facilities could be visible
- 4 km survey area

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Landfall facilities
- Proposed microtunnels
- Proposed offshore pipelines
- Microtunnel entry shaft
- Microtunnel exit pit
- Boundary of the state nature reserve "Utrish"

United Gas Supply System

- Russkaya compressor station
- United Gas Supply System pipelines

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: For Information

Client: South Stream Offshore Pipeline — South Stream Energising Europe

Project Title: SOUTH STREAM OFFSHORE PIPELINE

Drawing Title: ZONE OF THEORETICAL VISIBILITY – LANDFALL FACILITIES

Drawn	Checked	Approved	Date
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Drawing Number: Figure 13.8

Rev

Plot Date: 06 Nov 2013
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA\Chapter 13 Landscape\Figure 13.8 Zone of Theoretical Visibility - Landfall Facilities.mxd

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13.5.4.2 Visual Receptor Groups

Within the Survey Area, potential visual receptor groups and their distance to the Project have been identified and are listed in Table 13.2. A number of locations have been selected to illustrate typical views for the majority of the receptor groups, referred to as representative viewpoints; these locations are shown on Figure 13.9. Photographs taken from the representative viewpoints showing views for the receptor groups are shown in Section 13.5.4.3. It is noted that all of the viewpoint locations are publicly accessible, with one exception; one photograph has been taken from private property under construction - Viewpoint 8 in Sukko.

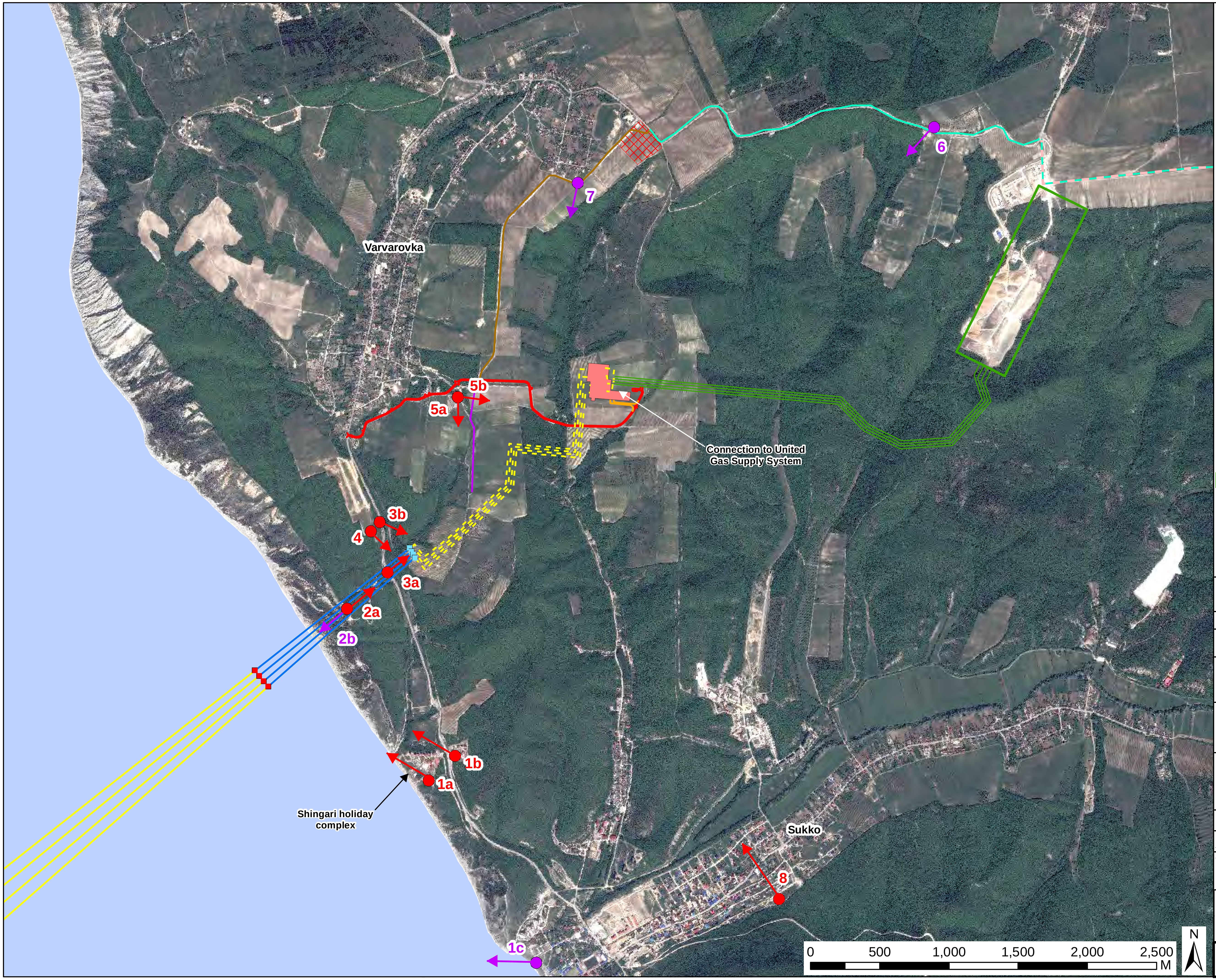
Table 13.2 Visual Receptor Groups

Representative Viewpoint Photographs	Approximate Distance to the Project (m)	Receptor Group
1a, 1b 1c	1360 1460 2820	Recreational visitors to the seashore, including the public beaches at Sukko and Anapa, and the private beach at the Shingari and Don holiday complexes.
2a 2b	630 800	Walkers (including recreational users e.g. horse-riders) on the coastal path along the cliff top.
3a 3b	230 290	Travellers on the Varvarovka-Sukko road.
4	300	Potential residents of “Lesnaya Polyana” the Clearing in the Woods development currently under construction.
5a 5b	500 500	Visitors to the Russian Orthodox and Armenian cemetery at Varvarovka.
6	2940	Travellers on the Varvarovka to Gai Kodzor road
7	1310	Residents living at North-East Varvarovka
8	3800	Residents living at Sukko.
2a, 4, 5a, 5b, 6 and 8	Varies	Agricultural workers on the land.
No Representative Viewpoint	Approximately 4 km	Visitors (only permitted under government license) to state nature reserve “Utrish”.

Continued...

Representative Viewpoint Photographs	Approximate Distance to the Project (m)	Receptor Group
No Representative Viewpoint	Varies	Recreational boat users.
No Representative Viewpoint	Varies	Residents living close to the access roads (passing through or around Rassvet, Gai Kodzor, and Varvarovka).

Complete.



LEGEND

- Representative viewpoint locations and direction of view – no photomontage
- Representative viewpoint locations and direction of view – with photomontage

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Landfall facilities
- Proposed microtunnels
- Proposed offshore pipelines
- Microtunnel entry shaft
- Microtunnel exit pit
- Proposed delivery route from Ports
- Permanent access road to be constructed by SSTTBV
- Temporary access road to be constructed by SSTTBV
- Varvarovka bypass road (used by Project during construction only)
- Gazprom Invest temporary bypass road to be utilised by SSTTBV
- Transfer site

United Gas Supply System

- Russkaya compressor station
- United Gas Supply System pipelines
- Permanent access road to be constructed by Gazprom Invest

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue
For Information

Client
South Stream Offshore Pipeline ENERGISING EUROPE

Project Title
SOUTH STREAM OFFSHORE PIPELINE

Drawing Title
REPRESENTATIVE VIEWPOINT LOCATIONS

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BB	RW	MW	18/02/14

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Figure 13.9	A

Plot Date: 18 Feb 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 13 Landscape\Figure 13-9 Representative Viewpoint Locations.mxd

13.5.4.3 Viewpoint Photographs

Viewpoint location photographs for the majority of representative receptor groups are set out below. For scaled viewpoint photographs, refer to Appendix 13.1: Photographs. The Project phases during which Project activities or structures will be visible from these viewpoints are detailed in Table 13.8.

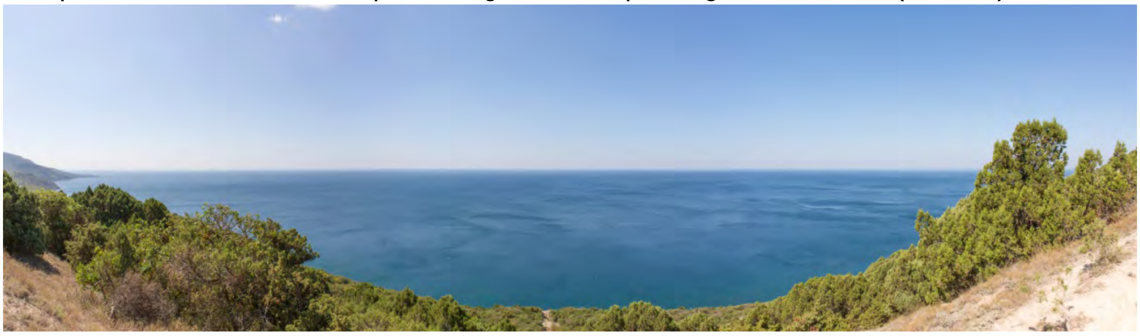
Viewpoint 1a: from Shingari Holiday complex (Recreational Visitors)

Viewpoint 1b: from Don Holiday Complex (Recreational Visitors)

Viewpoint 1c: from Sukko Beach (Recreational visitors)

Viewpoint 2a: from the coastal path along the cliff top facing inland (Walkers)

Viewpoint 2b: from the coastal path along the cliff top facing the Black Sea (Walkers)



Viewpoint 3a: from the Varvarovka-Sukko road (Travellers)

Viewpoint 3b: from the Varvarovka-Sukko road near “Lesnaya Polyana” (Travellers)

Viewpoint 4: from the Clearing in the Woods “Lesnaya Polyana” development (Future Residents)

Viewpoint 5a: from the Russian Orthodox and Armenian cemetery at Varvarovka facing South (Recreational Visitors)

Viewpoint 5b: from the Russian Orthodox and Armenian cemetery at Varvarovka facing East (Recreational Visitors)

Viewpoint 6: from the Varvarovka to Gai Kodzor road (Travellers)

Viewpoint 7: from North-East Varvarovka (Residents)

Viewpoint 8: from Southern hills of Sukko (Residents)

13.5.4.4 Access Roads

The proposed access roads used to transport materials, machinery and workforce on and off the construction sites to existing major road network are shown in Figure 13.2 and Figure 13.3. These routes are proposed mostly along existing roads and tracks, with some areas using the routes of minor, currently unsealed, roadways. The location of the access roads pass in proximity to a number of small residential areas. In these areas some residential properties gain views across these roads and to the open landscape beyond. However, the vast majority of these routes are on roads passing through the extensive agricultural land and adjacent to woodland areas where receptors are limited to agricultural and forestry workers as shown in Figure 13.9.

13.5.5 Baseline Summary

13.5.5.1 Landscape and Seascape Character

Within the Survey Area, one LCA and one SCA have been identified. The Undulating Plateau LCA comprises the rolling, extensively wooded, rural landscape extending inland away from the coast, made up of three main character types, namely forest, wooded valleys and cultivated land. The Black Sea Coastal SCA comprises the open sea and the line of characteristically coastal geomorphology and vegetation along the Black Sea coast, made up of two main character types, namely coastal slope and shoreline.

The landfall facilities are proposed across predominantly cultivated agricultural land and a small section of wooded valley within the Undulating Plateau LCA. The Eastern section of the microtunnelled pipelines is beneath the wooded sloping landscape which backs on to the coastal slopes of the Black Sea Coastal SCA. The microtunnelled pipelines emerge below sea level and therefore impacts on this character area are likely to be limited to periods during the Construction and Pre-Commissioning Phase only; this applies to the microtunnelled section of the pipelines within the LCA also.

The distinctive linear patterned vegetation and seasonally changing appearance of the agricultural fields would provide opportunity to tolerate change such as temporary removal of vegetation cover and excavation during construction, and the undulating nature of the topography provides opportunity to tolerate and conceal localised development, such as spoil storage and site plant, without degrading the overall character of the LCA. This tolerance and lack of susceptibility to change of the type proposed by the Project is important to note and is discussed further in the impact assessment section of this chapter.

13.5.5.2 Visual Amenity

Within the Survey Area, a number of receptor groups with potential to experience an impact on their visual amenity have been identified (as listed in Table 13.2). Within this list, residential receptors include people living at Sukko and Varvarovka, potential residents of "Lesnaya Polyana" the development currently under construction south of Varvarovka, and residents living close to the access roads. Recreational receptors comprise visitors to the seashore, including the public beaches at Sukko and Anapa, and the private beach at the Shingari and Don holiday complexes, walkers on the coastal path, visitors (only permitted under Government license) to state nature reserve “Utrish” and recreational boat users. Other receptors whose visual amenity could potentially be affected are visitors to the Russian Orthodox and Armenian cemetery at Varvarovka, travellers on the Varvarovka-Sukko and Varvarovka-Gai Kodzor roads, and agricultural workers on the land.

Due to the largely rural nature of the landscape in the Survey Area the number of potential receptor groups is relatively low. Relative numbers of visual receptors is accepted to vary greatly dependent upon seasons, with tourists visiting during summer months experiencing a shorter duration of exposure to views than permanent residents. Furthermore, it is noted that the tourist receptors are likely to be experiencing views during summer months when vegetation is in leaf and more effective at filtering views.

As noted above for the baseline character summary, the undulating topography of the Survey Area provides opportunities for concealed pockets of development to be carried out without potential views being impacted. This is a benefit of the location of the Project and is discussed further in the impact assessment section of this chapter.

13.6 Impact Assessment

This section presents and discusses the impact of the Project on landscape and visual receptors (see Sections 13.5.3 and 13.5.4). The approach to the impact assessment is based on the Guidelines for Landscape and Visual Impact Assessment (Ref. 13.4) and is outlined below:

- The magnitude of potential impacts is described as high, moderate, low or negligible based on criteria shown in Table 13.3 and Table 13.5;
- The sensitivity of each landscape and visual receptor was then classified as either: high, moderate or low based on pre-defined criteria shown in Table 13.4 and Table 13.6;
- The principal sources of potential significant effects associated with the Project are then described;
- The likely pre-mitigation impact significance (**High**, **Moderate**, **Low** or **Not Significant**) are assessed, and where possible quantified;
- Mitigation measures to avoid or reduce any **Moderate** or **High** category (significant) impacts are then developed in conjunction with other elements of the design (including mitigation for other environmental disciplines);
- The residual effects of the Project (i.e. the remaining effects taking account of proposed mitigation measures) are reported;
- Cumulative impacts of the Project in relation to other developments in the proximity of the Project Area are described and assessed in **Chapter 20 Cumulative Impact Assessment**; and
- Further consideration is then also given with regard to unplanned events; refer to **Chapter 19 Unplanned Events** for further detail.

Refer to **Chapter 3 Impact Assessment Methodology** for details of the methodology applicable throughout this ESIA Report. This includes the matrix used for determining the level of significance. Impacts with a significance ranking of **Moderate** or **High** are considered to be

'Significant Impacts'. Effects can result directly from the development itself or as a consequence of the development, in the form of indirect or secondary effects, such as traffic on surrounding roads. As noted in **Chapter 5 Project Description**, the assessment is made for three phases of the Project: Construction and Pre-Commissioning, Operational (including Commissioning) and Decommissioning; the duration of these phases is also outlined in that chapter.

13.6.1 Impact Assessment Methodology

This section discusses the methodology used to assess potential impacts associated with the Project on the existing baseline conditions described in Section 13.5.

13.6.1.1 Impact Assessment Criteria

Criteria for Landscape and Seascape Character Impacts

Impact Magnitude

Impact magnitude criteria were developed based on the recognised Good International Industry Practise (GIIP) guidance document Landscape Character Assessment Guidance for England and Scotland (Ref. 13.3). These are summarised in Table 13.3. As detailed in **Chapter 3 Impact Assessment Methodology**, the impact magnitude is considered to be a function of extent, duration, frequency and reversibility; where possible these aspects have been considered in the development of the LVIA criteria. The Guidelines for Landscape and Visual Impact Assessment (Ref. 13.4) also notes the criteria for impact magnitude should consider scale, extent and duration or reversibility. It is noted, however, that some of these criteria are subjective in terms of LVIA and professional judgement in assigning impact magnitude ratings in considered a key part of the LVIA process.

Table 13.3 Impact Magnitude – Landscape and Seascape Character

Magnitude	Description
High	Ranging from a limited change in landscape and seascape characteristics over an extensive geographical area, to an intensive or pronounced change over a more limited area. Impact is more likely to be high if change is long-term or permanent.
Moderate	Moderate change in a localised area (e.g. limited woodland clearance without compromising the overall integrity of the wider woodland area). Could include high impact change of a short-term or temporary nature.
Low	Minor change in scale and geographical extent (e.g. loss of small areas of vegetation or indirect impact resulting from intervisibility with development in adjoining character type). Impact is more likely to be low if change is short-term or temporary.
Negligible	Virtually imperceptible change to the baseline context.

Receptor Sensitivity

The sensitivity of a receptor is both a reflection of how robust (resilient or vulnerable) it is to a change in baseline conditions, as well as a description of the value ascribed to the affected landscape.

The existing landscape and seascape can be assessed in terms of the number and type of discrete landscape and seascape character areas that comprise the overall setting. The criteria for evaluating sensitivity of character areas include their susceptibility to the proposed development specifically, and the value attached to the landscape in general; these are summarised in Table 13.4. These criteria have been developed based upon the recognised GIIP guidance document, Landscape Character Assessment Guidance for England and Scotland (Ref. 13.3).

Table 13.4 Receptor Sensitivity – Landscape and Seascape Character

Sensitivity	Description
High	Landscape of distinctive components and characteristics, or a relatively undisturbed, pristine landscape, where changes or disruptions to the existing landscape would be noticeable and difficult to mitigate or restore; a small change is likely to be prominent or even dominant; a change to the landscape could alter the classification and integrity of the landscape character or quality and its perceived value relative to the scale and openness.
Moderate	Landscape of relatively widespread, featureless, common components and characteristics, able to tolerate some changes or modifications without altering the classification of landscape character or quality. Landscape lacking in structural landform would also be considered of medium sensitivity.
Low	Landscape of relatively indiscernible components and characteristics, the nature of which is likely to be tolerant of substantial change, where modifications are unlikely to alter its character or quality classification. Landscape of poor condition, and low perceived value relative to their scale and form. Where a landscape holds a high potential for mitigation it would also be considered to be of low sensitivity.
Negligible	N/A – it is not considered appropriate to include this category since no landscape is considered so unimportant that it may safely be disregarded.

Criteria for Visual Amenity Impacts

Impact Magnitude

Based on the Guidelines for Landscape and Visual Impact Assessment (Ref. 13.4) a series of visual impact magnitude category definitions were developed. These are detailed in. Table 13.5. As with landscape impact magnitude elements of extent, duration, frequency and reversibility have been considered in the development of the LVIA criteria. However, it is noted that some of these characters are subjective in terms of LVIA and professional judgement in assigning impact magnitude ratings is considered a key part of the LVIA process.

Table 13.5 Impact Magnitude – Visual Amenity

Magnitude	Description
High	Extensive change to existing view, loss of key characteristic features; introduction of anomalous and highly prominent or dominant new elements. Impact is more likely to be high if change is long-term or permanent.
Moderate	Notable change to existing view (e.g. partial loss of key characteristic features); introduction of prominent, but essentially localised new features or elements; could include high impact change of a short-term or temporary nature.
Low	Minor change to existing view (e.g. limited loss of characteristic features), changes are evident, but not especially prominent and are generally localised impact is more likely to be low if change is short-term or temporary.
Negligible	Barely perceptible change to existing view and/or very brief exposure to view.

Receptor Sensitivity

Receptor sensitivity for visual amenity is a function of both the degree to which the receptor has an expectation of/or appreciation of a view or landscape, and the degree to which the receptor is physically able to access the view or landscape in question. The subjective criteria adopted have been defined in accordance with the Guidelines for Landscape and Visual Impact Assessment (Ref. 13.4) are detailed in Table 13.6. Visual amenity is defined in GIIP (Ref. 13.4) as "*the overall pleasantness of the views they enjoy of their surroundings*".

Table 13.6 Receptor Sensitivity – Visual Amenity

Sensitivity	Description
High	Receptors with a key interest and expectation of enjoying the view (e.g. residential receptors, tourists or people engaged in outdoor recreation whose attention is focused on the landscape) and/or a greatly valued existing view (e.g. a designated landscape, unspoilt countryside, recognised viewpoint or conservation area).
Moderate	Receptors at locations where the view is valued but not fundamental to the location or activity (e.g. people engaged in outdoor recreation that does not focus on an appreciation of the landscape). Visual receptors are less sensitive to changes to their view if the quality, condition and extent of the existing view is unexceptional (e.g. some high density suburban townscapes).

Continued...

Sensitivity	Description
Low	Receptors engaged in activities that either distract from the view or require concentration on the foreground, resulting in a minimal interest or appreciation of the view (e.g. people at work or motorists travelling through the area with the sole purpose of getting from one place to another and not for the specific enjoyment of the scenery). Receptors might very well appreciate the view if they chose to, but visual amenity is not the principal reason for them to be present. Visual receptors are less sensitive to changes to their view if the quality of the existing view is poor (e.g. industrial areas or derelict land).
Negligible	N/A – it is not considered appropriate to include this category since no visual receptor is considered so unimportant that it may safely be disregarded.

Complete.

13.6.1.2 Modelling Undertaken

Receptor Sensitivity

Landscape character sensitivity is primarily a function of how robust (resilient or vulnerable) the existing landscape resource is to a given change in baseline conditions. In contrast, visual amenity is a function of how important the specific views and the general visual amenity of the landscape is to individuals or user groups.

Landscape and Seascape Character

Landscape and seascape character areas (LCA and SCA) were identified within the Survey Area, namely:

- Undulating Plateau LCA; and
- Black Sea Coastal SCA.

With regard to the Undulating Plateau, this LCA comprises a deeply undulating, extensively wooded landscape, which is common and characteristic of large areas of the plateau. The woodland is interspersed with open, cultivated land. Woodland is slow to establish and is valued as a natural habitat, but conversely it is effective at 'absorbing' development. In conjunction with the landform and with careful site selection, the woodland has the potential to accommodate development. Additionally, the use of existing open areas provides opportunities to minimise the need for woodland clearance. As such, based upon the criteria within Table 13.4, it is considered that the Undulating Plateau LCA is a moderate sensitivity receptor.

In contrast, based upon the criteria in Table 13.4, the Black Sea Coastal SCA is considered to be a high sensitivity receptor. It contains a relatively contained, linear landscape, limited to the coastline. This is valued for its combination of wildness and long ranging and expansive, panoramic views of the coastline and open sea, where any change has the potential to be highly visible and also to cause the coastal landscape to become fragmented. The combination of steep slopes, cliffs, rocky outcrops, beach and maritime vegetation, fronting the Black Sea, is sensitive to relatively small changes. However, importantly the open expanse of the sea is interrupted by commercial shipping that regularly uses the Black Sea shipping lanes off the coast in the vicinity of the Project, and is therefore less sensitive to the introduction of the Project fleet (anticipated to be an average of three vessels at any one time, refer to **Chapter 5 Project Description**).

Visual Amenity

In order to establish potential visual receptors a series of ZTVs have been created using the tallest structure, i.e. the vent stack. The ZTVs were generated using ASTER 30 m resolution Digital Terrain Model (bare earth) and analysed using ESRI ArcGIS 3D Analyst to determine ZTV based on line of sight.

Visual receptors were identified as those within the modelled ZTVs (Figure 13.6 to Figure 13.8) and have been calculated based on landform only (i.e. without taking account of woodland or built-up areas) and therefore represent a worst case scenario. In the case of the landfall facilities, on the basis of the visibility of the 30 m high vent stack (as noted above, the actual proposed height of the vent stack is now 21 m). The modelling shows where any part of the stack could possibly be visible, even if it will be only the very top. As such, it is considered to be a highly conservative (i.e. worst case) estimate of the ZTV.

Table 13.7 describes the visual receptors within the ZTV and assesses the level of sensitivity of these receptors to changes in visual amenity in accordance with the criteria set out in Table 13.6. Viewpoint photographs are shown in Appendix 13.1.

Table 13.7 Sensitive Receptors within the ZTV

Receptor Group	Description of Receptor Group Views	Receptor sensitivity
Recreational visitors to the shore, including the public beaches at Sukko and Anapa, and the private beach at the Shingari and Don holiday complexes.	The area is popular for its unspoiled nature and attractive views of coastal scenery and the sea. People on the beaches have open views out to sea to the west, and of the varied coastline to north and south. Views of coastal scenery tend to be highly valued by both local people and visitors using the beach for recreational purposes. From the beaches at Anapa, Sukko, the Shingari and Don holiday complexes, and other parts of the coast around the Taman Peninsula, there are open views towards the nearshore / offshore sections and construction vessels would be visible. However, all construction vessels would be seen in the context of commercial vessels on the existing shipping lanes and current port-related activities. Potential views inland towards the landfall section are prevented by the intervening coastal landform and woodland. In accordance with the criteria set out in Table 13.6, these receptors are judged to have a key interest or appreciation of the view and greatly value the existing view, refer to Viewpoint Photographs 1a, 1b and 1c.	High
Walkers on the coastal path along the cliff top.	Visual amenity is likely to be an important aspect for people choosing to use the coastal path. Views vary considerably depending on location and direction of view. There are panoramic views along the coastline, views inland over the rolling, wooded, plateau landscapes and open views out to sea. On other stretches, views are foreshortened by vegetation enclosing the path. There are views looking both inland of the landfall section from a short stretch of the path in its immediate vicinity and also looking out across the sea towards the nearshore / offshore sections. These receptors are judged to have a key interest or appreciation of the view and greatly value the existing view, refer to Viewpoint Photographs 2a and 2b.	High
Travellers on the Varvarovka to Sukko road.	People in vehicles have views over the rolling, wooded, plateau landscapes, the extent of which varies depending on levels of vegetation and whether the stretch of road is on a ridge or in a valley. These are kinetic views, fleeting and constantly changing for people in moving vehicles. Views include the landfall section from a short stretch of the road in its immediate vicinity. These road users are judged not to place importance on the existing view, refer to Viewpoint Photographs 3a and 3b.	Low

Continued...

Receptor Group	Description of Receptor Group Views	Receptor sensitivity
Potential Residents of the Clearing in the Woods “Lesnaya Polyana” development currently under construction.	There are views from this development site of part of the landfall section, which lies approximately 500 m away at its closest point. These potential receptors are judged to have a key interest or appreciation of the view, refer to Viewpoint Photograph 4. It is currently proposed that residential receptors will not be present until ca. 2015 or later (refer to **Chapter 14 Socio-Economics**).	High
Visitors to the Russian Orthodox and Armenian cemetery at Varvarovka.	People are likely to visit the cemetery for spiritual and emotional reasons, rather than specifically to enjoy the scenery. There are open views from the cemetery across the wooded valley selected for the landfall section, with the rolling landform of ridgelines forming the skyline beyond and the Black Sea in the distance. The landfall section area is partially visible, as is the area of the proposed access roads along the existing dirt tracks adjacent to the northern and eastern boundaries of the cemetery. In accordance with the criteria set out in Table 13.6 these receptors are judged to value the view but not find it fundamental to the activity of visiting the cemetery, refer to Viewpoint Photographs 5a and 5b.	Moderate
Travellers on the Varvarovka to Gai Kodzor road.	People in vehicles have very limited glimpse views of part the landfall section beyond the intervening hills and woodland from this road; these receptors are approximately 3 km North-East and they experience a wide panoramic view; the extent of these glimpse views of the Site would depend upon the type of vehicle. This section of road is included in the proposed access road. These receptors are judged not to place a lot of importance on the existing view, refer to Viewpoint Photograph 6.	Low
Residents living at North-East Varvarovka.	There are views of the existing unsealed road in the foreground where the proposed upgraded road would form part of the access road. This largely unsealed road is to be converted into a sealed road under existing permitted residential construction. There are also views of part of the landfall section from properties on the Eastern elevated area of Varvarovka facing South. The existing views are panoramic and long-range. The main Site is viewed at a distance of approximately 1.5 km. These receptors are judged to have a key interest or appreciation of the view and greatly value the existing view, refer to Viewpoint Photograph 7.	High

Continued...

Receptor Group	Description of Receptor Group Views	Receptor sensitivity
Residents living at Sukko.	Properties on the seafront and some taller buildings set back from the front have open, uninterrupted views across the beach over the Black Sea. Levels of intervening activity on the beach vary according to the season. Other buildings in elevated locations further back from the seafront, including some development currently under construction; also have views towards the nearshore / offshore section. The landfall section is visible from upper storeys of some properties in elevated locations on the south-eastern side of the village, looking north and at distances of over 3 km. Receptors have fixed views from windows, with no alternative direction of view. In accordance with the criteria set out in Table 13.6. These receptors are judged to have a key interest or appreciation of the view and greatly value the existing view, refer to Viewpoint Photograph 8.	High
Agricultural workers on the land.	Views comprise agricultural land of vineyards, orchards and meadows in a wooded setting. People are likely to be working on the open land, which forms clearings of varying size within the wider wooded landscape. The extent of their views depends on whether they are on a ridge or in a valley and is also influenced by the proximity of woodland. Workers are likely to also gain views of the access roads; in particular the construction of the access road to the north-east of the landfall facilities will be clearly visible from certain locations for these receptors. In accordance with the criteria set out in Table 13.6 these receptors are judged not to place a lot of importance on the existing view, refer to Viewpoint Photographs 2a, 2b, 4, 5a, 5b, 6 and 8.	Low
Visitors to state nature reserve “Utrish”.	Visual amenity is likely to be an important aspect for the limited number of people choosing to visit the reserve; visitors must acquire a Government license to gain access. There are views from the south- and west-facing, wooded slopes of the reserve, looking out across the Black Sea. Depending on levels of intervening vegetation at any particular location, construction vessels would be visible working along the nearshore / offshore section, broadly parallel to and around 4 km off the coast, along with non- Project related vessels using the shipping lanes. In accordance with the criteria set out Table 13.6 these receptors are judged to have a key interest or appreciation of the view and greatly value the existing view.	High

Continued...

Receptor Group	Description of Receptor Group Views	Receptor sensitivity
Recreational boat users.	From the sea, receptors have 360° views ranging from open sea to the west, to the coastal slopes and undulating inland landscapes beyond to the east. People have changing views and a variety of directions of view. However, the views for boat users would be restricted to the marine construction spread on the nearshore and offshore sections, not the landfall section. In accordance with the criteria set out in Table 13.6 these receptors are judged to value the view but not find it fundamental to the boat activity, such as fishing or diving.	Moderate
Residents living close to the access roads.	This receptor group is defined by residents living close to the access roads between the M25 junction at Rassvet and the Project facilities. The visual amenity of residents could be affected by required roadwork construction including limited ground remodelling, and construction vehicles passing through. In accordance with the criteria set out in Table 13.6 these receptors are judged to have a key interest or appreciation of the view and greatly value the existing view.	High

Complete.

Photomontages

Photomontages have been produced to illustrate anticipated views experienced by a number of sensitive visual receptors, the locations of these are shown on Figure 13.9, and the photographs are shown in Appendix 13.1. The methodology used to produce these photomontages is included in Appendix 13.2: Photomontage Methodology. A list of the photomontages is set out in Table 13.8. Predicted impacts at these viewpoints are discussed in the following sections on the assessment of potential impacts and residual effects.

Table 13.8 Photomontage Locations

Photograph No.	Photomontage Location	Phase Represented
13.1.1a.1	Viewpoint 1a: from Shingari Holiday complex (Recreational Visitors)	Construction and Pre-Commissioning Phase
13.1.1b.1	Viewpoint 1b: from Don Holiday Complex (Recreational Visitors)	Construction and Pre-Commissioning Phase
13.1.2a.1	Viewpoint 2a: from the coastal path along the cliff top facing inland (Walkers)	Construction and Pre-Commissioning Phase
13.1.2a.2	Viewpoint 2a: from the coastal path along the cliff top facing inland (Walkers)	Year One Operational Phase
13.1.3a.1	Viewpoint 3a: from the Varvarovka-Sukko road (Travellers)	Construction and Pre-Commissioning Phase
13.1.3b.1	Viewpoint 3b: from the Varvarovka-Sukko road near “Lesnaya Polyana” (Travellers)	Construction and Pre-Commissioning Phase
13.1.4.1	Viewpoint 4: from the Clearing in the Woods “Lesnaya Polyana” development (Potential Residents)	Construction and Pre-Commissioning Phase
13.1.4.2	Viewpoint 4: from the Clearing in the Woods “Lesnaya Polyana” development (Potential Residents)	Year One Operational Phase
13.1.5a.1	Viewpoint 5a: from the Russian Orthodox and Armenian cemetery at Varvarovka facing South (Recreational Visitors)	Construction and Pre-Commissioning Phase
13.1.5a.2	Viewpoint 5a: from the Russian Orthodox and Armenian cemetery at Varvarovka facing South (Recreational Visitors)	Year One Operational Phase

Continued...

Photograph No.	Photomontage Location	Phase Represented
13.1.5b.1	Viewpoint 5a: from the Russian Orthodox and Armenian cemetery at Varvarovka facing East (Recreational Visitors)	Construction and Pre-Commissioning Phase
13.1.5b.2	Viewpoint 5a: from the Russian Orthodox and Armenian cemetery at Varvarovka facing East (Recreational Visitors)	Year One Operational Phase
13.1.8.1	Viewpoint 8: from Southern hills of Sukko (Residents)	Year One Operational Phase
13.1.8.2	Viewpoint 8: from Southern hills of Sukko (Residents)	Commissioning and Operational phases – Wireframe

Complete.

13.6.2 Assessment of Potential Impacts: Construction and Pre-Commissioning

13.6.2.1 Introduction

This section identifies and evaluates the magnitude of the various predicted impacts that are likely to arise in relation to the Landscape and Seascape Character Areas and visual receptors identified in Section 13.5, as a result of the Construction and Pre-Commissioning Phase of the Project.

13.6.2.2 Project Activities with potential to cause landscape and visual impacts

The implementation of the Project involves activities that have the potential to impact both the terrestrial and the marine environments during the Construction and Pre-commissioning Phase.

Landscape and visual impacts would be most apparent during this phase and potentially due to unplanned events (see Section 13.7).

Terrestrial construction, pre-commissioning and operational activities affecting landscape and visual amenity, including habitat removal, site grading and the erection of industrial structures, will generate permanent modifications to the landscape. Temporary impacts to the landscape will also occur as a result of construction activities, which will include the operation of large mechanical equipment, power generators, soil stockpiles, parking of large construction machinery, and the generation of dust from construction activities. For further detail on the size of specific elements required for these activities, refer to **Chapter 5 Project Description**.

It will be necessary to clear all vegetation from the Pipeline route corridor and from any areas for temporary facilities. This will include vines planted in the vineyards, which cover a large proportion of this area. The areas cleared will be reinstated with some form of vegetation following the completion of the Construction and Pre-Commissioning Phase so this is considered to be a short-term and reversible impact (refer to Section 13.6.3 for details of assumed reinstatement). However, there will be a permanent change in the land use for the area occupied by the permanent landfall facilities and the permanent RoW as reinstatement of previous vegetation would not be possible in all areas, in particular on the permanent RoW. In areas directly adjacent to the RoW, graded bands of vegetation will be planted to re-vegetate the cleared areas.

The preparation and construction of the access roads between the M25 and the construction sites will include some new temporary hard surface roads, resurfacing of existing roads, upgrading dirt tracks to sealed roads, installation of localised sections of acoustic fencing (where necessary), and other minor improvements. It is anticipated that the majority of roads which are constructed on new routes will be reinstated after use; however, some are proposed to be retained where appropriate as agricultural access tracks, or for maintenance of Project facilities.

Offshore and nearshore construction impacts on seascape and visual amenity will result from pipe-laying vessels and support vessels (the construction spread) in the proximity of the shore and in the line of sight on the sea.

For further details on the duration of these phases refer to the construction schedule within **Chapter 5 Project Description**. For the purposes of this assessment, the Construction and Pre-Commissioning activities are estimated to be undertaken over a period of less than two years.

The relevant activities of the Project are summarised in Table 13.9.

Table 13.9 Construction and Pre-Commissioning Activities

Activity	Onshore	Offshore	Nearshore
Mobilisation of vessels to and from site, and vessel movements within marine construction spread.		✓	✓
Construction traffic on access roads to and from the site.	✓		
Delivery, storage and handling of pipe, plant and equipment for offshore, nearshore and landfall section construction, including containers, mobile cranes and reach stackers along the access roads.	✓		
Preparation of the construction site: fencing of the working section, clearance of trees and shrubs, grading of access roads and temporary construction sites.	✓		
Transfer of construction machinery to construction sites, installation of infrastructure required.	✓		

Continued...

Activity	Onshore	Offshore	Nearshore
Excavation and backfilling works: stockpiling of topsoil and subsoil, digging of trenches for pipe laying, channels etc.	✓		
Transportation of pipes and auxiliary materials to the Pipeline route and temporary storage. Welding and other works required for pipe laying and control works for checking the Pipeline safety.	✓	✓	✓
Building of facilities required for Pipeline operation, including construction of 21 m* high vent stack.	✓		
Pipeline construction at microtunnel exit point		✓	✓
Restoration of temporary roads and temporary construction sites.	✓		
Replanting of disturbed areas using appropriate local species in line with the detailed landscape restoration plan.	✓		
Pre-Commissioning works.	✓		

* The vent stack has been reduced from 30 m to 21 m since the ZTV analysis was undertaken

Complete.

13.6.2.3 Assessment of Potential Impacts (pre-mitigation)

During the Pre-Commissioning Phase works likely to affect landscape and visual amenity would be limited to two activities – three days of vessel operation to aid in the pumping of sea-water as part of hydrotesting, and onshore traffic movements to dispose of the small volume of liquid waste associated with cleaning and drying of the pipes. The landscape and visual amenity impacts associated with these activities are considered to be **Not Significant** and therefore not considered further. Consequently, the impacts discussed below relate only to construction activities.

As noted above, refer to **Chapter 3 Impact Assessment Methodology** for details relating to calculating the level of significance.

Landscape Character

With regard to the Undulating Plateau LCA, it is noted that this landscape of moderate sensitivity (as defined in Section 13.6.1.1) would be subject to direct impacts as a result of site clearance and construction work (e.g. clearance of existing vegetation and establishment of man-made structures). The extent and nature of this clearance (approximately 21.8 hectares (ha)), in comparison with the total area of the Undulating Plateau LCA within the Survey Area, is considered to be a limited geographical area. Additionally, it is a characteristic of the agricultural land cover that its impact on the landscape fabric varies, appearing as bare earth alternating to lush vegetation cover, throughout its seasonal management. The LCA would also experience impacts from other general construction elements, such as vehicular and labour force movements within the road infrastructure, potential noise and light emission. The Construction and Pre-Commissioning Phase associated impacts are considered likely to be adverse, direct, temporary, short-term and local (i.e. only in the Pipeline route corridor and access roads).

Some indirect impacts are also predicted such as the potential for coating of soil and vegetation with dust during the construction activities. The impact is assessed as adverse, direct, short-term (only during construction - estimated to be a maximum of two years), local (within the area of the Pipeline route) and reversible, because of the restoration of the landscapes after construction period. However, the outcomes of some of the construction activities, such as woodland clearance would be longer-term and effectively permanent but would not compromise the overall integrity of the wider woodland.

The reversibility of construction impacts would be largely dependent upon the successfulness of the restoration of the landscapes following the construction period in line with the Project restoration management measures set out in **Chapter 22 Environmental and Social Management**. Overall, it is considered that the magnitude of impact of construction activities on landscape character within the Undulating Plateau LCA is moderate, resulting in a **Moderate** and adverse impact which is considered significant.

Within the Black Sea Coastal SCA, it is noted that this seascape of High sensitivity would be impacted by the microtunnelling construction proposed for crossing the coastline, the only visible construction activities would be offshore, which would result in some limited, adverse, direct, temporary, short-term deterioration of the seascape, considered to be of low impact magnitude, resulting in a **Moderate** adverse impact.

Visual Amenity

Table 13.10 details the perceived magnitude of impact during construction for each of the receptors identified in terms of visual amenity. Refer to photomontages for the majority of receptor groups showing the Construction and Pre-Commissioning Phase, in Appendix 13.1.

Offshore construction vessels would be visible from much of the coastline, including the coastal path. From Sukko, offshore construction activity would be visible both from the beach and from properties on the seafront, in addition to some elevated or taller properties further inland. The offshore construction corridor would also be visible to people on the beach at the Shingari and Don holiday complexes and other beach users on Anapa beach, which stretches from Anapa Bay south towards the landfall section. Anapa Bay is a popular beach directly in front of Anapa, from where construction vessels would not be visible due to the screening offered by the headland to the south. It is not anticipated that sediment disturbed by the construction process will be visible in the sea from the coastline and therefore this is not considered as a potential visual impact, for details of plume modelling, refer to **Chapter 12 Marine Ecology**, which also notes that this impact will be monitored.

Table 13.10 Visual Impact Significance (pre mitigation) upon Receptors within the ZTV during Construction and Pre-Commissioning Phase

Visual Receptor	Sensitivity	Impact Magnitude	Significance	Description
Recreational visitors to the seashore, including the public beaches at Sukko and Anapa, and the private beach at the Shingari and Don holiday complexes.	High	Moderate	**High**	People on the beaches have open views out to sea to the west. Construction vessels working on the nearshore / offshore section would be visible from beaches and other stretches of seashore. On the beach at Sukko, these would be at distances of between approximately 3 to 4 km, and the proposed microtunnel exit points would be behind the headland to the north and therefore not visible. All construction vessels would be seen in the context of commercial vessels on the existing shipping lanes. From the beach at the Shingari and Don holiday complexes, there would be open views of construction vessels working on the nearshore / offshore sections, including the microtunnel exit points, over 1 km away. Potential views inland towards the landfall section are prevented by the intervening coastal landform and woodland.
Walkers on the coastal path along the cliff top.	High	Low	**Moderate**	Views for people on the coastal path vary considerably depending on location and direction of view. From a short stretch of the path in the immediate vicinity of the landfall section, construction works would be visible looking inland. The extent of views of construction vessels working on the nearshore / offshore sections would vary greatly depending on the location of the viewer along the path. The closest element to the shore – the microtunnel exit points – would be approximately 800 m from the coastal path at its closest point. Further south, construction vessels may be seen working at around 4 km off the coast. North of the microtunnel exit points, supply vessels from Temryuk Port would be seen amongst other vessels on the existing shipping lanes.

Continued...

Visual Receptor	Sensitivity	Impact Magnitude	Significance	Description
Travellers on the Varvarovka-Sukko road.	Low	Low	**Low**	Views of construction activity on the landfall section would be gained from a short stretch of the road in its immediate vicinity; the microtunnel entry points are approximately 200 m from the road at its closest point. From stretches of the road where the sea is visible through the woodland, for example the stretch between Sukko and the Shingari Holiday complex, there are likely to be glimpses of construction vessels working around 4 km off the coast. Generally, these are kinetic views, fleeting and constantly changing for people in moving vehicles.
Residents of the Clearing in the Woods "Lesnaya Polyana" development currently under construction.	High	Negligible	**Low**	Whether or not the visual amenity of residents of the Clearing in the Woods development would be affected, will depend on the progress of that residential development in relation to the Construction Phase of the landfall section (approximately 500 m away at its closest point). At the time of survey, there were no properties where the visual amenity of residents would be affected. Assuming the development is constructed prior to the commencement of the Project, partial views of the construction activities from a small number of properties is likely to be possible.
Visitors to the Russian Orthodox and Armenian cemetery at Varvarovka.	Moderate	High	**High**	There are open views from the cemetery across the wooded valley selected for the landfall section, where construction activity would be visible at distances of between around 500 m and 1 km. Construction vessels would be visible in the distance on the Black Sea, at least 2.5 km away, beyond the rolling landform of wooded ridgelines. There would be clear views of the construction and use of the access road along the northern and eastern boundaries of the cemetery for these receptors.
Travellers on the Varvarovka – Gai Kodzor road.	Low	Negligible	**Not Significant**	It is not considered that there would be views of the construction activity from this road due to the intervening topography and woodland vegetation. This road would be used as an access road for the Construction Phase only. Due to the significance, these receptors are scoped out of this assessment from this point.

Continued...

Visual Receptor	Sensitivity	Impact Magnitude	Significance	Description
Residents living at North-East Varvarovka.	High	Moderate	**High**	People living in the new development on the elevated locations of the northeast of Varvarovka with windows oriented towards the landfall section and access roads are likely to gain clear views of the upgraded road and temporary acoustic barrier in the immediate vicinity. It is noted however, that this road is to be upgraded (to a sealed road) as part of existing permitted residential construction, irrespective of the Project. Further south, they may also view tall construction plant such as cranes and distant glimpses of the Project construction activities. The majority of construction operations would be screened by landform and woodland, however, construction of the access road (including the temporary acoustic barrier) would be short term. The impact of the construction of the access road and its use for Project-related traffic would be adverse, direct, temporary and short-term. The road would then be left in situ for future residential users of the proposed 'Chateau' residential development.
Residents living at Sukko.	High	Low	**Moderate**	Construction vessels working on the nearshore and offshore sections would be visible from properties overlooking the sea at distances of between 3 and 4 km. The proposed microtunnel exit points would be behind the headland to the north of Sukko and therefore not visible. From some properties in elevated locations with windows oriented towards the landfall section, upper parts of tall construction plant, such as cranes, are likely to be visible looking over and between buildings within Sukko, beyond the intervening, undulating, wooded landscape. The majority of construction activities would be screened by landform and woodland. The impact would be adverse, direct, temporary, short-term and local (only looking in one direction and at a distance of around 3 km).
Agricultural workers on the land.	Low	Low	**Low**	People working on the agricultural land of vineyards, orchards and meadows within the immediate vicinity of the landfall section would experience views of construction work and potentially the access roads. The extent of their views would depend on whether they are on a ridge or in a valley and would also be greatly influenced by the proximity of woodland.

Continued...

Visual Receptor	Sensitivity	Impact Magnitude	Significance	Description
Visitors to state nature reserve “Utrish”.	High	Low	**Moderate**	Depending on levels of intervening vegetation at any particular location, construction vessels would be visible from south- and west-facing, wooded slopes of the reserve. Vessels would be working along the nearshore and offshore section, broadly parallel to and around 4 km off the coast, in the context of other vessels on the existing shipping lanes.
Recreational boat users.	Moderate	Moderate	**Moderate**	Due to the nature of the coastal topography and woodland, construction activities on the landfall section are unlikely to be visible. Boat users would have open views of construction vessels working on the nearshore / offshore sections. Supply vessels would be seen in the context of other commercial shipping in the vicinity.
Residents living close to the access roads.	High	Low	**Moderate**	The visual amenity of some residents living close to the access roads would be affected by increased numbers of vehicles passing through or close to affected settlements. Appendix 9.1: Traffic and Transport Survey notes an average increase in vehicular movements of less than 10% at the highest peak during construction on existing roads (refer to **Chapter 14 Socio-Economics** and **Chapter 5 Project Description** for more detail of specific routes and type of vehicle). Furthermore, certain residents would be also visually affected by the construction works required to upgrade a limited amount of these roads to the standards required for construction traffic, this would predominantly involve resurfacing works.

Complete.

13.6.2.4 Mitigation and Monitoring: Construction and Pre-Commissioning Phase

Taking account of the potential impacts identified above, a Russian Landfall Construction Management Plan (CMP) will be prepared and communicated to contractors before any on-site works begin (**Chapter 22 Environmental and Social Management**). The CMP will detail the mitigation and monitoring measures, including requirements for the detailed landscape restoration plan, outlined in this section.

A range of design controls have been incorporated into the Construction and Pre-Commissioning Phase of the Project to ensure that the impact is minimised, as follows:

- Site selection away from settlements to minimise potential visual impact on residents;
- Alignment of proposed Pipeline to cause minimal damage to existing vegetation as far as practicable;
- Wooded nature of surrounding landscape minimises extent of direct visual impact and indirect impact on landscape character;
- Use of existing open land (agricultural fields) to minimise the need for further woodland clearance;
- Coastal crossing by means of microtunnelling to avoid the need for excavation of cliffs; and
- A buried pipeline is proposed as opposed to an above ground pipeline.

Where design controls have not fully mitigated an impact, further mitigation measures have thus been introduced. As described above, the key landscape and visual impacts would be associated with the Construction and Pre-Commissioning Phase; hence the majority of proposed mitigation measures are also related to that phase of the Project. Landscape and visual impacts during this phase would be minimised through:

- Protection of woodland and other vegetation to be retained, with the use of appropriate protective measures including fencing where appropriate;
- Erection of construction fencing and screening, and where necessary and practicable, the contractor shall use hoardings to screen unsightly, low-level construction activity close to publically accessible areas or residential properties;
- Phasing of construction where possible, to enable adverse impacts to be restricted to specific areas of the construction corridor at any one time;
- Phased consecutive programme of excavation and restoration (including prompt installation of proposed planting where practicable) to minimise areas of disturbed ground at any one time and to provide for direct placement of soils which would, in turn, minimise the amount of soil that has to be stockpiled and provide for a rapid reinstatement of the site;
- Progressive reinstatement of RoW in accordance with a landscape restoration plan following installation of the Pipeline;
- Rehabilitation and re-vegetation as soon as practicable;

- Avoidance of night-time construction activities as far as practicable;
- Utilisation of directional shielding for all lights used (including on construction associated vessels with the exception of navigational lights);
- Contractual requirement for an ethos of tidy working and regular removal of debris etc. and other materials with potential negative effect on the visual amenity and landscape character;
- Utilisation of suitable dust suppression methods where practicable to avoid dust plumes that would increase the prominence of the works, and which may otherwise coat nearby vegetation;
- Suitable weed control on temporary soil stockpiles and disturbed ground in accordance with the landscape restoration plan;
- Adoption of GIIP restoration practices and suitably experienced contractors;
- Appropriate planting in accordance with a landscape restoration plan (or equivalent). This plan would stipulate the planting of native vegetation in areas which do not have to remain open for operational reasons, to compensate for vegetation which has been cleared or disturbed; in particular areas around the landfall facilities and along the edges of the RoW where practicable including appropriately selected vegetative screening should be applied around the landfall facilities, and some retained access roads;
- Use of suitable vehicles and good vehicle maintenance on a regular basis to reduce visibility of exhaust emissions;
- An access road to bypass Varvarovka shall be routed so as to minimise disturbance to as many residences as reasonably possible;
- The proposed access road in proximity to the cemetery has been routed away from the cemetery boundary, in order to minimise the impact on visual amenity and landscape character. The selected route to the east is therefore separated from this receptor by intervening ground and furthermore, is proposed to be partially screened by planting in accordance with the landscape restoration plan. This planting shall be installed at the start of construction to maximise establishment time and effectiveness, and shall be maintained during the Operational Phase whilst the road continues to be used by the Project;
- Removal of acoustic barriers as soon as possible; and
- Reinstatement of newly constructed roads after construction where practicable or retention as agricultural access tracks and for maintenance.

The majority of construction impacts are considered to be reversible through the implementation of an appropriate landscape restoration plan during and after the Construction and Pre-Commissioning Phase. As such non-reversible impacts are limited to built elements, as they are completed within the Construction and Pre-Commissioning Phase, that may be visible to sensitive receptors (i.e. the vent stack and the permanent RoW).

13.6.2.5 Residual Impacts: Construction and Pre-Commissioning Phase

Table 13.11 presents a summary of the potential residual impacts to landscape and visual amenity arising from the Project during the Construction and Pre-Commissioning Phase, taking into account of the identified mitigation measures. Measures, stated in full above, are summarised, for ease of reference, in Table 13.11. In some occurrences the application of these measures may lead to a reduction in the adverse impact but may not be reflected in a lower categorisation of impact significance.

The majority of residual impacts are identified to be either of **Low** significance or **Not Significant** following mitigation and, as such, do not require any further management by the Project. However, a small number of **Moderate** (significant) impacts were identified for the following receptors:

- Parts of the Undulating Plateau LCA such as along the access roads, the landfall section, in the vicinity of the landfall facilities and at the microtunnel entry shaft;
- Recreational visitors to the seashore;
- Construction impacts upon the visual amenity of walkers on the coastal path at certain locations along the cliff top;
- Visitors to the Russian Orthodox and Armenian cemetery at Varvarovka;
- Residents living at North-East Varvarovka; and
- Recreational boat users.

These impacts would be short-term and result from the installation of physical infrastructure in a currently rural environment.

One key measure likely to further reduce these impacts is seen to be consultation with the affected stakeholders and their individual subjective assessment and concerns associated with the potential impacts associated with the Project (refer to **Chapter 6 Stakeholder Engagement** for further details). In particular, this may include:

- Further consultation with affected stakeholders (e.g. residents of Varvarovka, beach users, Shingari and Don holiday complex) to alert them of the proposed activity in detail as to what visual impacts may be expected;
- Discussion with the affected stakeholders as to their subjective opinion on the importance of temporary visual amenity impacts; and
- Detailed discussions with regard to scheduling of any particularly intrusive works, so as to ensure they occur at the time least likely to generate impacts to sensitive receptors.

Table 13.11 Assessment of Potential Residual Impacts: Construction and Pre-Commissioning Phase

Activity	Potential Impact	Receptor	Receptor Sensitivity	Impact Magnitude	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
All construction activities undertaken onshore as part of the landfall section, including: • Land clearance; • Bulk earthworks and spoil stockpiles; • Infrastructure installation; • Operation of vehicles, plant and equipment; and • Transfer of materials, equipment and workers on / off site.	Temporary alteration to landscape through loss of vegetation, altered landforms, construction equipment, vehicle movement, and material storage.	Undulating Plateau LCA	Moderate	Moderate	Moderate	Phasing of construction. Construction fencing and screening. Progressive reinstatement of RoW in accordance with the detailed landscape restoration plan following installation of the Pipeline. Rehabilitation and re-vegetation as soon as practicable.	**Moderate** adverse, direct, temporary, short-term.

Continued...

Activity	Potential Impact	Receptor	Receptor Sensitivity	Impact Magnitude	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
All construction activities undertaken as part of the nearshore / offshore sections, including: • Nearshore dredging; • Anchoring of pipe-lay winches; • Transfer of materials and equipment from the port(s); and • Operation of marine construction vessels.	Temporary alteration to the coastal SCA through operation of construction and supply vessels.	Black Sea Coastal SCA	High	Low	Moderate	Phasing of construction. Avoidance of night-time construction activities as far as practicable. Directional shielding for lighting, other than navigational lights on vessels.	**Low** adverse, direct, temporary, short-term.

Continued...

Activity	Potential Impact	Receptor	Receptor Sensitivity	Impact Magnitude	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
All construction activities undertaken onshore as part of the landfall section, including: • Clearance; • Bulk-earthworks; • Infrastructure installation; • Operation of vehicles, plant and equipment; and • Transfer of materials, equipment and workers on / off site.	Distant views of landfall section construction works.	Residents living at Sukko.	High	Low	Moderate	Phasing of construction. Avoidance of night-time construction activities as far as practicable. Directional shielding for lighting.	**Low** adverse, direct, temporary, short-term.

Continued...

Activity	Potential Impact	Receptor	Receptor Sensitivity	Impact Magnitude	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
All construction activities undertaken onshore as part of the landfall section, including: • Clearance; • Bulk-earthworks; • Infrastructure installation; • Operation of vehicles, plant and equipment; and • Transfer of materials, equipment and workers on / off site.	Views of construction work on the landfall section and access roads. Refer to Photomontages 13.1.5a.1 and 13.1.5b.1.	Visitors to the Russian Orthodox and Armenian cemetery at Varvarovka.	Moderate	High	High	Phasing of construction. Routing of access road (as shown in photomontages) east of cemetery and installation of mitigation planting and minimal duration of use. Screening planting to be installed at start of construction to establish and maximise effectiveness of screening access road in proximity to Cemetery. Construction fencing and screening. Progressive reinstatement of RoW in accordance with the detailed landscape restoration plan following installation of the Pipeline. Rehabilitation and re-vegetation as soon as practicable.	**Moderate** adverse, direct, permanent.

Continued...

Activity	Potential Impact	Receptor	Receptor Sensitivity	Impact Magnitude	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
All construction activities undertaken onshore as part of the landfall section, including: • Clearance; • Bulk-earthworks; • Infrastructure installation; • Operation of vehicles, plant and equipment; and • Transfer of materials, equipment and workers on / off site.	Views of the acoustic barrier along the access road. Limited views of construction work on the landfall section.	Residents living at North-East Varvarovka.	High	Moderate	High	Use of suitable vehicles and good vehicle maintenance on a regular basis to reduce visibility of exhaust emissions. Removal of acoustic barriers as soon as possible. Phasing of construction. Avoidance of night-time construction activities as far as practicable. Directional shielding for lighting. Construction fencing and screening. Progressive reinstatement of RoW in accordance with the detailed landscape restoration plan following installation of the Pipeline. Rehabilitation and re-vegetation as soon as practicable.	**Moderate** adverse, direct, temporary, short-term.

Continued...

Activity	Potential Impact	Receptor	Receptor Sensitivity	Impact Magnitude	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
All construction activities undertaken onshore as part of the landfall section, including: • Clearance; • Bulk-earthworks; • Infrastructure installation; • Operation of vehicles, plant and equipment; and • Transfer of materials, equipment and workers on / off site.	Limited views of construction work on the landfall section. Refer to Photomontage 13.1.2a.1	Walkers on the coastal path along the cliff top.	High	Low	Moderate	Phasing of construction; Construction fencing and screening; Progressive reinstatement of RoW in accordance with the detailed landscape restoration plan following installation of the Pipeline; Rehabilitation and re-vegetation as soon as practicable.	**Moderate** adverse, direct, temporary, short-term.
	Limited views of construction work on the landfall section. Refer to Photomontages 13.1.3a.1 and 13.1.3b.1.	Travellers on the Varvarovka-Sukko road.	Low	Low	Low	Phasing of construction. Construction fencing and screening. Progressive reinstatement of RoW in accordance with the detailed landscape restoration plan following installation of the Pipeline. Rehabilitation and re-vegetation as soon as practicable.	**Low** adverse, direct, temporary, short-term.

Continued...

Activity	Potential Impact	Receptor	Receptor Sensitivity	Impact Magnitude	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
All construction activities undertaken onshore as part of the landfall section, including: • Clearance; • Bulk-earthworks; • Infrastructure installation; • Operation of vehicles, plant and equipment; and • Transfer of materials, equipment and workers on / off site.	Views of the construction traffic on this access road. Limited views of construction work on the landfall section.	Travellers on the Varvarovka-Gai Kodzor road.	Low	Low	Low	Phasing of construction. Construction fencing and screening. Progressive reinstatement of RoW in accordance with the detailed landscape restoration plan following installation of the Pipeline. Rehabilitation and re-vegetation as soon as practicable.	**Low** adverse, direct, temporary, short-term.

Continued...

Activity	Potential Impact	Receptor	Receptor Sensitivity	Impact Magnitude	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
All construction activities undertaken onshore as part of the landfall section, including: • Clearance; • Bulk-earthworks; • Infrastructure installation; • Operation of vehicles, plant and equipment; and • Transfer of materials, equipment and workers on / off site.	Change to visual amenity through loss of native vegetation, altered landforms, construction equipment, access roads, vehicle movement and material storage. Refer to Photomontages 13.1.2a.1, 13.1.2b.1, 13.1.4.1, 13.1.5a.1, 13.1.5b.1, and 13.1.8.1.	Agricultural workers on the land.	Low	Low	Low	Phasing of construction. Construction fencing and screening. Progressive reinstatement of RoW in accordance with the detailed landscape restoration plan following installation of the Pipeline. Rehabilitation and re-vegetation as soon as practicable.	**Low** adverse, direct, temporary, short-term.

Continued...

Activity	Potential Impact	Receptor	Receptor Sensitivity	Impact Magnitude	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
All construction activities undertaken onshore as part of the landfall section, including: • Clearance; • Bulk-earthworks; • Infrastructure installation; • Operation of vehicles, plant and equipment; and • Transfer of materials, equipment and workers on / off site.	At the time of survey, there were no properties where the visual amenity of residents would be affected. Refer to Photomontage 13.1.4.1.	Residents of the Clearing in the Woods "Lesnaya Polyana" development currently under construction.	High	Negligible	Low	Phasing of construction. Construction fencing and screening. Progressive reinstatement of RoW in accordance with the detailed landscape restoration plan following installation of the Pipeline. Rehabilitation and re-vegetation as soon as practicable.	**Not Significant**

Continued...

Activity	Potential Impact	Receptor	Receptor Sensitivity	Impact Magnitude	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
All construction activities undertaken as part of the nearshore / offshore sections, including: • Nearshore dredging; • Anchoring of pipe-laying winches; • Transfer of materials and equipment from the port(s); and • Operation of marine construction vessels.	Views of construction vessels along the nearshore / offshore sections and supply vessels running to and from the port(s) Refer to Photomontage 13.1.8.1	People living and working at Sukko and visitors to the town.	High	Low	Moderate	Phasing of construction. Avoidance of night-time construction activities as far as practicable. Directional shielding for lighting, other than navigational lights on vessels.	**Low** adverse, direct, temporary, short-term

Continued...

Activity	Potential Impact	Receptor	Receptor Sensitivity	Impact Magnitude	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
All construction activities undertaken as part of the nearshore / offshore sections, including: • Nearshore dredging; • Anchoring of pipe-laying winches; • Transfer of materials and equipment from the port(s); and • Operation of marine construction vessels.	Temporary presence of non-recreational vessels in the waters off the holiday complexes, comprising construction vessels along the nearshore/ offshore sections and supply vessels running to and from the port(s). Refer to Photomontages 13.1.1a.1 and 13.1b.1.	Recreational visitors to the seashore, including the public beaches at Sukko and Anapa, and the private beach at the Shingari and Don holiday complexes.	High	Moderate	High	Phasing of construction. Avoidance of night-time construction activities as far as practicable. Directional shielding for lighting, other than navigational lights on vessels.	**Moderate** adverse, direct, temporary, short-term

Continued...

Activity	Potential Impact	Receptor	Receptor Sensitivity	Impact Magnitude	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
All construction activities undertaken as part of the nearshore / offshore sections, including: • Nearshore dredging; • Anchoring of pipe-laying winches; • Transfer of materials and equipment from the port(s); and • Operation of marine construction vessels.	Views of vessels working along the nearshore/ offshore sections and supply vessels running to and from the port(s).	Walkers on the coastal path along the cliff top.	High	Low	Moderate	Phasing of construction. Progressive reinstatement of RoW in accordance with the detailed landscape restoration plan following installation of the Pipeline. Rehabilitation and re-vegetation as soon as practicable.	**Moderate** adverse, direct, temporary, short-term
	Views of construction vessels along the nearshore/ offshore sections and supply vessels running to and from the port(s). Views of all onshore construction activities.	Visitors to state nature reserve “Utrish”.	High	Low	Moderate	Phasing of construction. Avoidance of night-time construction activities as far as practicable. Directional shielding for lighting, other than navigational lights on vessels. Progressive reinstatement of RoW in accordance with the detailed landscape restoration plan following installation of the Pipeline. Rehabilitation and re-vegetation as soon as practicable.	**Low** adverse, direct, temporary, short-term.

Continued...

Activity	Potential Impact	Receptor	Receptor Sensitivity	Impact Magnitude	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
All construction activities undertaken as part of the nearshore / offshore sections, including: • Nearshore dredging; • Anchoring of pipe-laying winches; • Transfer of materials and equipment from the port(s); and • Operation of marine construction vessels.	Temporary presence of non-recreational vessels in the coastal waters, comprising construction vessels along the nearshore/ offshore sections and supply vessels running to and from the port(s).	Recreational boat users.	Moderate	Moderate	Moderate	Phasing of construction. Avoidance of night-time construction activities as far as practicable. Directional shielding for lighting, other than navigational lights on vessels.	**Moderate** adverse, direct, temporary, short-term.
All construction activities undertaken onshore as part of the landfall section, including: • Transfer of materials and equipment from the major existing road networks; and • Transport of construction workers.	Upgrade to existing infrastructure. Additional vehicles along existing minor roads.	Residents living close to the road access roads from the M25 at Rassvet.	High	Low	Moderate	Use of suitable vehicles and good vehicle maintenance on a regular basis. Reinstatement of newly constructed roads after construction where practicable or retention as agricultural access tracks and for maintenance.	**Low** adverse, indirect, temporary, short-term

Complete.

13.6.3 Assessment of Potential Impacts: Operational (including Commissioning) Phase

13.6.3.1 Introduction

This section identifies and evaluates the magnitude of the various predicted impacts that are likely to arise in the relation to the landscape and seascape character and visual receptors identified in Section 13.5, as a result of the Operational and Commissioning Phases of the Project. This phase shall be referred to as Operational Phase henceforth as it is considered that the landscape and visual effects would be identical for these phases. The above-ground landfall facilities will be operated throughout the Project lifecycle and they will therefore cause a permanent impact to the landscape during the Operational Phase of the Project.

13.6.3.2 Project Activities with potential to cause landscape and visual impacts

During the Operational Phase, impacts would be mainly experienced from locations within the terrestrial environment with potential for additional impacts due to unplanned events (refer **Chapter 19 Unplanned Events**).

The above-ground landfall facilities would be operated throughout the Project lifecycle and they would therefore cause a permanent impact to the landscape during the Operational Phase of the Project. There would be a permanent change in the land use for the area occupied by the permanent landfall facilities and the RoW as reinstatement of previous, deep-rooted vegetation (such as grape vines) would not be possible in all areas, in particular within the permanent RoW area which is required to be kept clear (except for low growing vegetation such as grasses) (See **Chapter 14 Socio-Economics** for more details).

For the purposes of this assessment, it is assumed that all areas of vineyards which would have been cleared for construction would have been replanted with some form of crop or vegetation (except in those areas directly over the RoW area which is required to be kept clear (except for low growing vegetation such as grasses) and the landfall facilities, as required). This is reflected in the relevant photomontages.

All offshore activities would have ceased. The relevant activities of the Project are summarised in Table 13.12.

Table 13.12 Operational Phase Activities

Activity	Onshore	Offshore	Nearshore
Permanent above-ground plant, including a 21 m high vent stack.	✓		
Permanent woodland clearance on plant site and along permanent RoW.	✓		
Intermittent maintenance and clearance of tree and shrub regrowth along the pipeline easement.	✓		

* The vent stack has been reduced from 30 m to 21 m since the ZTV analysis was undertaken

13.6.3.3 Assessment of Potential Impacts (Pre-Mitigation)

Landscape Character

Direct impacts on the Undulating Plateau LCA would result from the presence of permanent, above-ground plant and land cleared for the permanent RoW. The proposed landfall section facilities include a metering facility, pipeline inspection gauge (PIG) traps and electrical and instrumentation installations, for further details refer to **Chapter 5 Project Description**. All of the plant would be well below the top of the canopy top of adjoining woodland, except for the proposed 21 m high vent stack, which is likely to protrude above the existing canopy cover by a few metres. The effects on the landscape fabric itself would be largely confined to the landfall facilities, however, the impacts upon the landscape character would be adverse, direct, long-term (for the entire duration of operation) and localised.

Maintenance activity would be infrequent and relatively low-key.

However, the extensive woodland surrounding the Project is effective at 'absorbing' development by screening much of the Project. On this basis the operational impact upon the Undulating Plateau LCA would be low, resulting in a **Moderate** impact; therefore this is considered a significant impact, but a localised one relative to the scale of the LCA.

The short section of the coastal belt within the Black Sea Coastal SCA that would be crossed by the Pipeline route would experience very minor residual impacts on the SCA once installed, such as reinstatement of the vegetation above the micro-tunnelling route and occasional maintenance vessels. It is therefore considered that the impact magnitude upon the Black Sea Coastal SCA is negligible**,** resulting in a **Low** effect which is not considered a significant impact.

Visual Amenity

Table 13.13 details the perceived magnitude of impact during operation for each of the receptors identified in terms of visual amenity. Refer to photomontages for the majority of receptor groups shown in in Appendix 13.2.

Table 13.13 Visual Impact Significance (pre mitigation) upon Receptors within the ZTV during Operation

Visual Receptor	Impact Magnitude	Sensitivity	Significance	Comment
Recreational visitors to the seashore, including the public beaches at Sukko and Anapa, and the private beach at the Shingari and Don holiday complexes.	Negligible	High	**Low**	Occasional maintenance vessels would be visible on the nearshore / offshore sections in the context of other commercial shipping.
Walkers on the coastal path along the cliff top.	Low	High	**Moderate**	Occasional glimpses of the top of the vent stack amongst the trees and occasional views of the landfall facilities and RoW are likely from a very local stretch of the route in the vicinity of the landfall section. Occasional maintenance vessels would be visible on the nearshore and offshore sections.
Travellers on the Varvarovka-Sukko road.	Negligible	Low	**Not Significant**	Occasional glimpses of the top of the vent stack amongst the trees and occasional views of the RoW are likely from a very local stretch of the road in the vicinity of the landfall section.
Residents of the Clearing in the Woods "Lesnaya Polyana" development currently under construction.	Low	High	**Moderate**	Residents of newly constructed dwellings at the southern end of the residential development would have views of the western end of the landfall section, including the location of the microtunnel entry points (approximately 500 m away). Operational and maintenance vehicles would also be visible.

Continued...

Visual Receptor	Impact Magnitude	Sensitivity	Significance	Comment
Visitors to the Russian Orthodox and Armenian cemetery at Varvarovka.	Moderate	Moderate	**Moderate**	The landfall facilities would be partially visible amongst woodland and the cleared RoW would be apparent. Infrequent maintenance vehicles would also be visible. Reinstatement of the access road adjacent to the cemetery boundary would be completed where possible, and installation of vegetative screening would be established. If the access road is re-aligned during construction to bypass the cemetery this would be left in situ and would be partially screened also by the established planting.
Residents living in north east Varvarovka and future residents of the Chateau development.	Low	High	**Moderate**	The acoustic barrier along the access road directly in view for this receptor will have been removed and residents will gain clear views of the sealed road which will form infrastructure for access within their development. The top of the vent stack and the operation compound is likely to be barely perceptible beyond the intervening agricultural land from properties with windows facing south towards the landfall section, at distances of approximately 1.5 km. These operational structures will not protrude above the wooded hills behind and will therefore be well integrated into the landscape. Occasional maintenance vessels would be barely visible on the nearshore and offshore sections in the context of other commercial shipping.
Residents living at Sukko.	Negligible	High	**Low**	The top of the vent stack is likely to be visible above the woodland from properties in elevated positions with windows facing north or north-west towards the landfall section; at distances of between 3 and 4 km. Occasional maintenance vessels would be visible on the nearshore and offshore sections in the context of other commercial shipping.

Continued...

Visual Receptor	Impact Magnitude	Sensitivity	Significance	Comment
Agricultural workers on the land.	Moderate	Low	**Moderate**	People working on the agricultural land of vineyards, orchards and meadows within the immediate vicinity of the landfall section would experience views of the landfall facilities and RoW. Operational and maintenance vehicles would also be visible. The extent of their views would depend on whether they are on a ridge or in a valley and would also be greatly influenced by the proximity of woodland.
Visitors to state nature reserve “Utrish”.	Negligible	High	**Low**	Occasional maintenance vessels would be visible on the nearshore and offshore sections in the context of other commercial shipping. Occasional distant glimpses of the re-vegetated RoW would be barely perceptible in the wider landscape from this distance.
Recreational boat users.	Negligible	Moderate	**Low**	Occasional maintenance vessels would be visible on the nearshore and offshore sections, in the context of other commercial shipping.
Residents living close to the access roads.	Negligible	High	**Low**	Upon completion of construction, the amount of additional traffic associated with the Project is likely to be imperceptible. Roads in close proximity to the landfall facilities which were newly constructed would have been reinstated as far as reasonably possible or retained as agricultural access tracks and for maintenance.

Complete.

13.6.3.4 Mitigation and Monitoring: Operational

In terms of mitigation measures and monitoring, adverse effects on the landscape and visual amenity would be reduced where possible as set out in the landscape restoration plan, this would continue from the Construction and Pre-Commissioning Phase and throughout the Operational Phase.

To address the limited remaining operational landscape and visual impacts the following mitigation measures are recommended:

- Directional shielding for any permanent lighting at landfall facilities;
- On-going management and monitoring of appropriate native tree and shrub woodland;
- Planting in areas which do not have to remain open for operational reasons, to compensate for woodland removed. This would include areas of vegetative screening around the main plant and also along the edges of the RoW where practicable, including appropriately selected vegetative screening should be applied around the landfall facilities. Management of all planting must continue in accordance with the detailed landscape restoration plan, for the duration of the Operational Phase;
- Use of suitable vehicles and good vehicle maintenance on a regular basis to reduce visibility of exhaust emissions and vehicular noise;
- Appropriate vessel maintenance; and
- Roads and transfer sites in close proximity to the landfall facilities which were newly constructed to be reinstated as far as reasonably possible or roads retained for agricultural access and maintenance, in accordance with the landscape restoration plan.

13.6.3.5 Residual Impacts: Operational

Table 13.14 presents a summary of the potential residual impacts on landscape and visual receptors arising from the Project during the Operational Phase of the Project, following application of the identified mitigation measures. Measures, stated in full above, are summarised, for ease of reference, in the Table 13.14. In some occurrences the application of these measures may lead to a reduction in the adverse impact but may not be reflected in a lower categorisation of impact significance.

It can be seen that all of the residual impacts are identified to be either of **Low** significance or **Not Significant** following mitigation and, as such, are not considered to be of significance to visual or landscape receptors.

Table 13.14 Assessment of Potential Residual Impacts: Operational

Activity	Potential Impact	Receptor	Receptor Sensitivity	Impact Magnitude	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Operation of permanent landfall facilities, including: • 21 m high vent stack; • Permanent RoW; and • Occasional maintenance of vehicle movements.	Permanent presence of landfall facilities and permanent RoW as part of the landscape; nuisance light pollution at night associated with facility lighting.	Undulating Plateau LCA	Moderate	Low	Moderate	On-going management of all new planting. Vegetative screening around permanent infrastructure. Appropriate design and colour choice for fencing and permanent infrastructure. Directional shielding on all facility lights.	**Low** adverse, direct, permanent.
Occasional operation of marine maintenance vessels.	Views of maintenance vessels.	Black Sea Coastal SCA	High	Negligible	Low	No mitigation required.	**Low** adverse, direct, local, intermittent.

Continued...

Activity	Potential Impact	Receptor	Receptor Sensitivity	Impact Magnitude	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Operation of permanent landfall facilities, including: • 21 m high vent stack; • Permanent RoW; and • Occasional maintenance of vehicle movements.	Distant views of upper parts of vent stack; nuisance light pollution at night associated with facility lighting. Refer to photomontage 13.1.8.2.	Residents living at Sukko	High	Negligible	Low	Appropriate design and colour choice for fencing and permanent infrastructure. Directional shielding on all facility lights.	**Not Significant**.
Operation of permanent landfall facilities, including: • 21 m high vent stack; • Permanent RoW; and • Occasional maintenance of vehicle movements.	Permanent presence of landfall facilities and permanent RoW as part of the visual landscape; short-term presence of maintenance vehicles within the visual landscape.	Residents living at North-East Varvarovka.	High	Low	Moderate	Use of suitable vehicles and good vehicle maintenance on a regular basis to reduce visibility of exhaust emissions. Rehabilitation and management of access roads and transfer sites as soon as possible with appropriate species. Maintenance of all planting. Appropriate design and colour choice for fencing and permanent infrastructure. Directional shielding on all facility lights.	**Low** adverse, direct, permanent.

Continued...

Activity	Potential Impact	Receptor	Receptor Sensitivity	Impact Magnitude	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Operation of permanent landfall facilities, including: • 21 m high vent stack; • Permanent RoW; and • Occasional maintenance of vehicle movements.	Permanent presence of landfall facilities and permanent RoW as part of the visual landscape; short-term presence of maintenance vehicles within the visual landscape. Refer to photomontages 13.1.5a.2 and 13.1.5b.2.	Visitors to the Russian Orthodox and Armenian cemetery at Varvarovka.	Moderate	Moderate	Moderate	Rehabilitation and management of access roads and transfer sites as soon as possible with appropriate species. Maintenance of all planting. Appropriate design and colour choice for fencing and permanent infrastructure. Directional shielding on all facility lights. Reinstatement of track adjacent to eastern boundary (as shown in photomontages) and establishment of mitigation vegetative screening.	**Low** adverse, direct, permanent.

Continued...

Activity	Potential Impact	Receptor	Receptor Sensitivity	Impact Magnitude	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Operation of permanent landfall facilities, including: • 21 m high vent stack; • Permanent RoW; and • Occasional maintenance of vehicle movements.	Permanent presence of landfall facilities and permanent RoW as part of the visual landscape; short-term presence of maintenance vehicles within the visual landscape. Refer to photomontage 13.1.2a.2.	Walkers on the coastal path along the cliff top.	High	Low	Moderate	Rehabilitation and management of access roads and transfer sites as soon as possible with appropriate species. Maintenance of all planting. Appropriate design and colour choice for fencing and permanent infrastructure. Directional shielding on all facility lights.	**Low** adverse, direct, permanent.
	Permanent presence of landfall facilities and permanent RoW as part of the visual landscape; short-term presence of maintenance vehicles within the visual landscape.	Travellers on the Varvarovka-Sukko road.	Low	Negligible	Not Significant	Rehabilitation and management of access roads and transfer sites as soon as possible with appropriate species. Maintenance of all planting. Appropriate design and colour choice for fencing and permanent infrastructure. Directional shielding on all facility lights.	**Not Significant**

Continued...

Activity	Potential Impact	Receptor	Receptor Sensitivity	Impact Magnitude	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Operation of permanent landfall facilities, including: • 21 m high vent stack; • Permanent RoW; and • Occasional maintenance of vehicle movements.	Permanent presence of landfall facilities and permanent RoW as part of the visual landscape; short-term presence of maintenance vehicles within the visual landscape. Refer to photomontage 13.1.2a.2, 13.1.4.2, 13.1.5a.2, 13.1.5b.2 and 13.1.8.2.	Agricultural workers on the land.	Low	Moderate	Moderate	Rehabilitation and management of access roads and transfer sites as soon as possible with appropriate species. Maintenance of all planting. Appropriate design and colour choice for fencing and permanent infrastructure. Directional shielding on all facility lights.	**Low** adverse, direct, permanent.
	Permanent presence of landfall facilities and permanent RoW as part of the visual landscape; short-term presence of maintenance vehicles within the visual landscape. Refer to photomontage 13.1.4.2.	Residents of the Clearing in the Woods “Lesnaya Polyana” development currently under construction.	High	Low	Moderate	Rehabilitation and management of access roads and transfer sites as soon as possible with appropriate species. Maintenance of all planting. Appropriate design and colour choice for fencing and permanent infrastructure. Directional shielding on all facility lights.	**Low** adverse, direct, permanent.

Continued...

Activity	Potential Impact	Receptor	Receptor Sensitivity	Impact Magnitude	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Marine vessel maintenance operations.	Temporary presence of non-recreational vessels in the waters off the coast.	Resident living at Sukko.	High	Negligible	Low	Appropriate vessel maintenance.	**Not Significant**
	Temporary presence of non-recreational vessels in the waters off the coast.	Recreational visitors to the seashore, including the public beaches at Sukko and Anapa, and the private beach at the Shingari and Don holiday complexes.	High	Negligible	Low	Appropriate vessel maintenance.	**Not Significant**
	Temporary presence of non-recreational vessels in the waters off the coast.	Walkers on the coastal path along the cliff top.	High	Negligible	Low	Appropriate vessel maintenance.	**Not Significant**

Continued...

Activity	Potential Impact	Receptor	Receptor Sensitivity	Impact Magnitude	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Marine vessel maintenance operations.	Temporary presence of non-recreational vessels in the waters off the coast.	Visitors to state nature reserve "Utrish".	High	Negligible	Low	Appropriate vessel maintenance.	**Not Significant**
	Temporary presence of non-recreational vessels in the waters off the coast.	Recreational boat users.	Moderate	Negligible	Low	Appropriate vessel maintenance.	**Not Significant**
Transport of maintenance workers and materials.	Retention of some upgraded roads. Additional vehicles along existing roads.	Residents living close to the access roads	High	Negligible	Low	Use of suitable vehicles and good vehicle maintenance on a regular basis to reduce visibility of exhaust emissions. Reinstatement as far as reasonably possible, of access roads.	**Not Significant**

Complete.

13.6.4 Assessment of Potential Impacts: Decommissioning Phase

13.6.4.1 Introduction

The Project is designed to be operational for 50 years. The decommissioning programme would be developed during the late Operational Phase. The decommissioning strategy is set out in **Chapter 5 Project Description**. It is likely that the technological options and preferred methods for decommissioning of such transportation systems will be different after 50 years, and the status of the Pipeline at the time of decommissioning would also impact on the chosen decommissioning methods. The eventual decommissioning requirements will be taken into account in the final design stage by ensuring that a range of possible options will be available.

Under all circumstances, decommissioning activities would be carried out according to prevailing statutory international and national legislation and regulations and GIIP regarding environmental and other potential impacts. An assessment will be undertaken and approval obtained during operation to confirm that the planned decommissioning activities are the most appropriate to the prevailing circumstances and future land use. The assessment would outline management controls and aim to demonstrate that the decommissioning activities would not cause unacceptable environmental and social impacts.

13.6.4.2 Assessment of Potential Impacts (pre-mitigation)

At this stage in the Project, the full extent of the decommissioning requirements is not known. However, it is likely that the receptors and impacts will be similar albeit less than those presented for the Construction and Pre-Commissioning Phase. These are outlined in detail in Section.

Given the timeframe involved there is also considerable uncertainty associated with what the baseline conditions will be like in 50 years, and whether the receptor sensitivity is likely to differ. There may also be additional sensitive receptors due to development and changes in land use.

Essentially two options are available for the decommissioning of the landfall section in particular; namely in situ decommissioning or pipe removal.

13.6.4.3 Mitigation and Monitoring

The potential impacts during the Decommissioning Phase will be similar to that of the Construction and Pre-Commissioning Phase. Mitigation and monitoring measures as outlined in Section 13.6.2.4 will therefore be relevant. If pipework is left in situ, and only above ground structures are removed, impacts on landscape character and visual amenity will be greatly reduced. Areas which had to remain open for operational reasons could also be available for appropriate tree and shrub planting, if other requirements for the land had not arisen. This would also be incorporated into a decommissioning landscape restoration plan in accordance with GIIP as applicable at that time.

13.6.4.4 Residual Impacts: Decommissioning Phase

Table 13.12 represents a summary of the potential residual impacts to landscape character and visual amenity arising from the Project during the Construction and Pre-Commissioning Phase and these would be similar albeit less during the Decommissioning Phase following application of the identified mitigation measures.

The **Moderate** residual impact significance upon the Undulating Plateau LCA, and the visual receptors (visitors to the seashore, walkers along the coastal path, users of the cemetery and recreational boat users) would be unavoidable, but short-term.

It is not anticipated that any long term significant impacts to the landscape character and visual amenity will arise from the Decommissioning Phase of the Project, due to the landscape restoration plan.

13.7 Unplanned Events

The potential for unplanned events is discussed in **Chapter 19 Unplanned Events,** factors noted there which could form adverse impacts on landscape and visual receptors are as follows:

- Fuel and oil spillages potentially leading to damage of vegetation - landscape and visual effects;
- Forest fires potentially leading to devastation of vegetation - landscape and visual effects; and
- Oil spillage potentially leading to temporary adverse impacts on the seascape character and visual amenity.

13.8 Cumulative Impacts Assessment

As part of the ESIA process, potential cumulative impacts as associated with the Project have been considered and are presented in **Chapter 20 Cumulative Impact Assessment**.

13.9 Conclusions

Based on the preceding assessment, it is concluded that during the Construction and Pre-Commissioning Phase both the Undulating Plateau LCA and the Black Sea Coastal SCA would be subject to **Moderate** adverse (significant) impacts. However, such impacts would be short term. Remediation measures such as planting and vegetation screening also help reduce the significance of impacts as vegetation becomes increasingly established.

During the Construction and Pre-Commissioning Phase the majority of residual impacts are identified to be either of **Low** significance or **Not Significant** following mitigation and, as such, are not considered to be of concern to the visual and landscape receptors, and therefore not significant to the Project (in accordance with the **Chapter 3 Impact Assessment Methodology**). However, a number of **Moderate** (significant) impacts have been identified in respect of the following receptors:

- Recreational visitors to the seashore;
- Walkers on the coastal path along the cliff top;
- Visitors to the Russian Orthodox and Armenian cemetery at Varvarovka;
- Residents living at North-East Varvarovka; and
- Recreational boat users.

It is considered that the visual impacts upon recreational receptors in the vicinity of the coast (visitors to the seashore and holiday complexes, coastal path walkers and boat users) during the Construction and Pre-Commissioning Phase would potentially experience the more major impacts associated with the Project. These impacts are direct, temporary and short-term.

The residual impacts for landscape character and visual amenity during the Operational Phase are all identified to be either of **Low** significance or **Not Significant** and therefore not significant when design controls and mitigation measures are taken into account.

In conclusion, based upon this assessment of landscape character and visual amenity impacts, it is considered that the Project would not cause significant, permanent adverse effects to the identified receptors within the Study Area.

References

Number	Reference
Ref. 13.1	Federal Law 'On Specially Protected Natural Areas' 14.03.1995, No. 33-FZ.
Ref. 13.2	Council of Europe (2000). European Landscape Convention.
Ref. 13.3	The Countryside Agency and Scottish Natural Heritage (2002). Landscape Character Assessment: Guidance for England and Scotland. Edinburgh, Scotland.
Ref. 13.4	Landscape Institute and Institute of Environmental Management & Assessment (2013). Guidelines for Landscape and Visual Impact Assessment (Third Edition). Abingdon, UK.

Chapter 14: Socio-Economics

URS-EIA-REP-204635

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Figures

14 Socio-Economics

14.1 Introduction

This chapter presents an assessment of the potential socio-economic impacts resulting from the Project. In addition, mitigation measures designed to reduce, remediate or avoid potential impacts are described, and the residual impacts (i.e. impacts after mitigation measures are implemented) assessed.

14.1.1 Structure of Socio-Economics Chapter

Section 14.2 draws on the Project description (see **Chapter 5 Project Description**), the Scoping Stage and the stakeholder engagement process to identify potential impacts. Section 14.3 details the approach taken for the socio-economic baseline and impact assessment with regard to the spatial boundaries and defines the zone of influence for socio-economic impacts. Section 14.4 and Section 14.5 provide quantitative and qualitative baseline data commencing with a description of the data sources used in the baseline and followed by baseline summaries related to population and demography; economy; employment and livelihoods; land use; the local communities; public infrastructure and services; transport; accommodation and real estate; health, well-being and social infrastructure; the local tourism, recreation and leisure sector; and the local and regional fisheries industry.

Section 14.6 reports on the impact assessment in relation to socio-economic receptors, including during Construction and Pre-Commissioning and Operational Phases. Where relevant, this section presents the impact assessment at the pre-mitigation stage before presenting suggested mitigation measures, followed by the potential residual socio-economic impacts that would result following implementation of mitigation. Section 14.10 provides a summary of the key findings of this assessment.

14.1.2 Human Rights Due Diligence

Prior to concluding this chapter, Section 14.9 covers the Human Rights Due Diligence process that has been undertaken to complement the socio-economic impact assessment. This section explains the due diligence process that has been followed and examines human rights issues in respect of general policies and procedures, including labour and working conditions, local communities, supplier engagement, and security provision.

14.1.3 Relationship to the Community Health, Safety and Security Impact Assessment

A community health, safety and security impact assessment has been undertaken following the standards and guidelines of finance institutions and covering community health, safety, and security, as well as workforce occupational health and safety. The chapter also addresses the potential for impacts associated with construction traffic including road safety issues and severance. The results of this process have been documented in **Chapter 15 Community Health, Safety and Security** and in Appendix 15.1 Occupational Health and Safety. Appendix

9.1 Traffic and Transport Study has informed the findings of the assessments. The socio-economic and health impact assessment teams have worked together closely in undertaking these assessments.

14.1.4 Relationship to Other Chapters

An Ecosystem Services impact assessment has been undertaken following the standards and guidelines of finance institutions. The results of this process have been documented in **Chapter 17 Ecosystem Services**. The socio-economic and ecosystem services impact assessment teams have also worked together closely in undertaking these assessments.

This socio-economic impact assessment chapter has taken into account the findings of other chapters to inform and evidence the assessment of impacts on socio-economic receptors; including, but not limited to, **Chapter 9 Air Quality**, **Chapter 10 Noise and Vibration** and **Chapter 13 Landscape and Visual**.

The findings of this chapter are also supported by several appendices including Appendix 9.1, Appendix 12.2 Sediment Dispersion Study and Appendix 14.1 Fisheries Study.

14.2 Scoping and Stakeholder Consultation

14.2.1 Impacts Identified During Scoping

A scoping exercise was undertaken in 2012 and resulted in the disclosure of a Scoping Report (Ref. 14.1) in December 2012, followed by associated stakeholder consultation. The aims of the scoping process were to identify the potential Project-related impacts, so as to inform further baseline studies, seek feedback from stakeholders on the Scoping Report and identify any additional issues to be considered in the ESIA process.

The Scoping Report identified receptors and communities with the potential to be affected by the Project Activities. For the purposes of this socio-economic assessment, certain communities (Gai Kodzor, Rassvet, Varvarovka, Sukko, Supsekh, and the town of Anapa) are referred to as the 'Local Communities' for the Project. These communities were identified as potentially Project-Affected Communities (PACs) in the Scoping Report, with the exception of Rassvet which has been identified since. The Scoping Report also identified potential impacts on these communities in relation to land use and ownership, the local economy and traffic.

Fishery businesses and individual fishers have been engaged since the scoping meetings in December 2012, and were also interviewed as part of the Fisheries Study in March and October, 2013. South Stream Transport met with representatives of RPK Briz Fishing Company, ZAO Morskoy Club, and OOO RAM Fishing Company. Briz Fishing Company was the only company to respond to a meeting request in March 2013. In October, 2013 a meeting request was sent to OOO RK Chernomorec but they declined to meet in person or provide feedback for the ESIA Report.

Fishers have raised concerns about the potential access to fishing grounds and also potential disruption on the migration routes of fish in the Black Sea from construction activities, including from light, noise and vibration. They were concerned that the Project could affect the migration routes of fish, which could potentially impact on fish catches and subsequently company profits. In addition, concerns were raised that the Pipeline might interfere with trawl gear. However, as the nearshore section of the Project Area is located within the Anapa Bank, in which bottom trawling is not permitted, the potential interaction with trawl fishing gears and the Project pipelines is thus reduced. Stakeholders also asked if the pipelines will be marked with buoys or on charts. The fishers also indicated that they would alter their trawling patterns once they knew the exact location of the Pipeline (Ref. 14.2, Ref. 14.3, Ref. 14.4 and Ref. 14.5).

Given the concerns that were raised and the importance attached to the issue by stakeholders, a fisheries study was undertaken (see Appendix 14.1) to assess potential Project impacts on fisheries. The Fisheries Study examined the potential risks of the Project to both fish stocks (including fish health and migration routes for various species) and the fishing activities of local fishers and fishing businesses.

Stakeholder consultation also identified some specific, primarily local, concerns that had not been covered in the Scoping Report, including questions about the safety of the Pipeline, local gas supplies, traffic, and access to local areas. A summary of stakeholder interests and concerns is provided in **Chapter 6 Stakeholder Engagement**.

14.2.2 Post-Scoping Stage Revisions

Following the Scoping Stage, refinement of the Project Description and further investigation of the baseline conditions within the Study Area (Section 14.3.3) enabled this assessment to conclude that there will be no significant impact in relation to certain issues. As such, these issues do not merit further consideration within the socio-economic assessment, and have not been the focus of baseline studies; this approach allows the socio-economic assessment to focus on the issues (and supporting information) pertinent to the Project. The rationale for screening out these potential impacts and risks is discussed below.

Indigenous peoples: Baseline studies have not identified any indigenous peoples, as defined by IFC Performance Standard 7, in the vicinity of the Project or the Local Communities. As such, no potential impacts on indigenous peoples were identified or assessed.

Utilities services: The Project, during both construction and operation, will make provision for meeting its electricity, sewage and telecommunications needs by means (e.g. by using diesel generators and using chemical toilets) that will be independent of existing systems serving domestic or commercial users within the Local Communities. Water will be obtained from a well in Sukko by agreement with the well owner; water will only be abstracted between October and April, and will be stored in water tanks at the landfall construction site for use throughout the year. Therefore, no potential impacts on existing users of utilities (specifically electricity, water, sewage and telecommunications) were identified or assessed. See **Chapter 17 Ecosystem Services** for further information.

Utilities infrastructure: The design of the Project has ensured that existing third party services will be located, marked, and either safeguarded or diverted prior to the start of construction, in accordance with owners' agreements (see **Chapter 5 Project Description**). Accordingly, unless in case of accidental disruption, no potential impacts to these services, or to the domestic or commercial users of these services, were identified or assessed (see

Chapter 19 Unplanned Events for consideration of the issues associated with accidental damage to third party property and utilities).

Since the Scoping Report was issued, the community of Rassvet has been identified as a potentially affected Local Community due to confirmation that construction traffic will travel through Rassvet. Therefore, potential socio-economic impacts on Rassvet have been considered in this chapter.

14.3 Spatial and Temporal Boundaries

14.3.1 The Project Area and Project Sections

The Project was described in the Scoping Report and a revised, detailed Project Description is provided in **Chapter 5 Project Description**.

The Project Area comprises three sections—landfall, nearshore and offshore—within which the Project's activities will occur. The landfall section includes South Stream Transport's landfall facilities (a fenced area containing metering and other equipment), 2.5 km of buried pipelines, and four microtunnels transitioning from land to sea. The short nearshore section starts at the exit of the microtunnels, approximately 400 m from the shore, and continues another 425 m to where the water is 30 m deep. From here, the offshore section begins and involves pipe-laying in deeper waters. Further information explaining the extent and nature of each section is given in **Chapter 1 Introduction.**

14.3.2 Location

The proposed site of the landfall section of the Project is located within the Anapa Resort Town (ART) municipal district, a district with Resort Status [1] (see Section 14.4.2.1 for further information on this status) on the Black Sea coast, in the Krasnodar region (or Krai) of the Russian Federation. It is set among rolling hills leading to the cliffs at the shore of the Black Sea.

The Project is located near to the six identified Local Communities (town of Anapa; Gai Kodzor, Rassvet, Supsekh, Sukko and Varvarovka). These communities have been identified either because they are the closest communities to the Project Area or, in the case of Rassvet and the town of Anapa, because they have the potential to experience impacts associated with construction and accommodation of the Project workforce.

The town of Anapa (estimated population 59,000) is the largest Local Community and is also the nearest large urban settlement, approximately 10 km to the north of the landfall section of the Project. With the exception of Anapa, the surrounding area is largely rural and includes a

[1] This Resort Town status was established by Presidential Decree of 1994 No. 1954 and the Russian Government Executive Order of 1996, No. 591-p. Resort Town status recognises Anapa as a place of importance for tourism. The Resort Town status provides for certain land and development management regimes that are intended to safeguard the area's environmental qualities so as to ensure the area's suitability and appeal for resort and tourism related activities.

number of small to medium-sized communities near the landfall section of the Project. Of the remaining Local Communities, Varvarovka is the closest to the landfall section; it is located approximately 2 km northwest of the Project Area. All of the Local Communities are situated within the ART municipal district. The Local Communities are shown in Figure 14.1, together with the Project, including temporary and permanent access roads, and described in Section 14.4.3.

Novorossiysk is located on the Black Sea approximately 50 km by road to the southeast of the Project landfall section, and its port may be utilised by the Project.

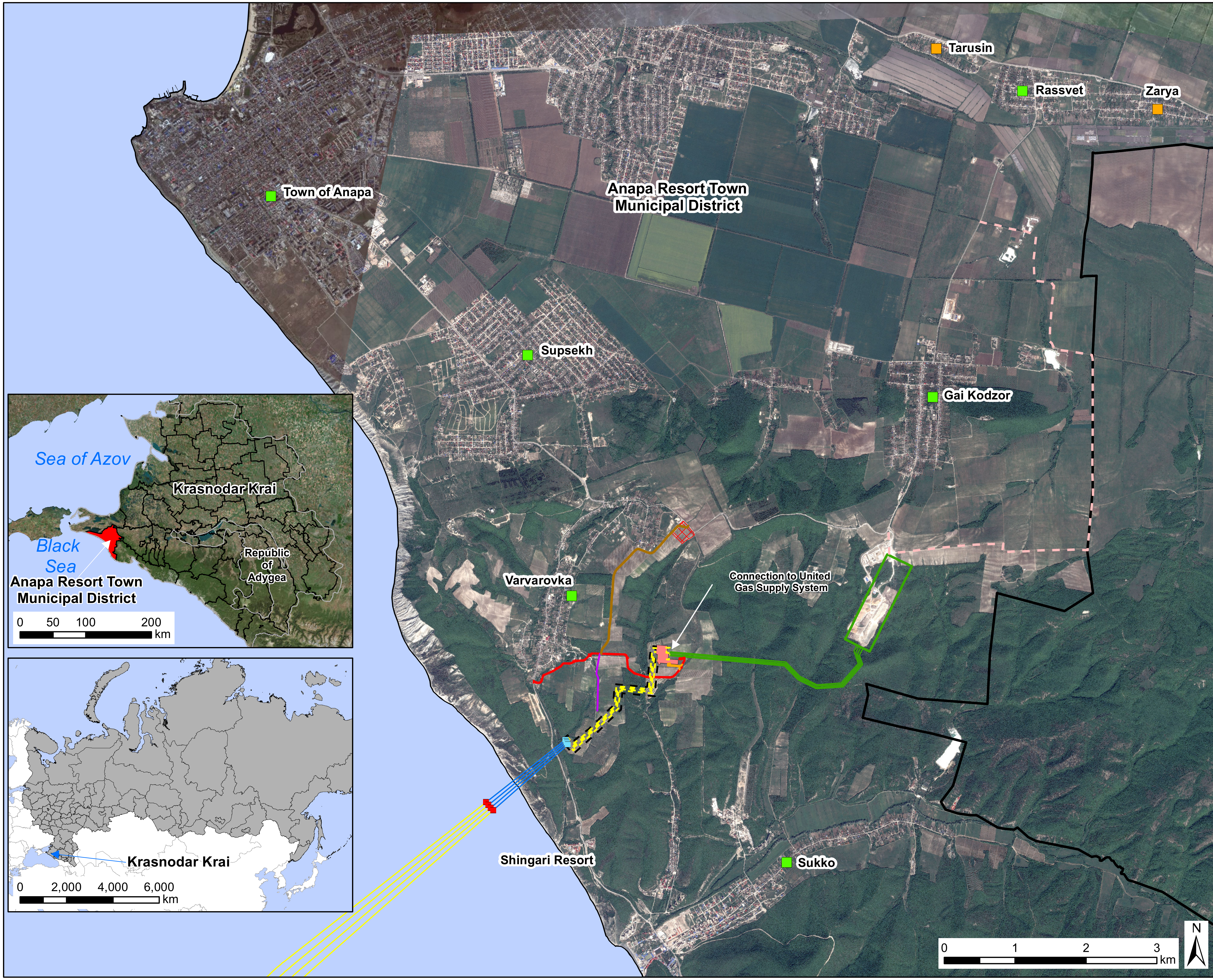
14.3.3 Study Area and Zone of Influence

Onshore and offshore socio-economic Study Areas were identified and mapped in the Scoping Report. The Onshore Study Area included the area within 2 km of the landfall section of the Project and also within a 300 m zone either side of potential (existing) access routes[2]. Offshore, the Study Area was based on a 1 km wide zone following the nearshore and offshore route of the Pipeline, ending at the EEZ border between Russia and Turkey; this is the area in which the construction vessel spread will operate. The Study Area definition provided a primary frame of reference to consider the potential impacts arising as a result of the Project on its immediate surroundings. References in this chapter to the Study Area refer to the Onshore Study Area unless otherwise stated.

The Project may also give rise to economic impacts at a range of geographic scales, from the national scale (Russian Federation) to the regional scale (Krasnodar Krai), to the municipal district level (Anapa Resort Town (ART)[3]). Any impacts within the Study Area will usually be at the local scale (the Local Communities), although this assessment has also identified the town of Anapa and Rassvet as Local Communities due to the potential for possible impacts associated with workforce accommodation and construction traffic. For the socio-economic impacts described in this chapter, the anticipated zones of influence are also identified. Economic impacts, for example, may be experienced at all levels, whereas community and transport-related impacts are generally local. Exceptions to this pattern are clearly stated under each respective impact assessment.

[2] An access route is a collection of roads on which project traffic is carried, which (i) runs within a community, and (ii) may be expected to experience an increase of 30% in heavy traffic/overall traffic volumes, except for very sensitive receptors where an impact could be experienced with a 10% increase.

[3] Hereafter, this level will always be referred to as the Anapa Resort Town (or ART where abbreviated) and refers to the entire municipal district administrative level which encompasses the Town of Anapa and the identified Local Communities, as well as other communities.



LEGEND

- Local communities
- Other communities
- Anapa resort town municipal district boundary

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Landfall facilities
- Proposed microtunnels
- Proposed offshore pipelines
- Microtunnel entry shaft
- Microtunnel exit pit
- Construction corridor
- Permanent access road to be constructed by SSTTBV
- Temporary access road constructed by SSTTBV
- Varvarovka bypass road (used by Project during construction only)
- Transfer site

United Gas Supply System

- Russkaya compressor station
- United Gas Supply System pipelines
- Permanent access road to be constructed by Gazprom Invest
- Gazprom Invest temporary bypass road to be utilised by SSTTBV

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue
For Information

Client
South Stream
Offshore Pipeline
ENERGISING EUROPE

Project Title
SOUTH STREAM
OFFSHORE PIPELINE

Drawing Title
NATIONAL, REGIONAL AND
MUNICIPAL DISTRICT CONTEXT
OF THE PROJECT

Drawn	Checked	Approved	Date
DH	RW	MW	25 Feb 2014

URS Internal Project No.	Scale @ A3
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Drawing Number
Figure 14.1
Rev

14.4 Methodology and Data

To assess potential socio-economic effects, data and information for the relevant baseline characteristics have been identified and considered. Data have been collected and presented at different spatial levels (national, regional, municipal district and local levels, as appropriate).

Socio-economic data and information included in this assessment have been obtained from a wide range of sources including secondary sources (i.e. existing data including census statistics, government or academic reports, etc.) and primary sources (i.e. new data collected through interviews, field surveys and stakeholder engagement activities, as described in **Chapter 6 Stakeholder Engagement**.

Where possible, the baseline characteristics section presents data for the Local Communities individually. For certain aspects of the baseline, data is only available at the Supsekh Rural District and Gai Kodzor Rural District levels. These cases are clearly indicated.

14.4.1 Data Sources

In the Russian Federation, there are generally good-quality social statistics at national, regional (Krasnodar Krai) and municipal district (Anapa Resort Town) levels. Some statistics at all three levels are collected by the national statistical agency Rosstat, while other statistical data are collected by the regional statistical agency Krasnodarstat or by the municipal district administration.

Data on local level administrative units, such as those within which the Local Communities fall, is available but limited. The extent of the available data was determined by contacting and visiting the local government administrations. Some current data were not available as they are not recorded at the local level. Therefore, primary data collection consisting of specific surveys and studies was needed to obtain the required data.

The following sections set out the secondary data obtained, the data gaps identified, and the primary data research and baseline surveys undertaken to supplement available secondary data.

Secondary Data

Secondary data and information was obtained from relevant regional and national bodies and for the identified Local Communities. The secondary data was obtained from publically available databases and by contacting local government authorities and explaining data needs with requests for access to data, and then accessing and recording the data in local government offices.

The main sources of secondary data include:

- Information provided by the Krasnodar Krai Territorial Authority of the Russian Federal State Statistics Service (ROSSTAT);

- Information provided by the Anapa Resort Town (ART) municipal administration, Gai Kodzor Rural District administration, and Supsekh Rural District administration;
- Information published on the official website of the Russian Federal State Statistics Service (www.gks.ru);
- The Russian Federation Common Interagency Information Statistical Service (www.fedstat.ru); and
- The results of the Russian Federation 2010 National Census (www.perepis-2010.ru).

Data Gaps

Analysis revealed a number of data gaps which were most acute in the following areas:

- Demographics and migration;
- Economy, including the ART municipal district tourism sector and construction sector; and
- Housing and the property market.

Primary Data Collection

In light of the data gaps that emerged from the review of secondary data, a data collection exercise was undertaken with the aim of obtaining additional secondary data within the respective zones of influence. It sought to supplement the secondary data gaps as well as to verify and ground-truth the secondary data in order to better understand the key social issues and constraints. Primary data on socio-economic characteristics were collected during field visits in 2012, 2013 and 2014. These visits included observations of conditions in the Local Communities; meetings and interviews with local government authorities and local businesses including fisheries enterprises representatives and tourism entities; and a survey of existing traffic volumes near the landfall. The visits sought to:

- Observe and ascertain the prevailing socio-economic characteristics in the area;
- Conduct socio-economic baseline studies and collect data;
- Conduct qualitative interviews with local officials in order to build up a more detailed picture of the socio-economic environment in the Study Area and zones of influence, particularly within the identified Local Communities; and
- Observe and ascertain the condition of roads and other infrastructure that may be used by the Project.

Table 14.1 lists the stakeholder engagement activities to date which have informed the primary data collection efforts, as indicated by the purpose and topic and the meeting[4]. (Other meetings which have been held, including those which have informed the identification and prioritisation of stakeholder issues are presented in **Chapter 6 Stakeholder Engagement**.)

[4] This table includes meetings concerning the ESIA and does not include meetings concerning land acquisition, land / facilities use, or permitting.

Table 14.1 Stakeholder Engagement Activities to Date

Stakeholder Name	Date	Purpose and Topic of Meeting
ART Municipal District Administration	20 August 2012	Regional and local socio-economic baseline data collection for ESIA
Gai Kodzor Rural District Administration	21 August 2012	Regional and local socio-economic baseline data collection for ESIA
Supsekh Rural District Administration	23 August 2012	Regional and local socio-economic baseline data collection for ESIA
Supsekh community	10 December 2012	Scoping Open House Community Meeting
Sukko and Varvarovka Community	11 December 2012	Scoping Open House Community Meeting
Gai Kodzor Community	12 December 2012	Scoping Open House Community Meeting
Local NGOs in Anapa Resort Town	13 December 2012	Scoping consultations
National NGOs in Moscow	14 December 2012	Scoping consultations
Briz Fisheries	25 March 2013	Regional and local socio-economic baseline data for ESIA
Supsekh Rural District Administration	26 March 2013	Regional and local socio-economic baseline data for ESIA
Horse-riding Stables, Sukko	26 March 2013	Regional and local socio-economic baseline data for ESIA
Utrish Nature Reserve	26 March 2013	Regional and local socio-economic baseline data for ESIA
ART Municipal District Administration	27 March 2013	Regional and local socio-economic baseline data for ESIA
Utrish Nature Reserve	18 April 2013	Introductory meeting and to gather information/data on the reserve.
Anapa Resort Town Municipal District Administration	31 May 2013	Public Hearing on EIA documentation
OOO Morskoy Club (Fishing Organisation in Bolshoy Utrish)	14 October 2013	Fisheries data / information request

Continued…

Stakeholder Name	Date	Purpose and Topic of Meeting
RPK Briz (Fishing Organisation with office in Varvarovka)	14 October 2013	Fisheries data / information request
OOO RAM (Fishing Organisation in town of Anapa)	15 October 2013	Fisheries data / information request
Fond Yug	16 October 2013	Local socio-economic data / information request
Agrifirm Kavkaz	16 October 2013	Local socio-economic data / information request
Shingari Holiday Complex	16 October 2013	Local socio-economic data / information request
Environmental Specialist, town of Anapa	16 October 2013	Information on local hiking and horse riding activities
Representative from horse riding company, Varvarovka	17 October 2013	Information on local horse riding activities and business
Vivat Tourism Agency	17 October 2013	Local socio-economic data / information request
Anapa Resort Town Municipal District Administration	5 February 2014	Local socio-economic data / information request
Supsekh Rural District Administration	5 February 2014	Local socio-economic data / information request
Gai Kodzor Rural District Administration	5 February 2014	Local socio-economic data / information request
School of Rassvet	5 February 2014	Local socio-economic data / information request

Complete.

Information from Other Chapters

The socio-economic baseline has also considered information from other chapters, in order to inform and evidence the subsequent assessment of impacts on socio-economic receptors; including but not limited to **Chapter 13 Landscape and Visual**, **Chapter 15 Community Health, Safety and Security, Chapter 16 Cultural Heritage** and **Chapter 17 Ecosystem Services**, as well as Appendix 9.1 and Appendix 14.1. Other chapters of the ESIA Report are cross referenced where appropriate.

14.4.2 Data Assumptions and Limitations

Limitations

The following limitations apply to the data in this baseline:

- Some of the trend series data includes large movements between years, particularly for data during 2010 and 2011. It is likely that the completion of the 2010 data has enabled the statistical gathering agencies to revise statistics based on the 2010 Russian Census. However, it appears that a retrospective revision of data has not been carried out. While this can result in unexplained movement in the trend series data, it indicates that the latest data is likely to be more accurate;
- Where possible, a minimum of five years data has been provided. In some cases, it has not been possible to obtain a full five years of trend series data; and
- In certain circumstances, data is not always available; however, where possible, efforts have been made to obtain qualitative data in place of quantitative data.

It is considered that the above limitations do not compromise the integrity of the assessments made within this chapter.

Assumptions

The following assumptions have been made:

- The Project workforce in the nearshore and offshore sections of the Project will be specialised and non-local. This workforce will be accommodated on the vessels on which they work. The workers will come ashore only for brief periods in transit when rotating on and off the vessels. They are likely to come ashore at a port and proceed with onward travel. This port may or may not be in Russia;
- There will be no accommodation camp for the landfall section workforce; and
- Further to the statement in **Chapter 5 Project Description** that non-local construction workers will be lodged in the nearby towns and villages, it is assumed for the purposes of this assessment that they will lodge in the town of Anapa. This is based on the consideration that it is the town of Anapa, rather than the Local Communities, that is most likely to have a sufficient supply of suitable accommodation options available for requirements given the anticipated number of non-local workers.

Chapter 15 Community Health, Safety and Security states that South Stream Transport (or the Contractor) will undertake a Rapid Health Appraisal of the potential socio-economic and health impacts related to the preferred option(s) for workforce accommodation during the Construction and Pre-Commissioning Phase. The purpose of this appraisal is to avoid significant adverse impacts on Local Communities by identifying potential impacts and appropriate mitigation and management measures before the start of construction. The appraisal will include consultation with applicable local and regional authorities, including health and social service providers.

14.5 Socio-Economic Baseline

This section provides a summary of the baseline methodology (including data sources and limitations), and describes the baseline socio-economic characteristics of the Project Area and Study Area. The section is structured as follows:

- Section 14.5.1: Geographic and Political Context;
- Section 14.5.2: Administrative Framework;
- Section 14.5.3: Introduction to Local Communities;
- Section 14.5.4: Population and Demography;
- Section 14.5.5: Economy;
- Section 14.5.6: Employment and Livelihoods;
- Section 14.5.7: Land Ownership;
- Section 14.5.8: Land and Marine Area Use;
- Section 14.5.9: Social Infrastructure and Services;
- Section 14.5.10 Tourism, Recreation and Leisure;
- Section 14.5.11: Fisheries;
- Section 14.5.12: Vulnerable Groups; and
- Section 14.5.13: Baseline Summary and Key Findings.

Information presented in Section 14.5.4 to Section 14.5.6 includes data for the Russian Federation, Krasnodar Krai and the ART municipal district, as well as at the Local Community level where available, in order to demonstrate how local demographic and socio-economic characteristics compare with the national and regional levels.

Information presented in Section 14.5.3 and Section 14.5.7 to Section 14.5.14 focuses primarily on the municipal district and/or local level (Local Community), with occasional reference to regional and federal level data where relevant.

14.5.1 Geographical and Political Context

14.5.1.1 Geographical Context

The South Stream Offshore Pipeline will extend across the Black Sea from the Russian coast near Anapa, to the coast of Bulgaria near Varna. It travels through Russian territorial waters, the Russian EEZ, the Turkish EEZ, the Bulgarian EEZ, and Bulgarian territorial waters.

14.5.1.2 Political Context

Russia's political system is based on the 1993 Constitution and is a democratic federal law-governed state (Ref. 14.6). The President is the head of state, and the Prime Minister has responsibility for running the government. The Prime Minister is appointed by the president, and confirmed by the State Duma. Parliamentary elections were held in 2011 and presidential elections in 2012, with Vladimir Putin coming to power and appointing Dmitry Medvedev as Prime Minister. The ruling party is United Russia.

Vladimir Putin was Boris Yeltsin's successor and, since then, has been Russia's dominant political figure. Putin served two terms as President before becoming Prime Minister, and then subsequently resuming the Presidency in 2012. Putin won presidential elections in 2000 and again in 2004. In the elections of 2008 Putin was barred by the Constitution from running for a consecutive third term as President, instead making way for Dmitry Medvedev (Ref. 14.7) who appointed Putin as Prime Minister. When Putin returned to the Presidency in 2012, Medvedev was appointed as Prime Minister.

14.5.2 Administrative Framework

14.5.2.1 Introduction and Overview

National, Regional and Municipal District Sub-Level Administrative Structure

Figure 14.2 shows the location of the Project in relation to the national, regional and municipal district levels of local government. A brief description of each level of government and relevant administrative framework is provided below.

Russian Federation

The Russian Federation consists of 83 federal administrative units of different extent and status. The administrative structure and organisation of the Russian Federation is described further in **Chapter 2 Policy, Regulatory and Administrative Framework**.

Krasnodar Krai

Krasnodar Krai is located approximately 1,000 km south of Moscow. It occupies the whole of Russia's Black Sea coast and contains the country's main beach resorts. This region has grown in popularity, particularly with tourists, since the fall of the Soviet Union as more Russians choose to take seaside holidays within Russia rather than along Ukraine's Black Sea Coast.

The largest cities in the region include Krasnodar (with a population of 709,800), Sochi (334,300), Novorossiysk (227,900) and Armavir (189,100). Krasnodar Krai's southern-most coastal city Sochi hosted the 2014 Winter Olympic Games; preparations for this resulted in considerable spending on infrastructure in the region, especially in and around Sochi.

Anapa Resort Town Municipal District

The ART municipal district is one of 38 administrative districts within Krasnodar Krai and it has the status of a city or municipal district (Ref. 14.8). ART has a growing population, which reached approximately 147,000 in 2012 (Ref. 14.9) and covers a total area of 982 km^2. It borders the Black Sea to its west, Temryuk District to the north, Krymsk District to the east and the port city of Novorossiysk to the south. The administrative centre is the town of Anapa (approximately 59,000 inhabitants) and there are 52 communities in total within the municipality, including the five designated as Local Communities for the ESIA: Gai Kodzor, Rassvet, Sukko, Supsekh and Varvarovka. The town of Anapa is also designated as a Local Community.

The ART municipal district was designated a health resort town in 1957 (Ref. 14.10) and is designated at a Russian federal level as a specially protected natural area[5] (SPNA) (Ref. 14.11), under the category of 'health improving (spa) resort area' known as the Anapa Sanitary Protection Area (SPA) (Ref. 14.12). The Anapa SPA designation entails a series of development control regimes that apply to three different sanitary protection zones (SPZs) within the SPA, the general purpose of which is to protect the area from any activities that may adversely affect the natural therapeutic resources and sanitary conditions of the resort town area (Ref. 14.13) (see **Chapter 2 Policy, Regulatory and Administrative Framework** for further information).

The area around and between the communities of Gai Kodzor, Rassvet, Supsekh, Sukko and Varvarovka is primarily woodland or agricultural land. Vineyards account for most of the agricultural land, although the level of active cultivation varies. The pipelines will be located on a gently sloping plateau, which is separated from the Black Sea by a steep coastal cliff. Watercourses include the Shingar River and an unnamed tributary of the Sukko River; both rivers are intermittent (i.e. seasonal) and flow approximately north to south across the landfall section.

The state of the road infrastructure in the area is variable. Main roads linking the Local Communities to the town of Anapa are sealed and appear well-maintained. Some of the local roads between and within the Local Communities are simple dirt tracks. Traffic in the area varies according to the number of tourists in the area, and is highest during the summer months.

Municipal District Sub-Level Administrative Structure and the Local Communities

The ART municipal district includes one urban district, the town of Anapa, and ten rural districts. Two of these rural districts include the Local Communities identified for this socio-economic impact assessment), as shown below:

- Gai Kodzor Rural District, which includes the communities of Gai Kodzor and Rassvet[6]; and
- Supsekh Rural District[7], which includes the communities of Supsekh, Varvarovka and Sukko.

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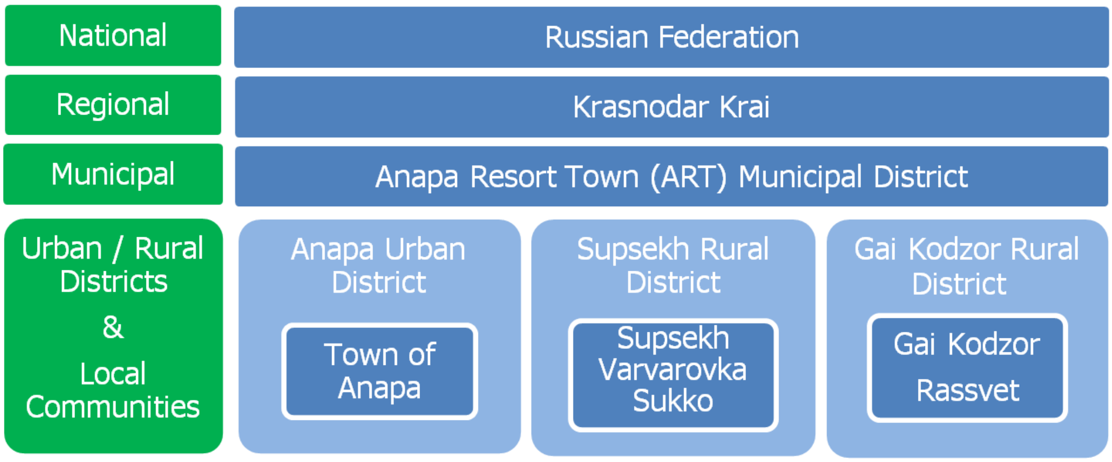
[5] SPNA zones can also be designated for a number of other purposes such as wetlands, protected natural landscape, traditional nature use, national parks, natural moments, etc.

[6] Gai Kodzor Rural District contains four rural communities in total; these are Gai Kodzor village, Rassvet, Khutor (a smaller community), and Khutor Zarya and a total population of approximately 6,000 people in 2011 (Ref. 14.15). The total area of this Rural District is approximately 33 km^2

[7] Supsekh Rural District contains six rural communities in total. These are: Supsekh, Sukko, Varvarovka, Prostornyi, Bol'shoi Utrish and Malyi Utrish.

Figure 14.2 Project-Related Russian Sector Administrative Structure



14.5.3 Introduction to Local Communities

14.5.3.1 Overview

Table 14.2 provides a summary of some of the key statistics for the Local Communities and is followed by a short description of each Local Community.

Table 14.2 Local Communities – Area and Population (2012)

Local Community	Area (ha)	Population	Proportion of ART Municipal District Population
Town of Anapa	N/A	59,000	40%
Gai Kodzor	175	3,370	2.3%
Rassvet	94	1,410	1.0%
Sukko	396	3,150	2.1%
Supsekh	635	8,760	6.0%
Varvarovka	215	2,250	1.5%

Sources: Area of Local Communities (Ref. 14.14). Population figures: Town of Anapa (Ref. 14.15); Gai Kodzor and Rassvet (Ref. 14.16); Sukko, Supsekh and Varvarovka (Ref 14.17). Note: Population figures rounded to nearest 10 people. Population for Rassvet does not include the adjoined village of Zarya, which has a population of approximately 1,180 people.

14.5.3.2 Local Community Profiles

Town of Anapa

The town of Anapa, located approximately 8 km north of the landfall section of the Project at its closest point, is the only designated urban district[8] within the ART municipal district and is the seat of the municipal district administration. The town of Anapa's importance as a tourist centre is underlined by the designation of the wider municipal district as a 'resort town'. The town is one of a number of holiday resorts along the Black Sea coast and is a popular holiday destination for Russian tourists, especially for family holidays and children's activities. The town of Anapa has a population of approximately 59,000 (Ref. 14.15). It is served by an airport, railway station and bus station and is also easily accessible by road via the M25 which is part of the intercity regional road network in Krasnodar Krai (see Appendix 9.1 for further detail on transport infrastructure in the area).

As one of the main holiday resorts on the Black Sea coast, the town of Anapa relies heavily on tourism. The resident population increases seasonally when tourists visit the area; the high tourist season runs through July and August and can extend into September.

Gai Kodzor

Gai Kodzor (Figure 14.3) is the administrative centre of the Gai Kodzor Rural District. Gai Kodzor has a population of approximately 3,370 within an area of approximately 175 ha.

Figure 14.3 Gai Kodzor

The southern edge of the community lies approximately 3 km northwest of the Project Area and approximately 4 km from the landfall facilities. The section of road passing through Gai Kodzor is one that was considered as part of the access to the landfall section of the Project, but a bypass road has since been built around the community by Gazprom Invest and it will also be used by Project construction traffic. The community is built on either side of the existing paved road. Approximately 70% of the population is Armenian (Ref. 14.16). A community centre, a

[8] As a sub-municipal district level administrative unit.

school, a bakery and various shops are located along the road running through the community. Site visits noted that some local residents of Gai Kodzor sell their produce along the road, e.g. fruit.

Rassvet

Rassvet is a small community located within the Gai Kodzor Rural District. Rassvet has a population of approximately 1,410 within an area of approximately 94 ha, and is bounded to the north by the M25. The community lies approximately 5 km north of Gai Kodzor community at the junction of the M25 and the proposed construction access route heading south towards the landfall section of the Project. To the immediate east of Rassvet is an adjoining but separate smaller community of Zarya (population approximately 1,180), while to the west and separated by a strip of open land is the much smaller and also separate community of Tarusin (population approximately 390). Similar to neighbouring Gai Kodzor, the population is nearly 60% Armenian, with the remaining 40% being of Russian ethnicity (Ref. 14.71).

The community has a school, nursery school, post office, community centre, car wash and tyre shop, hardware store, bottled water facility, supplier of sewage/water tanks, as well as a small number of shops along the main road. In addition to the retail premises, site visits noted that some local residents of Rassvet sell their produce, e.g. vegetables and watermelons, along the M25 road; while residents living on the main north-south road through Rassvet (ulitsa Kommunarov) sell goods such as potatoes along the road (Ref. 14.18).

Sukko

Sukko (Figure 14.4) is part of the Supsekh Rural District and lies on the coast. Sukko has a population of approximately 3,150 within an area of approximately 396 ha. Sukko Beach is located approximately 3 km south-east of the Project landfall section construction area, while the nearest residential properties on the northern outskirts of the town of Sukko are located approximately 2 km southeast of the Project Area, with the intervening land consisting of dense woodland. A water well in Sukko will be used to supply water during the Construction and Pre-Commissioning Phase of the Project; however, due to seasonal constraints, water will only be abstracted between October and April.

Sukko is organised along a single, long road that runs through the middle of the community with one end of this road leading to the beach, which is the main, easily accessible public beach between the town of Anapa and the Utrish Specially Protected Natural Area (SPNA). Tourism is well established in Sukko and there are more tourist facilities in Sukko than in the other Local Communities (including Supsekh even though Supsekh is a larger community) due to Sukko's prominence as a tourist destination being located on a beach (the other Local Communities, excepting the town of Anapa, being located inland). The town has well-developed tourist infrastructure and services including recreation centres, fishing and horse riding facilities. Accommodation facilities in the community include over 300 hotels; seven health resorts, sanatoria and health improvement centres; and three children's and tourist camps. One of the children's holiday camps is located next to the public beach (Smena or 'Time Off'), which is well known in the area. In addition, Sukko has a kindergarten, a sports centre and a healthcare facility, as well as many restaurants, shops and kiosks catering to visiting tourists. Many of the buildings in this community are four to five storeys high and appear to be hotels. Most other buildings are one to two-storey detached houses. Marine activities include scuba diving, yachting and recreational fishing.

Figure 14.4 Sukko

Supsekh

Supsekh, located approximately 4 km north of the landfall section (refer to Figure 14.5), is the administrative centre of the Supsekh Rural District. Its population is approximately 8,760 and its area is approximately 635 ha.

Supsekh is close to the town of Anapa and, although physically separate, it appears to function as a suburb of the town of Anapa; a high proportion of its residents work in the town of Anapa, and access services and facilities there. The housing in the community is of a similar size and quality to that observed in Varvarovka. However, the community has a more extensive range of social infrastructure, including schools and community centres, and several retail and service outlets including supermarkets, a pharmacy and restaurants.

Figure 14.5 Supsekh with the Town of Anapa in the Background

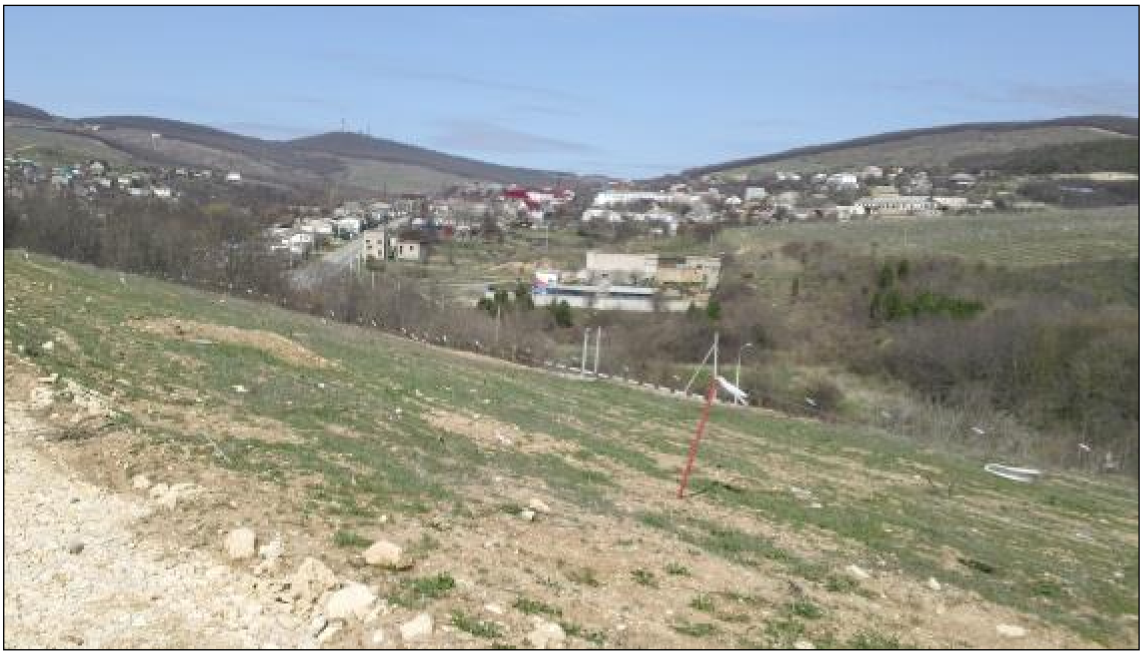
Varvarovka

Varvarovka is the closest community to the Project. The nearest identified buildings are located to the north-west within approximately 1 km of the landfall section; the intervening land is agricultural in nature with some woodland. A Project transport route from the water well in Sukko (which will supply the Project) will run along the southern edge of the community. In addition, the community lies on a section of road that was considered for access to the Project landfall section during construction; however, a Varvarovka Bypass Road will be constructed as part of the Project and used by construction traffic to avoid construction vehicles travelling on the main road through Varvarovka during the Construction Phase.

Varvarovka (Figure 14.6) occupies an area of approximately 215 ha with a population of approximately 2,250 and is located within the Supsekh Rural District. The population is mainly ethnic Russian with a significant Armenian minority forming around 40% of the population. It is located approximately 2 km south-east of the community of Supsekh.

Varvarovka consists of two main streets, one asphalted (or paved), which are connected at several points by dirt tracks. Most houses are single or two-storey detached structures arranged along the hill which slopes through the community. Varvarovka has a number of amenities such as a nursery and a general school, a community centre and a sports centre along with a few small shops. The Kavkaz Winery (together with a separate but related firm, ZAO Agrifirm Kavkaz) is well-known for grape production and wine making, and is located in the community. This enterprise includes wine-processing facilities, a distribution and administrative centre and a wine shop, all located along the main paved road. Varvarovka is also the headquarters of Briz, one of two small commercial fishing organisations in the Anapa area.

Figure 14.6 Varvarovka (Viewed from the Lesnaya Polyana site)



14.5.3.3 Shingari and Don Holiday Complexes

Approximately 2 km south of Varvarovka, between Varvarovka and Sukko, are two neighbouring holiday complexes (tourist resorts) known as the Shingari and Don holiday complexes, which are not considered in this chapter to form part of any of the Local Communities. They are located approximately 1.5 km south of the landfall section. Shingari is a privately owned complex of holiday residences built on the coastal cliff top adjacent to the landfall section. There is a beach in front of Shingari immediately below the complex which is accessible to guests staying at Shingari by steps from the resort. The Don complex is located opposite Shingari on the north side of the roadway running between Varvarovka and Sukko, and its residents also have access to the beach via a path that runs on the outside of the Shingari complex perimeter boundary.

Shingari reported that it has capacity for approximately 300-370 guests and that it welcomes approximately 6,000 to 7,000 guests per year. It is a year round resort, although the peak season (during which time occupancy is 100%) runs from June to early October. The shoulder season starts at the beginning of May, during which time they typically achieve 50% occupancy. At other times, they tend to operate at approximately 20 to 30% capacity. Shingari mostly works with corporate clients and most guests are company employees who have been provided vouchers to stay at the complex by their companies. Most visitors are from different regions of Russia, with around 3% of visitors coming from other countries within the former Soviet Union. Around 150 people are employed by Shingari although this rises to 200 during peak season. Most employees are local and reside in Anapa.

The Don holiday complex has capacity for 50 guests, and it is understood that Don operates on a similar basis, although only for employees or other people associated with Russian Railways, and it is not open to the public (Ref 14.19) (see also **Chapter 17 Ecosystem Services**).

14.5.4 Population and Demography

14.5.4.1 Population

Russia experienced a steady decline in its population from 1991 through to 2009 due to declining birth rates, rising death rates and emigration. However, since 2010, the nation's population has grown[9], reaching 143.0 million in 2012 (an increase of 0.6% over the period 2007 to 2012) (Ref. 14.20). A similar trend is observed in Krasnodar Krai, where the population in 2012 was estimated at approximately 5.3 million, and population increased by 3.6% over the five years to 2012 (Ref. 14.15).

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[9] This reversal is likely due to a combination of increased confidence in Russia's economic prospects as a result of continued steady economic growth and also government polices to stimulate population growth. One policy, known as the 'maternal capital' scheme provides vouchers worth approximately RUB 400,000 (approximately US$13,000) and which are given to mothers who have two or more children (this figure is indexed every year). This has been provided since 2007 and the vouchers can only be used for a limited range of purposes such as home improvements, education, and the mother's pension savings.

In the ART municipal district, the population increased by 9.1% during the period from 2007 to 2012. In 2012 it was 147,200, with about 40% living in the town of Anapa itself (Ref. 14.15).

Of the Local Communities, the town of Anapa is the largest, with 59,000 people, followed by Supsekh with approximately 8,760 people. Varvarovka, Gai Kodzor and Sukko are relatively small at 2,250, 3,370 and 3,150 people respectively (town of Anapa data (Ref 14.15); Gai-Kodzor data (Ref. 14.16); Sukko, Supsekh and Varvarovka data Ref 14.17). Rassvet is the smallest of the Local Communities with a population of approximately 1,410 (Ref. 14.16).

The ART Municipal District, including the Local Communities, is experiencing a higher rate of population growth than that seen at the national and regional levels, owing to higher birth rates, lower death rates and positive net migration. The main factors contributing to migration growth are the influx of migrant labour for the construction, tourism and agricultural sectors, as well as a relocation programme run by the Russian military to resettle service personnel to the area on retirement (Ref. 14.21).

14.5.4.2 Demographics

The gender ratio at the national and regional levels is approximately 46% male and 54% female, while in the ART municipal district it is 47% male and 53% female. The profile of the Local Communities is similar (Ref. 14.15).

Whereas at the national and regional levels there has been a slight decrease in the proportion of the population that is of working age, in the ART municipal district during the period 2007 to 2011, the number of people of working age increased by approximately 14% (from 84,200 to 95,900). The biggest contribution to this increase comes from females (Ref. 14.15). This is in line with the economic growth that ART has been experiencing in recent years.

Ethnic Russians form the great majority of the population at national and regional levels, making up more than 80% of the population (Russian Federation data Ref. 14.22; Krasnodar Krai data Ref. 14.23). The ART district is characterised by a high proportion of ethnic Armenians (Ref. 14.24). The ethnic composition of the Local Communities is broadly as follows:

- Varvarovka: Russians, plus other ethnic groups (excluding Armenians) account for approximately 60%; and Armenians for approximately 40%;
- Sukko: Russians, plus other ethnic groups (excluding Armenians) account for approximately 75% and Armenians for approximately 25%;
- Supsekh: Russians, plus other ethnic groups (excluding Armenians) account for approximately 50% and Armenians for approximately 50% (Ref. 14.17);
- Gai Kodzor[10]: Armenians account for just over 70% of residents, with Russians accounting for around 26%. Other groups include Ukrainians, Yezidy[11], Greeks and Tatars (Ref. 14.25); and

[10] In 2011, the entire rural district has a population of approximately 5,980 people. Accordingly, Gai Kodzor and Rassvet together account for approximately 80% of the total population of the Gai Kodzor rural district.

[11] A Kurdish ethno-religious group with Indo-Iranian roots.

- Rassvet: 60% Armenian, with the remaining 40% being of Russian ethnicity (Ref. 14.71).

Most recent migrants to the Russian Federation (almost 90% in 2010 and 2011) have come from the countries of the former USSR (Ref. 14.26). The regional and local migration profile is similar. In Krasnodar Krai in the first half of 2012 more than half (53%) of migrants came from Uzbekistan and 18% came from Armenia (Ref. 14.15). Migrants from these countries are the main immigrants to the ART Municipal District and Local Communities. They migrate to the area to work in tourism and agriculture and, particularly, construction (Ref 14.27; Ref 14.21).

14.5.5 Economy

14.5.5.1 Gross Domestic and Regional Product Indicators

Russian Federation and Krasnodar Krai

The Russian Federation is among the world's largest economies. It is classified by the World Bank and International Monetary Fund as a developing economy and is heavily dependent on natural resources. Table 14.3 gives information on the GVA[12] (i.e. GDP and GRP respectively) for the Russian Federation and Krasnodar Krai. In 2012, the Russian economy grew by an estimated 3.4% in real terms, down from 4.3% growth in both 2011 and 2010 (Ref. 14.26; Ref. 14.28).

Krasnodar Krai ranks eighth in the Russian Federation by gross regional product (GRP). Data for the region indicates that regional economic growth has been strong (Ref. 14.29).

Table 14.3 Gross Economic Output, Russian Federation and Krasnodar Krai

Level	2006	2007	2008	2009	2010	2011	2012
Russian Federation, GDP (trillion RUB)	26.9	33.2	41.3	38.8	46.3	55.8	62.6
Krasnodar Krai, GRP (billion RUB)	484	648	804	862	1,028	1,230	n/a

Source: Russian Federation data – Ref. 14.28; Krasnodar Krai data (Ref 14.30)

Data on the GVA and GVA per capita for the ART municipal district is not available. However, refer above for information in relation to wage levels in the district.

[12] GVA is a measure of the value of goods and services produced by an area, sector or producer minus the cost of the raw materials and other inputs used to produce them. Unlike GDP, GVA does not include taxes or subsidies on the goods and services. GVA is useful for comparing performance across different areas as it is often difficult to allocate taxes and subsidies sub-nationally.

Table 14.4 Annual GDP / GRP Per Capita (thousands RUB)

Level	2005	2006	2007	2008	2009	2010	2011
Russian Federation	126.0	157.9	196.7	238.9	226.0	316.1	380.3
Krasnodar Krai	73.1	94.9	126.8	156.6	166.5	197.3	235.1

Source: for RF 2010-2011 (Ref. 14.26); For RF 2005-2009 and KK 2005-2011 (Ref. 14.31).

Capital investment flows at the national and regional level grew between 2006 and 2011, with a slight downturn at the national level in 2009 following the global economic crisis of 2008 (Ref. 14.32; Krasnodar Krai data Ref. 14.9).

The ART Municipal District also experienced consistent growth over this period (Ref. 14.9). Investment has been concentrated in three key sectors: tourism, recreation and leisure; residential development; and agriculture (Ref. 14.24). No information regarding capital investment flows was available for the individual Local Communities.

14.5.5.2 Economic Sectoral Composition – Overview

Russian Federation, Krasnodar Krai and Anapa Resort Town

In 2010, the composition of the Russian Federation economy broken down into three overarching sectors (as measured by GDP) were as follows: services (60.6%); industry (35.4%); and agriculture (4.0%) (Ref. 14.26). In 2012, they accounted for 60.0%, 36.1%, and 3.9% of the economy respectively (Ref 14.33) (see Appendix 14.2 Economic Data).

In 2012 and at the next level down, wholesale and retail trade accounted for almost 20% of GVA[13]; while manufacturing accounted for a further approximately 15%. Extractive industries, including oil and gas production, account for more than 10% of economic output (Ref. 14.26). (See Appendix 14.2 for a more detailed proportional breakdown of the contribution made by different economic sectors to the Russian economy). In 2011, the Russian Federation became the world's leading oil producer and is the second-largest producer of natural gas. The Russian Federation holds the world's largest natural gas reserves, the second-largest coal reserves, and the eighth-largest crude oil reserves (Ref 14.34).

For Krasnodar Krai, the economy is dominated by construction (accounting for 19.5% of GVA in 2011); retail and wholesale trade (16.4%) and transport and communications (15.1%). Hotels and restaurants (the closet proxy indicator for the tourism sector) accounted for approximately 2.7% of output (Ref. 14.30). However, this figure would not capture other economic activity associated with tourism such as construction activity, transport, retail, real estate and other

[13] The full title used by the Russian statistical agency Rosstat is 'wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods'. Hereafter, we refer to the sector as the wholesale and retail trade sector unless otherwise noted.

services. (See Appendix 14.2 for a more detailed proportional breakdown of the contribution made by different economic sectors to the Krasnodar Krai economy). Construction work associated with the 2014 Winter Olympic Games in Sochi, as well as with tourism more generally along the Black Sea coast, is likely to have contributed to the increased importance of this sector in Krasnodar Krai, which has risen from being the fifth largest sector in 2007 to its current strong position in the economy.

At the municipal district level, the ART municipal district administration estimates that the two leading sectors are the tourism sector and the retail and services sector, each accounting for approximately 40% of economic activity. Construction is estimated to account for approximately 10% of economic activity, followed by agriculture (3% to 5%). Fisheries are estimated to account for less than 1% of economic activity in the municipal district (Ref. 14.35).

Local rural district administration officials estimate that tourism accounts for between 40% and 45% of the economy in the smaller, rural Local Communities (i.e. other than the town of Anapa) (Ref. 14.16 and Ref. 14.27). It is likely to account for the greatest share of the economy in Sukko, while some the other Local Communities are more likely benefit indirectly, in particular by way of their residents being employed in tourism sector businesses. For more detailed information on the role that tourism plays in the Local Communities, see Section 14.4.10.

Fisheries

Fishing in the Russian Federation contributed 0.2% to national GDP in 2010, 2011 and 2012 (Ref. 14.26 and Ref. 14.33). The industry production index for the fisheries sector[14] was 98.5 in 2010 and 112.5 in 2011, indicating relatively strong growth in the value of output in the sector in 2011 after a small contraction the previous year (Ref. 14.26). In Krasnodar Krai, the equivalent figure for contribution to GRP was a constant 0.1% in each year from 2007 to 2011 (Ref. 14.30).

Comparable data for the fisheries sector at the ART municipal district level is not collected on the same basis as at the national and regional levels. However, it is estimated by the ART Municipal District administration that in that district in 2012, the sector contributed less than 1% to the municipal district's economic output (Ref. 14.35).

14.5.6 Employment and Livelihoods

14.5.6.1 Employment Trends

At the national and regional levels, the labour market has been recovering in 2010 and 2011 from the 2009 downturn in employment (Ref. 14.36; Ref. 14.14.15). In contrast, the ART municipal district has experienced steady growth in employment in recent years and does not appear to have been as seriously affected by the global financial crisis (Ref. 14.24).

[14] The index is an economic indicator measuring the value of production year on year as recorded for economic activity in the 'Fishing' sector. The index is expressed relative to the previous year in comparable prices at a base value of 100 such that a figure below 100 indicates contraction in the real value of output while a figure above 100 indicates an increase in the real value, or growth, in that sector.

In the Local Communities, the majority of residents work outside their local community. Sukko records the lowest proportion of people working outside their home community; whereas in Varvarovka and Supsekh more than four out of every five people employed work beyond their community (Ref. 14.17). This indicates that these communities are more likely to have strong economic links with the town of Anapa and the job opportunities provided there.

Seasonal jobs in tourism and related sectors are an important source of employment in the whole of the ART municipal district during the peak tourist season, as shown in Table 14.5. It is understood that this increase in seasonal employment opportunities effectively eradicates unemployment (or at least reduces it to very low levels) in the tourism season (Ref. 14.21). The data indicates that the number of seasonal jobs in the municipal district exceeds the number of people employed in regular jobs by almost two-thirds. The municipal district was not able to give information on the type of jobs performed, nor was it able to give information on the proportion of seasonal migrants in seasonal employment. However, jobs lasting less than one month are not accounted for in the regular employment numbers, so the number may include a variety of casual workers on short contracts. A local official in the Supsekh Rural District administration estimated separately that there are an estimated 500 temporary workers in Sukko in the tourist season working in hotels, trading and in other services such as cleaning (Ref. 14.27).

Table 14.5 Annual Seasonal Jobs in Anapa Resort Town Municipal District, 2006-2011

	2006	2007	2008	2009	2010	2011
Seasonal jobs	35,000	49,000	40,000	70,000	95,000	117,000

Source: Ref. 14.24

14.5.6.2 Unemployment

In Russia, unemployment rose in the wake of the global financial crisis to 8.4% in 2009, and has since declined, as shown in Table 14.6. The total unemployment[15] rate has since dropped further to 5.4% in January 2013, which represents a record low for the last two decades (Ref. 14.37).

Table 14.6 Russian Federation, Total Unemployed Rate, 2008-2011

	2008	2009	2010	2011	Jan 2013
Unemployment Rate (%)	6.3	8.4	7.5	6.6	5.4

Source: Ref. 14.38

[15] Total unemployment is measured through a regular labour force survey employing a sampling based methodology (i.e. the rate is estimated by surveying a subset of the population) and refers to the share of the labour force that is without work but available for and seeking employment.

Although a published unemployment rate is not available for Krasnodar Krai, using published statistics on the total number of unemployed and the economically active population (Ref. 14.15), it is estimated that the total unemployment rate in 2010 was 6.8%.

In the ART municipal district, a comparable measure of unemployment is not available. In order to be comparable, this calculation would need to include both registered and unregistered unemployment numbers, but only registered unemployment estimates are available. However, available information provided by local officials in 2012 indicates that unemployment levels are comparatively low, partly due to the strength of the tourism and construction sectors and also due to seasonal employment (Ref. 14.24). In March 2013, local officials suggested that unemployment in the district was the lowest in the whole of the Krasnodar Krai (Ref. 14.21).

In February 2014, local officials at the Anapa Resort Town Municipal District Administration reported that 616 people were registered as unemployed at that time, including 67 registered unemployed people in the Supsekh Rural District Administration (which includes the Local Communities of Supsekh, Varvarovka and Sukko). However, during the busy summer period the number of registered unemployed in ART falls to approximately 100 people due to the creation of temporary seasonal employment opportunities in the tourism sector. The administration reported that some local residents work during the summer, and register as unemployed to receive social security payments outside of the peak tourist season (Ref. 14.39).

The administration also reported some general characteristics of the unemployed in the ART Municipal District; approximately 60 to 70% of registered unemployed are women, nearly 35% are young people (i.e. 16 to 29 years old) and around 10% are of pre-retirement age[16]. No specific economic sectors are considered to represent a higher proportion of unemployed. Unemployment is considered a key factor contributing to low income households (Ref. 14.39).

Reliable unemployment rate data for the Local Communities were not available but they are expected to closely reflect the municipal district rates. During the summer tourist season, unemployment levels are reportedly very low in Supsekh Rural District as most people find employment in the hotel, restaurant and general tourism sectors. In mid-2013, during the summer peak season, local officials reported that only one person was registered unemployed in Varvarovka; nine in Sukko; and 58 in Supsekh (Ref. 14.17). Reliable unemployment data or estimates for Gai Kodzor and Rassvet were not available.

14.5.6.3 Migrant Labour

Demand for labour, including that generated by seasonal employment peaks associated with the summer peak tourism season, as well as the growth in construction activity in the ART municipal district that has been occurring since 2006, has resulted in new migration patterns at the local level.

Migrant workers come to the ART municipal district from a number of countries of the former Soviet Union states as well as other Russian regions, to work in construction, tourism

[16] Pre-retirement age is a qualitative and commonly used term in Russia, generally understood by people using it to refer to the 10 years leading up to retirement age (which is 60 for men and 55 for women).

(particularly retail trading during the tourism season) and agriculture. For example, migrant workers from Dagestan are employed annually by Agrifirm Kavkaz. See Section 14.4.6.5 for more information specific to those workers.

Generally, the majority of migrants are men aged up to 30-35 who usually do not bring their families with them. Information on the average duration of stay is not readily available, but it is understood from local officials that workers in the hospitality and tourism sector typically stay for the duration of the peak tourism season before returning home again, and tend to return annually (Ref. 14.39).

Local officials report that the type of jobs performed by migrant workers varies depending on their country of origin. Generally migrants from Uzbekistan are employed in the construction and agricultural sectors, whereas migrants from Ukraine and Moldova are more likely to work in the services sector (Ref. 14.59). However, there is evidence to suggest that local people are also employed in the construction sector (see Table 14.7).

As of January 2014, approximately 2,000 foreign migrants were registered with the ART Municipal District Administration (this number does not include internal Russian Federation migrants). It is thought by local officials that the majority of these workers are from Uzbekistan, Moldova, Ukraine and Tajikistan, and that they have come to the area primarily to work in the construction sector (Ref. 14.39).

14.5.6.4 Employment Brokerage Services

The Anapa Employment Centre in the town of Anapa is a government recruitment agency that has previously worked with the private sector and has some experience of liaising with large companies in regard to brokering employment opportunities for local workers. Although the Centre has experienced mixed degrees of success more recently with companies that have stated that they wish to create up to 500 jobs, as to date, no local residents have been employed by these companies. The Anapa Employment Centre also helps local workers to access employment at health resorts (e.g. maintenance and landscaping work) in the lead up to and during the peak tourist season. This is recognised as a form of 'public work', whereby registered unemployed people are often taken on for this work, but also continue to receive social payments during the period they are undertaking such 'public work' employment. Local residents can be engaged on a public works project for between one to two months, and in 2013, 234 people were engaged in public work (Ref. 14.39).

The Anapa Employment Centre also runs a programme for vulnerable groups. Organisations employing local residents who are considered to be vulnerable (e.g. having a disability) receive compensation (Ref. 14.39). There are also some private recruitment agencies operating in Anapa Resort Town (Ref. 14.39).

14.5.6.5 Employment by Economic Sectors

Russian Federation, Krasnodar Krai and Anapa Resort Town

The main sectors in terms of employment for the Russian population in 2010 include the wholesale and retail[17] sector (17.8% or 12.06 million employed people) and manufacturing and process industries (15.2% or 10.29 million people) (Ref. 14.24). In Krasnodar Krai, manufacturing and process industries are the leading sector for jobs, followed by wholesale, retail and repair (Ref. 14.15).

Table 14.7 shows employment in the ART municipal district for selected economic sectors from 2006 to 2010. The wholesale and retail sector is by far the largest employer but in other regards the employment profile differs from the national and regional picture: there is less dependency on manufacturing and processing, and more on agriculture and hotels and restaurants (reflecting the importance of tourism to the municipal district economy).

While the proportion of employment in hotels and restaurants as a percentage of total employment (approximately 2,600 workers in 2010 or 3.6% of total employment) appears relatively low when compared to other employment sectors and given the estimate by the ART municipal district administration that the tourism sector accounts for as much as 40% of economic output, it is still double the national average (1.8%). Further, the number reflects the annual average number of employees per annum working in a given sector and does not include those employed in small enterprises[18] or those in employment for less than one month (Ref. 14.27).

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[17] The full title of this sector is "whole and retail business; repair of vehicles, motorcycles, household equipment"

[18] The definition of a 'small enterprise' is provided in Federal *Law N209-FZ of July 27, 2007 Small and Medium Business in the Russian Federation*. Small and medium enterprises are consumers' cooperatives and business (commercial) organizations, as well as individual entrepreneurs (that operate without creating a legal entity) and farms. Main criteria for identifying small enterprises are: a) the share of governmental bodies, foreign organizations, public and religious associations and other organizations that are not small and medium enterprises should not exceed 25%; b) the average annual number of employees should not exceed 100 persons (incl. 100); c) annual sale proceeds should not exceed 400 million RUR.

Table 14.7 Employment in Anapa Resort Town and Percentage of Total, Selected Sectors

Anapa Resort Town	2006	2007	2008	2009	2010
Total number of workers*	64,800	69,300	70,500	71,500	72,200
Employment by Sector, Percentage of Total:					
Agriculture, hunting and forestry	6.0	5.2	4.7	4.6	4.7
Fisheries	1.1	1.0	1.0	1.0	1.0
Mineral extraction**	1.1	0.3	0.4	0.4	0.3
Manufacturing	5.7	3.6	3.7	3.8	3.7
Electricity, gas and water†	2.2	1.9	2.0	2.1	1.5
Construction	7.3	7.1	7.1	7.0	6.9
Wholesale and retail trade	41.8	45.0	40.0	41.0	42.0
Hotels and restaurants	4.5	3.5	3.4	3.5	3.6
Transport and communication	5.1	3.8	3.8	3.9	4.0
Real estate and renting services	0.5	1.9	2.0	2.0	2.4
Education	5.7	6.5	6.5	6.6	6.4
Healthcare and social services	11.9	12.7	17.9	17.8	16.2
Other community, social and personal service activities	2.3	3.3	3.3	3.6	4.3

Source: (Ref. 14.24)
* As indicated by the number of staff on payroll.
** Mining and quarrying (includes mining of energy and non-energy producing minerals)
† Production and distribution of electricity, gas and water

Local Communities

Data on the breakdown of employment by sector in the town of Anapa is not available. However, given that the town accounts for approximately 40% of the population of the municipal district, the breakdown for the district is likely to be broadly representative of the breakdown by sector in the whole of the Anapa Resort Town municipal district. The main exception to this is likely to be that there will be less of a bias to primary industries such as agriculture and mineral extraction.

Data for employment by economic sector is also not available at the level of the other Local Communities. However, information provided by local officials suggests that in three of the smaller communities (i.e. Varvarovka, Sukko and Gai Kodzor) agricultural sector enterprises, and in particular grape-growing and winemaking enterprises, are the largest employers for people working within those Local Communities. In Varvarovka and Gai Kodzor, such enterprises also account for a majority of jobs within those communities (not including self-employed entrepreneurs and sole traders who may work from home). In comparison, the major employers in Supsekh include enterprises related to construction and manufacturing[19] (Ref. 14.25 and Ref. 14.17). Local officials in the Gai Kodzor Rural District (including both Gai Kodzor and Rassvet) confirmed in early 2014 that a small number of local residents (estimated to be five people) have obtained employment on the construction of the Russkaya compressor station (Ref. 14.18). The town of Anapa is also an employment hub and many residents of smaller nearby rural communities work in the town of Anapa, including in the seasonal tourism industry.

Agrifirm Kavkaz and Kavkaz Winery

There are two firms, with their operations centred on Varvarovka (Agrifirm Kavkaz and Kavkaz Winery), which provide employment for up to approximately 100 people[20]. This includes approximately 40 to 70 workers cultivating the vineyard fields including during the harvest period. These workers are engaged annually from April until the end of the pruning period, usually in mid-November and are seasonal migrant workers, understood to have originated primarily from Dagestan. The remainder, approximately 30 people, include office staff and other workers (e.g. drivers, etc.) and these employees are local to the area (Ref. 14.40).

Migrant workers employed at the Kavkaz Winery live temporarily in cabins near the vineyards of this firm and the Varvarovka village cemetery. These workers farm the vineyards, harvesting and cutting grapes. A maximum of 45 such workers live in these cabins during the harvesting period (Ref. 14.41).

Another winery based in the Local Communities of similar size, Russkaya Loza (with 1,580 ha) is partly based in Supsekh and partly based in Varvarovka, which employs approximately 50 workers in Supsekh Rural District and a further 7 to 8 in Gai Kodzor Rural District (Ref. 14.17; Ref. 14.25). This vineyard is not directly impacted by land acquisition associated with the Project.

14.5.6.6 Livelihoods

Overview

The majority of employment in Russia is formal rather than informal, i.e. most people are employed in regular, paid positions, rather than pursuing subsistence or other informal livelihoods. Nevertheless, some individuals, particularly those on lower incomes such as

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[19] That is, the manufacturing and processing industries sector.

[20] Agrifirm Kavkaz is concerned with the cultivation of approximately 400 to 600 ha of vineyard in the Study Area, while Kavkaz Winery is concerned with wine production.

pensioners, undertake additional economic activities to supplement and enhance their incomes (though they are not characterised as subsistence activities). For instance, there is a long tradition in Russia of household plots being used to contribute towards sustaining livelihoods and more recently, to enhance them.

Local Communities

In the ART municipal district, household plots account for 47% of agricultural output (Ref. 14.21 and Ref. 14.42). Many household plots are used to grow cherries, grapes, and other produce. Households use their own produce and also often sell it at local markets (this includes people registered as self-employed entrepreneurs) (Ref. 14.25). It has also been occasionally observed during site visits that some produce is sold along the roadside in Local Communities. It is possible that this activity makes a contribution to livelihoods.

Fishing is also evident and has been observed in Anapa. Based on observations of a small number of people fishing from piers, this is most likely for recreation rather than as a primary means to support livelihoods. However, according to local officials there may be a very small number of instances of fishing (i.e. from piers or the shore) to supplement livelihoods, although the officials were not able to provide any records or specific examples (Ref. 14.21).

It has been observed that local residents of Sukko appear to rent out rooms to visitors in the summer tourism season; presumably to supplement livelihoods (see Section 14.4.10).

Seasonal employment in tourism and the annual grape harvest is also an important source of employment in the ART municipal district (see Section 14.4.6).

14.5.6.7 Income

Gross Average Monthly Wages

In the Russian Federation, the gross average monthly wage in 2010 was approximately 21,000 RUB (Ref. 14.43). In Krasnodar Krai, the gross average monthly wage in 2010 was approximately 16,330 RUB (Ref. 14.15).

In the ART municipal district, the gross average monthly wage in 2010 was 14,000 RUB. The highest monthly wages in the ART municipal district were in the production and distribution of energy, gas and the water sector, followed closely by the transport and communications sector. Workers in the municipal district in the construction sector, and in the agriculture, hunting and forestry sector, received approximately 12,500 and 10,800 RUB per month, respectively, on a comparable basis[21]. The hotel and restaurant sector, which is important to the local economy given the reliance on tourism, is the lowest paid sector with a gross average monthly wage of approximately 8,100 RUB (Ref. 14.15).

[21] It was not possible to obtain an equivalent figure at municipal district level for workers in the fisheries sector; possibly because of the limited size of the sector in the district. However, at the national level, comparable data for the same year indicated that on average workers in the fisheries sector received an average gross monthly salary over 2.2 times that of workers in the agriculture, hunting and fishing sector. This pattern was also evident in statistics for the preceding five years.

Overall, when comparing the Russian Federation, Krasnodar Krai and ART municipal district across the whole economy, the gross average monthly wages in the ART municipal district are lower than average monthly wages in Krasnodar Krai and the Russian Federation for all sectors apart from agriculture.

Subsistence Level (or Poverty Line)

In 2011, the official subsistence level[22] in the Russian Federation was 6,369 RUB per month (Ref 14.44) and in Krasnodar Krai it was 5,931 RUB per month (Ref. 14.15). Nationally, the percentage of the total population with incomes below the subsistence level has fallen over the period from 2008 to 2012 from 13.4% to 11.0% (Ref. 14.45). Regionally, the percentage of the total population with incomes below the subsistence level fell from 17.7% to 12.2% over the same period (Ref. 14.46). At 5,976 RUB per month, the subsistence level calculated for ART is similar to the official subsistence level in Krasnodar Krai but lower than the national subsistence level. This reflects the relatively lower cost of living in rural areas (Ref. 14.24).

No estimate of the proportion of the total population with incomes below the subsistence level is available at the municipal district or local level. However, it is known that average pensions in the Russian Federation, Krasnodar Krai, and Anapa Resort Town in 2010 were between 7,476, 7,116 and 7,130 RUB, respectively. By the following year, 2011, average pensions had risen to 7,728 RUB in Krasnodar Krai indicating that pensioners' incomes are generally comfortably above the local subsistence level. A figure for Anapa Resort Town was not available (Ref. 14.15).

14.5.7 Land Ownership

Two landowners have been identified in relation to Project-related land acquisition to accommodate the permanent landfall facilities, Right-of-Way (RoW) and permanent access road:

1. Agrifirm Kavkaz (which is in turn owned by a residential and resort property development enterprise, 'Fond Yug') owns the majority of the land that is required temporarily or permanently for the Project; and
2. The Federal Forestry Agency (*Rosleshoz*) which is a governmental body under the Ministry of Natural Resources and Environment which administers national and municipal forests in Russia, including designating protected forests and which is also responsible for reviewing proposals for change of status of forestry lands for other uses. The remaining smaller area of land is administered by this agency and is the land within the Right-of-Way between the agricultural fields.

Agrifirm Kavkaz, which is concerned with vineyard cultivation, is technically a separate entity to Kavkaz Winery, which is concerned with wine production. Agrifirm Kavkaz has approximately

[22] The subsistence level is based on a calculation which takes into account the cost of a consumer goods basket, including for example food, utilities and household products, as well as mandatory payments and fees (according to RF Federal Law dated 24.10.1997 # 134-FZ "On subsistence level in Russian Federation"). It equates to a poverty line, which can be used to gauge the proportion of people living below a certain income level.

2,000 ha of land in total across the wider area, of which approximately 400 to 600 is planted with vineyard. Agrifirm Kavkaz was acquired by Fond Yug in 2008, primarily for the purpose of residential development. Fond Yug has contracted out the cultivation of the vineyards through Agrifirm Kavkaz (Ref. 14.40).

It is understood that Fond Yug bought Agrifirm Kavkaz and its 2,000 ha land holdings in 2008 with the intention to redevelop much of the land for master-planned residential and resort developments, retaining approximately 400 to 600 ha for use as vineyard. Fond Yug's website states that the company is a residential, resort and leisure real estate developer with a total of US$500 million under investment (Ref. 14.47).

Fond Yug's marketing materials indicate that the vineyard and winery businesses are valued by Fond Yug primarily for the prestige factor that the winery is able to bestow upon the residential developments, particularly the 'Chateau Club Village' residential development project. This proposed project offers prospective buyers the opportunity to have a small personal vineyard adjoined to their residence, and the expert advice and support of the Agrifirm Kavkaz staff to assist in the production of each resident's own wine (Ref. 14.40).

14.5.8 Land and Marine Area Use

14.5.8.1 Existing Land Uses

The location of the Project Area is described in Section 14.2.1 and the administrative context is further explained in Section 14.5.2.

Land in and surrounding the Project Area is predominantly forested, interspersed with pockets of open land used primarily for agriculture (including vineyards) and the residential, commercial (including tourism-related enterprises) and community land uses and areas of the Local Communities themselves (see Figure 14.1, Figure 14.7 and Section 14.4.3). Further information on agricultural and forest land uses in the Project Area is given below in Section 14.4.8.2. There are also other land uses including military zones, cemeteries, and memorials within or near the Project Area.

Chapter 16 Cultural Heritage identifies the Varvarovka village cemetery, a mixed Armenian and Russian cemetery (RU-TCH-06), approximately 398 m north of the northern pipeline centre-line and close to the Gazprom Invest Road (permanent access road) and 100 m west of the South Stream Transport temporary access road to the microtunnel site. The Varvarovka village cemetery lies on the eastern edge of Varvarovka village, close to the Agrifirm Kavkaz vineyards. The cemetery is extensive and divided into family plots. It includes the common grave of Soviet soldiers and civilians killed in the fighting and executed by the fascist invaders in 1942 and 1943 (National Monument No. 380). **Chapter 16 Cultural Heritage** also identifies other cemeteries and churches in the wider area and provides more information on uses of land relating to Cultural Heritage. Refer to Figure 16.5 in that chapter for cultural heritage receptor locations.

The Utrish Nature Reserve, a state nature reserve covering the northern extent of the Caucasus Mountains, which includes some paths and trails for recreational users, is located approximately 3.5 km to the southeast of the landfall section of the Project.

14.5.8.2 Existing Land Uses within the Project Area

The landfall section of the Project Area can be divided into three parts: the landfall facilities; the buried pipeline (including construction corridor, potential transfer site and permanent pipeline RoW); and the microtunnels.

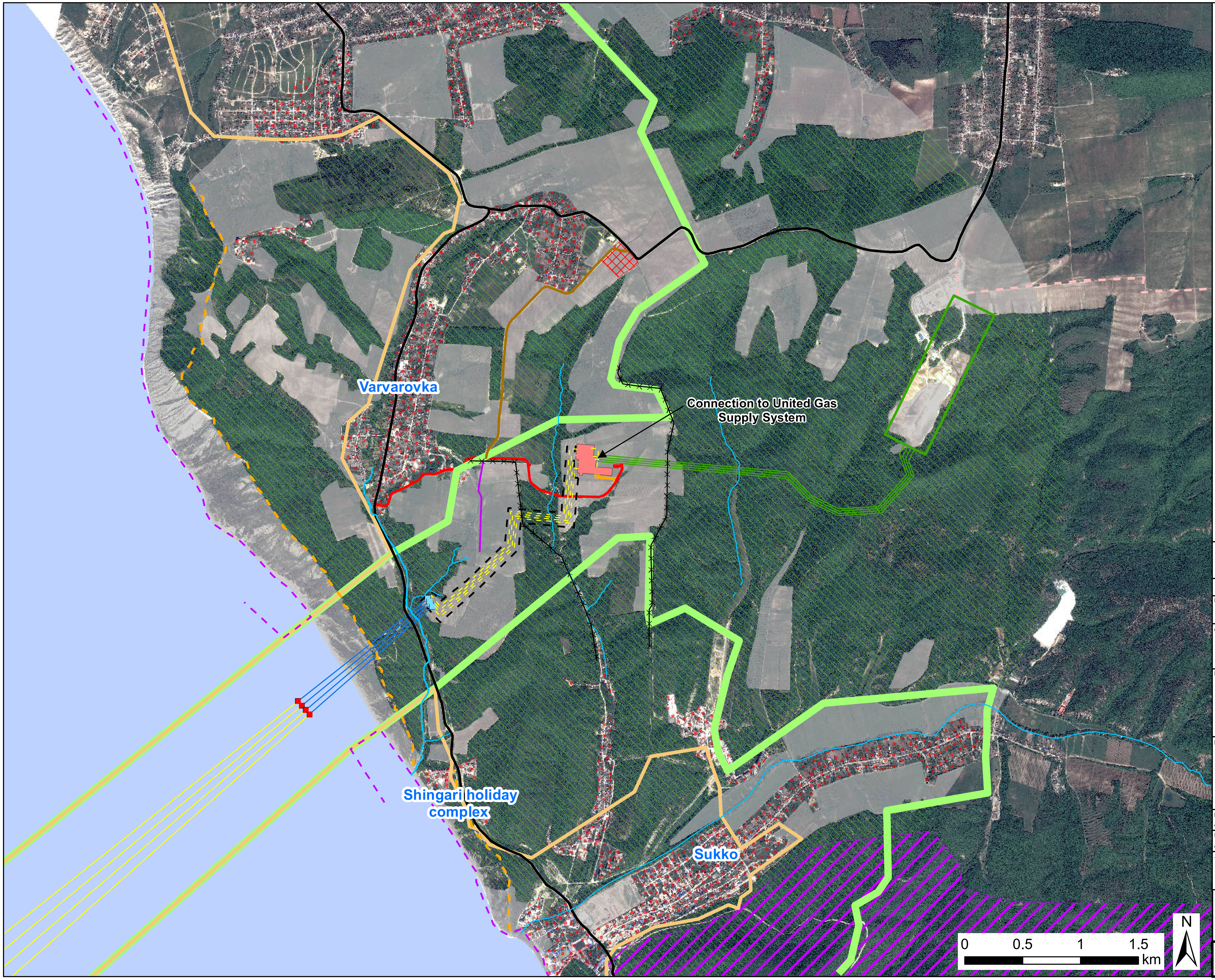
Landfall Facilities

The landfall facilities, and the upstream connection with the United Gas Supply System of Russia, will be located on an existing fallow field. There is no indication that the site is currently used for any commercial or recreational activities; nor that any trails cross the land.

Construction Corridor, Potential Transfer Site and Right-of-Way (RoW)

The construction corridor, including the permanent pipeline RoW for the buried section of the Pipeline, the potential transfer site and the associated temporary construction sites, overlap almost entirely with existing agricultural fields, except for two areas of forest. The main area of forest is an approximately 700 m strip of forest that separates two fields and which will be crossed by the Pipeline construction corridor and RoW. There is another much smaller area of forest at the southern end of the RoW that falls within the boundary of the microtunnel construction site and which is within the landholdings of Agrifirm Kavkaz. There is no evidence that either section of forest that falls within the construction corridor is commercially managed or used either by the respective owners or by any third party for economic or commercial purposes.

Figure 14.8 shows the existing land uses (agricultural fields, uncultivated scrub and forest) underlying the proposed construction corridor and temporary construction areas, including whether the fields are lying fallow, or contain mature or recently planted vineyard.



LEGEND

Sanitary Protection Zone

- The boundary of the first area of sanitary protection zone (exclusion zone)*
- The boundary of the second area of sanitary protection zone (limitation zone)*
- The boundary of the third area of sanitary protection zone (monitored zone)*
- Power lines (mapped within a 1km radius of Project)
- Rivers (mapped within a 1km radius of Project)
- Main roads
- Coastal path

Land use within 4km

- Built Environment
- Forest
- Open Land
- Boundary of the state nature reserve "Utrish"

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Landfall facilities
- Proposed microtunnels
- Proposed offshore pipelines
- Microtunnel entry shaft
- Microtunnel exit pit
- Construction corridor
- Permanent access road to be constructed by SSTTBV
- Temporary access road constructed by SSTTBV
- Varvarovka bypass road (used by Project during construction only)
- Transfer site

United Gas Supply System

- United Gas Supply System pipelines
- Russkaya compressor station
- Permanent access road to be constructed by Gazprom Invest
- Gazprom Invest temporary bypass road to be utilised by SSTTBV

* An application to make these the revised boundaries of the sanitary-mountain protection district is currently awaiting approval from the Federal Government.

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: For Information

Client: South Stream Offshore Pipeline – ENERGISING EUROPE

Project Title

SOUTH STREAM OFFSHORE PIPELINE PROJECT

Drawing Title

GENERAL LAND USE PATTERNS WITHIN 4KM OF THE PROJECT

Drawn	Checked	Approved	Date
AH	CP	AD	18 Feb 2014

URS Internal Project No.	Scale @ A3
46369084	1:30,000

URS Infrastructure & Environment UK Limited
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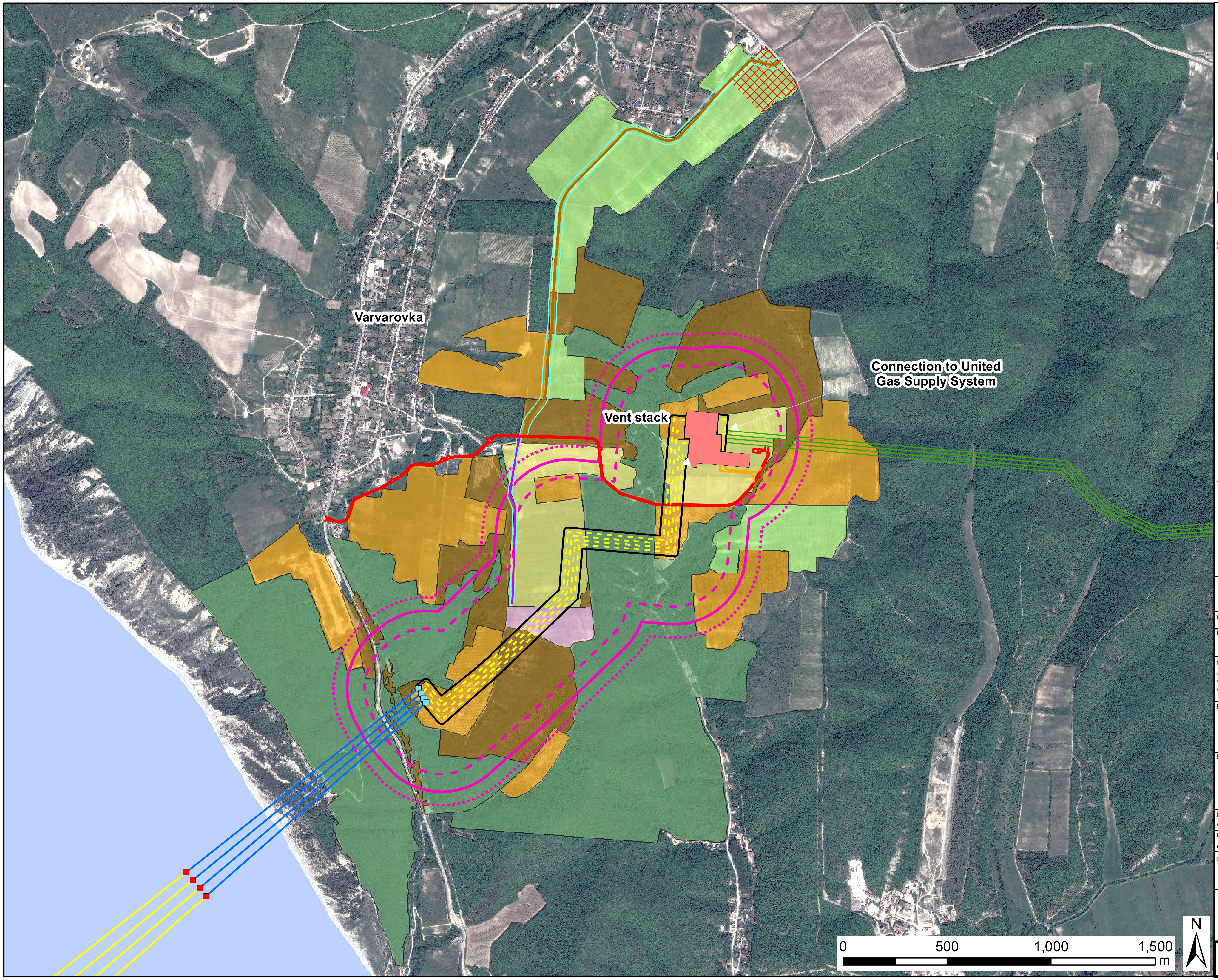
Drawing Number: Figure 14.7

Rev

Plot Date: 18/02/2014
File Name: I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 14 Socio-Ec\Figure 14-7 General Land Use Patterns within 4km of the Project.mxd



LEGEND

Land use (adjacent to Project)

- Productive vineyards
- Fallow field
- Forest
- Mature vineyard (abandoned)
- Recently planted vineyard (abandoned)
- Shrubs/uncultivated

Safety Exclusion Zones

- C- and E-class: no isolated buildings (1-2 levels), dachas, agricultural farms
- B-class: no cities, settlements, apartments of 3 levels or more, no developments/buildings with less than 100 people
- A-class: no airports, railways station, no developments/ buildings with population of more than 100 persons

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Landfall facilities
- Proposed microtunnels
- Proposed offshore pipelines
- Right-of-Way
- Microtunnel entry shaft
- Microtunnel exit pit
- Permanent access road to be constructed by SSTTBV
- Temporary access road constructed by SSTTBV
- Temporary construction area for road construction
- Varvarovka bypass road (used by Project during construction only)
- Transfer site

United Gas Supply System

- United Gas Supply System pipelines
- Permanent access road to be constructed by Gazprom Invest

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue

For Information

Client

South Stream
Offshore Pipeline
ENERGISING EUROPE

Project Title

SOUTH STREAM OFFSHORE PIPELINE

Drawing Title

EXISTING LAND USES WITHIN AND ADJACENT TO THE PROJECT AREA

Drawn	Checked	Approved	Date
AH	RW	MW	13 Mar 2014

URS Internal Project No.	Scale @ A3
46369082	1:17,500

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Drawing Number: Figure 14.8

Rev

Plot Date: 13 Mar 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 14 Socio-Ec\Figure 14-8 Existing Land Uses within and adjacent to the project area.mxd

Historically, the cultivated fields, owned by Agrifirm Kavkaz, that fall within the Project Area were planted with vineyards; however, the land is now a mixture of fallow fields, scrub, and abandoned vineyard. The exception to this is the proposed potential 5.38 ha transfer site and the land within the temporary construction area for the Varvarovka Bypass Road. This land is currently productively used as vineyard but it is also within the confines of a proposed luxury residential development known as Chateau Club Village, the plans for which would retain as much of the vineyard as possible with the exception of sites for the construction of luxury residential homes (see Section 14.4.8.3 for further detail on this proposed development).

Agrifirm Kavkaz has indicated that the majority of the planted vineyards within the construction corridor, potential transfer sites and RoW have not been maintained over the last two to three years. This includes a range of mature and young (i.e. recently planted) vineyards (Figure 14.9). The young vineyard appears to have been planted in the past 24 to 30 months on previously fallow land along the route of the Pipeline in the landfall section.

Areas of shrub or uncultivated land adjoin the southernmost-affected field containing the mature vineyard.

Figure 14.9 Abandoned Mature Vineyards near the Landfall Section

Microtunnels

The entry shafts to the microtunnels are located near the south-western edge of an agricultural field containing a mature but abandoned vineyard. The microtunnels then pass under a very short section of existing mature but abandoned vineyard, shrub and uncultivated land, forested land, coastal cliffs and the sea bed where they emerge onto the sea bed in the nearshore section (discussed under Marine Uses below). The microtunnels also pass under the Varvarovka-Sukko Road and a cliff top edge walking trail (the Mountains of the Caucasus trail). For more detail about this trail see Section 14.4.10.

14.5.8.3 Future Land Use

Anapa General Development Plan

The Anapa General Development Plan[23] (Ref. 14.14) contains plans and development proposals for the Anapa Resort Town municipal district over the next 20 years, including proposals for the expansion of several towns and villages in the municipal district to accommodate forecasted population growth.

In particular, the Anapa General Development Plan makes provision for significant increases in population, and the physical expansion of the urban and residential area of the town of Anapa, Supsekh, Varvarovka (see Figure 14.10 which has been taken from the Anapa Resort Town General Development Plan, most recently issued with amendments in November 2013), Gai Kodzor and Sukko. For Rassvet, it makes provision for a more modest increase in population (ca. 15%), with the provision of some additional facilities. The Anapa General Development Plan does not set out any timetable for implementing the plan.

In relation to land use near the Project, the Anapa General Development makes provision for an increase in the area of Varvarovka from approximately 200 ha to just over 600 ha over the plan period to accommodate a corresponding increase in population from approximately 2,000 to approximately 8,000 people over the plan period. This increase would be achieved by re-designating existing agricultural fields, forest and scrub areas mainly to the south of the existing limits of the village including land owned by Fond Yug, to residential development zones. This would include development of an urban residential extension or satellite to Varvarovka on the south side of the Pipeline alignment to the immediate north of Shingari. Part of this area overlaps with the outermost Safety Exclusion Zone during the operational life of the Project (i.e. between 345 m and 410 m from the outermost pipelines); however, the Anapa General Development Plan allows for 'cottage development' which is permissible within the development restrictions applicable within the outermost Safety Exclusion Zone[24].

The plans in the Anapa General Development Plan are aspirational and thus there is uncertainty as to when the development proposals will be fully realised. However, given the overlap between the proposed developments by Fond Yug and the future residential extensions to Varvarovka (see below), it is likely that some developments will proceed over the short to medium term. Figure 14.10 shows the existing and designed (i.e. future proposed) urban limits of Varvarovka.

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[23] Full title: 'Master Plan of Resort-City Anapa City District, Volume III - Materials to substantiate the general plan of Anapa city district in relation to settlements'.

[24] Onshore, to be put in place during the Operational Phase.

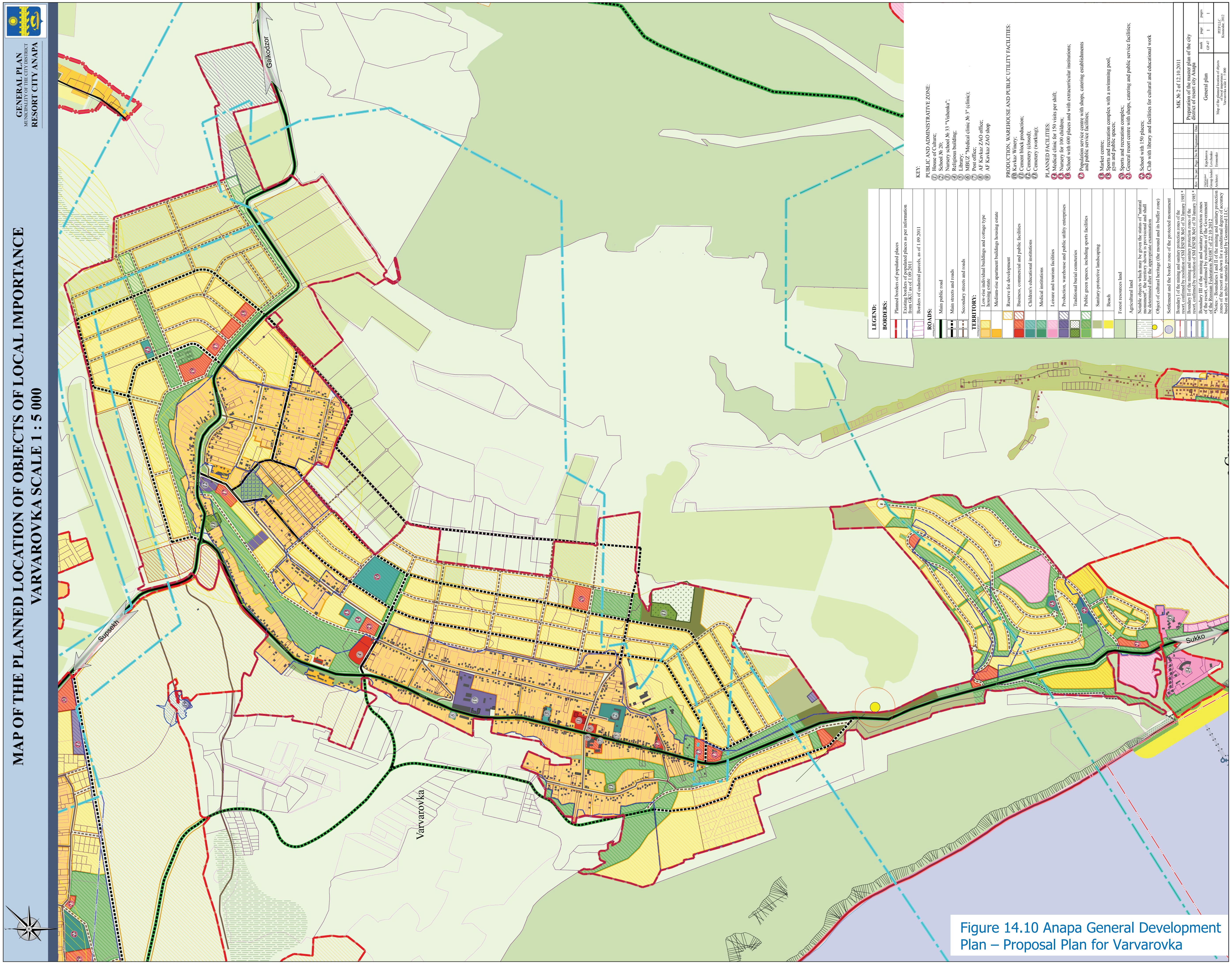

Figure 14.10 Anapa General Development Plan – Proposal Plan for Varvarovka

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Current Development Proposals

There are several development proposals affecting land within and around the Local Communities. Table 14.8 sets out proposed investment projects in the Local Communities together with the cost of each investment and the expected construction duration.

Table 14.8 Investment Projects Currently Under Development in the Local Communities

Investment Projects	Total Capital Investments (RUB)	Project Construction Duration*
Expansion of Shingari Holiday Complex	450 million	On hold, pending available funds. Commencement date not known.
Construction of children's amusement park with aqua park, Sukko	2.8 billion	2012 to 2019

Source: (Ref. 14.24)
* Project construction duration is estimated based on best available information. Despite the dates shown, some projects may experience delays and so the dates shown should be taken as a guide only.

In addition to the projects currently under development shown in Table 14.8, Fond Yug plans to implement several investment projects in Varvarovka and the surrounding area. These include several residential projects (see below), a plan to construct an electrical substation to serve Fond Yug's residential developments (Ref. 14.47) and a plan to widen the main road through Varvarovka (Ref. 14.17). There is also a proposal by another winery based in Gai Kodzor to construct a wine-tasting facility in Gai Kodzor (Ref. 14.25).

Table 14.9 sets out residential projects that are proposed. Of these, 'Sunny Hills', 'Reserved' and 'Utrish' are all more than 2 km from the Project.

Of the Fond Yug proposed developments, the site of the proposed Lesnaya Polyana housing development is located northwest of the microtunnel entry pit just beyond the outermost operational exclusion zone (Exclusion Zone 3 / A-class) as shown in Figure 14.11. Lesnaya Polyana is divided into approximately 160 plots, varying in size from 600 m^2 to 1,700 m^2 (Ref. 14.48). In October 2012, the development was on hold with no date set for construction to start; however, as of March 2013, construction of an access road and site levelling had been carried out. Prospective buyers could reserve a land plot and it is understood that approximately 1.5 ha worth of plots have been sold as of October 2013. As of February 2014, the internal street has been made and the site has been supplied with electricity, while water is in the process of being supplied also. Construction of housing is planned to start at some point in the next two to three years (Ref. 14.49).

The resort-residential project 'Anapolis' is located south of the Pipeline, overlapping in part with the outermost operational exclusion zone (although in this zone, the Anapa GDP allows for 'cottage development', which is permissible within the development restrictions applicable within the outermost onshore Safety Exclusion Zone 3[25]).

The 'Chateau Club Village' development is located on the north-eastern edge of Varvarovka just outside of the officially designated boundary or urban limit of the community. (It is presumed that the development, although residential, is permissible despite being outside of the official boundary / urban limit of Varvarovka, as it is essentially comprised of small vineyards rather than being a dense residential development). The development has been placed on hold for the duration of the construction of the Project as an agreement has been concluded with the developer (Fond Yug) to use the road through the site as a temporary access road (i.e. for the Varvarovka bypass road) (Ref 14.49).

Table 14.9 Residential Development Proposals in the Local Communities

Investment Projects	Location	Area	Status*
Townhouse project – 'Lesnaya Polyana' ('Clearing in the Woods') (Fond Yug)	Southern extension to Varvarovka	16.5 ha	Under construction following temporary hold. Estimated date of possible first occupation ca. 2016 to 2017 or later
Resort-residential project 'Anapolis' (Fond Yug)	South of Varvarovka and north of Shingari Holiday Complex	66.7 ha	Development of design document; scheduled for completion ca. 2018
Private residential and vineyard project – 'Chateau Club Village' (Fond Yug)	North-eastern edge of Varvarovka (but outside of the officially designated boundaries of the community)	69.0 ha	Has undergone construction of some internal infrastructure including the first part of the access road for the development; but is now on hold until completion of construction of the Project

Continued…

[25] Onshore, to be put in place during the Operational Phase.

Investment Projects	Location	Area	Status*
Townhouse project – 'Zapovedny' ('Reserved')	Sukko	11.5 ha	Access road has been built; plan to sell land plots before constructing houses
Residence development – 'Utrish Residence'	Sukko	13.6 ha	Under construction (ca. 2010 to 2015)
Townhouse project – 'Solnechnye Holmy' ('Sunny Hills')	Supsekh	34.8 ha	n/a

Sources: 'Lesnaya Polyana' – Ref. 14.50; 'Zapovedny' – Ref. 14.51; 'Utrish Residence' – Ref. 14.52; 'Solnechnye Holmy' - Ref. 14.53, as well as (for Fond Yug sites) Ref. 14.40; Ref. 14.47; Ref. 14.49.
* Project construction duration is estimated based on best available information. Despite the dates shown, some projects may experience delays and so the dates shown should be taken as a guide only.

Complete.

14.5.8.4 Existing Marine Area Use

In the marine section of the Project Area, fishing and commercial shipping are the principal socio-economic activities.

Fishing

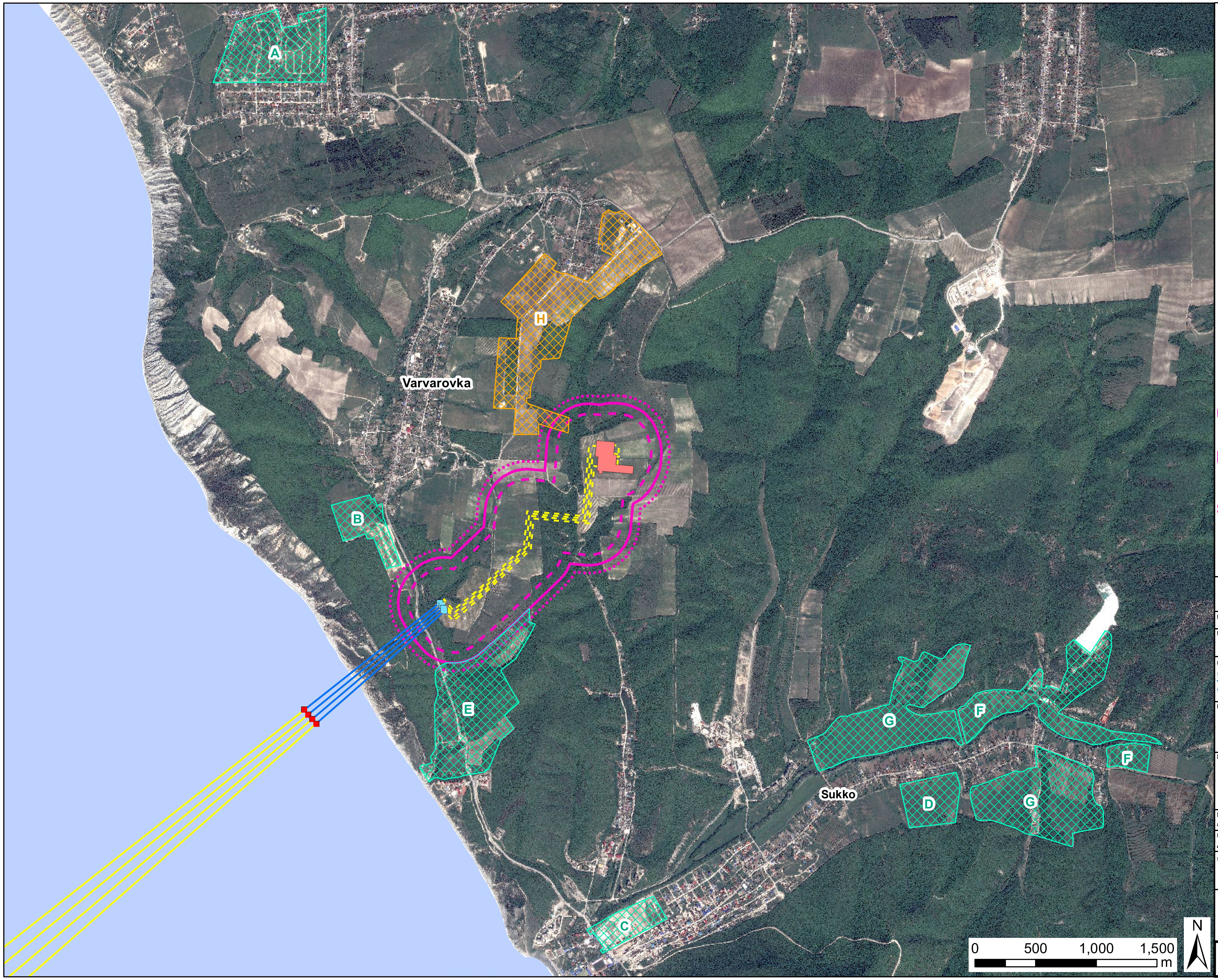
Most commercial fishing occurs in waters out to a depth of approximately 100 m. These waters are located within the 12 NM territorial water limit. Fishing generally occurs in the nearshore section, and shallower regions of the offshore section; the majority of the offshore section of the Project Area is not used for fishing.

Further detail in relation to fisheries – including fishing activities, grounds and the people who rely on this industry – within the Project Area is provided in Section 14.4.11 and Appendix 14.1.

Shipping Routes

Numerous shipping routes traverse and intersect across the Black Sea, connecting all the Black Sea countries. The Pipeline will cross several designated commercial shipping routes as well as routes used by passenger ferries that travel between Russian ports, mostly catering to summer season tourist visitors.

For further information on shipping routes, see Appendix 9.1.



LEGEND

Proposed residential developments (site boundaries shown are approximate)

Proposed residential development (estimated position and extent based on illustrative, not to scale drawing. Precise boundaries not known. Boundaries may differ considerably from those shown)

A - Townhouse project - 'Solnechnye Holmy' (' Sunny Hills')
B - Townhouse project - Lesnaya Polyana' ('Clearing in the Woods')
C - 'Residence development' - 'Utrish Residences'
D - Townhouse project - 'Zapovedny' ('Reserved')
E - Resort/Residential District – 'Anapolis'
F - Children's Entertainment Park
G - Resort/Residential District – 'Gornoye Ozero'
H - Chateau Club Village Development

Russian Sector of South Stream Offshore Pipeline

Proposed landfall section pipelines
Landfall facilities
Proposed microtunnels
Proposed offshore pipelines
Microtunnel entry shaft
Microtunnel exit pit

Safety Exclusion Zones

C- and E-class: no isolated buildings (1-2 levels), dachas, agricultural farms

B-class: no cities, settlements, apartments of 3 levels or more, no developments/buildings with less than 100 people

A-class: no airports, railways station, no developments/ buildings with population of more than 100 persons

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue
For Information

Client
South Stream
Offshore Pipeline
ENERGISING EUROPE

Project Title
SOUTH STREAM OFFSHORE PIPELINE

Drawing Title
SITE OF PROPOSED DEVELOPMENTS

Drawn	Checked	Approved	Date
AH	RW	MW	13 Feb 2014

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Drawing Number
Figure 14.11

Rev

Plot Date: 13 Feb 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 14 Socio-Ec\Figure 14-11 Site of proposed developments.mxd

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Sub-Sea Cables

A number of subsea telecommunication cables pass through Russian territorial and EEZ waters; the offshore pipeline route will cross six cables, four of which are telecommunications cables, while the other two serve unknown purposes and are understood to be out of service. The routes of these subsea cables are illustrated in Figure 5.34 within **Chapter 5 Project Description.** Chapter 5 also contains further information in relation to the cables, their owners and operators, the crossing agreements that will be put in place and the techniques used to safely lay the pipelines where they cross the cables.

Recreational Activities

There is some recreational use of the sea (e.g. swimming, diving) near the Project Area at Sukko beach and within nearby waters (see Section 14.4.10.2).

Oil and Gas Licence Area Exploration Activity

Rosneft OAO, a Russian oil and gas company, has licences for oil and gas exploration concessions off the coast of Krasnodar Krai in the Black Sea. The company's concession blocks in the Black Sea off the Russian coastline include the Tuapse Trough, West Chernomorsky and the South Chernomorsky offshore areas (Ref. 12.16). Figure 18.3 in **Chapter 20 Cumulative Impact Assessment** shows these concession blocks.

According to Rosneft's 2012 Annual Report (Ref. 14.54), the Tuapse Trough has a potential recoverable resource estimated at approximately 1.2 billion tonnes of oil equivalent and that 3D seismic work totalling approximately 4,200 km^2 was completed in 2012, whilst 3D seismic data obtained earlier have been processed. The West-Chernomorsky area has an estimated recoverable resource equal to approximately 1.4 billion tonnes of oil equivalent within a block area of approximately 9,000 km^2. Rosneft has carried out seismic works to study the area and has identified six promising formations. Rosneft press releases (Ref. 14.55) report that two exploration wells are to be drilled in 2015 to 2016 in line with license obligations. The South-Chernomorsky area has a recoverable resource of approximately 0.47 billion tonnes of oil equivalent, whilst the area has been subject to 2D seismic surveying in 2012.

South Stream Transport has met with Rosneft to discuss potential interactions between their oil exploration activities and the Project. However, further information detailing Rosneft's exploration locations and programme are not available at the time of writing.

14.5.8.5 Future Marine Area Use

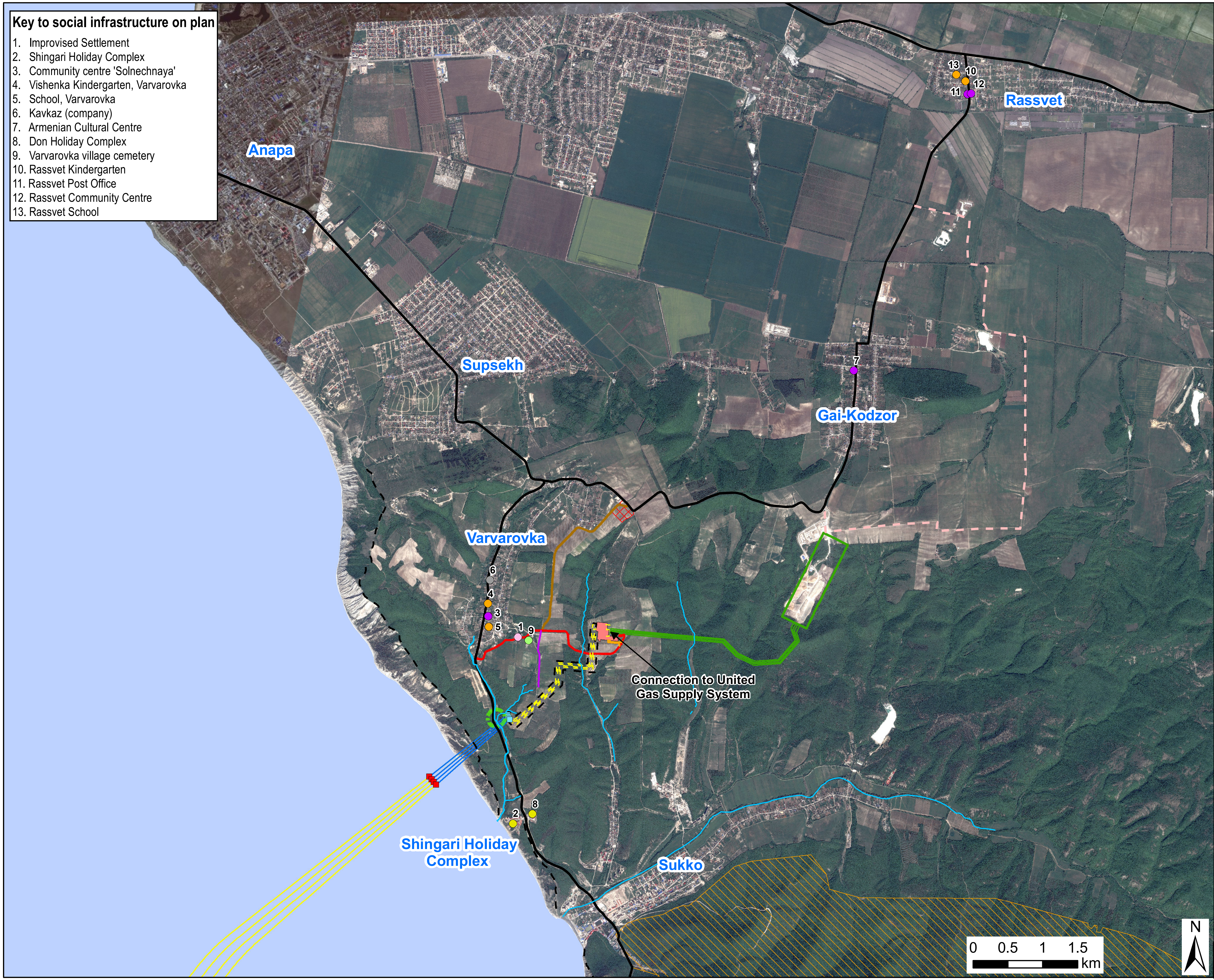
Plans for future development are understood to include two new telecommunication cables: one between Myskhako (City of Novorossiysk) and Cape Utrish, and the other between Cape Utrish and Cape Zhelezny Rog. No route-specific information was available at the time of writing.

Apart from this, there are no known proposals to develop new uses or activities, or to intensify existing uses and activities, in either the nearshore or offshore sections of the Project.

14.5.9 Social Infrastructure and Services

The town of Anapa is the primary hub in the Anapa Resort Town municipal district for services and facilities. The town's social infrastructure is more developed than that of the surrounding rural communities within the ART municipal district and includes community and leisure centres, libraries and museums. All households have electricity and mains water and gas supply. The Local Communities also have a range of community facilities including community centres and post offices. Further information in relation to housing, utilities and educational services follows below. For information on health infrastructure serving the municipal district and Local Communities, see **Chapter 15 Community Health, Safety and Security**.

Figure 14.12 shows the social and recreational infrastructure within and near to the Local Communities surrounding the Project.



LEGEND

Social infrastructure (mapped within a 2km radius of Project)

- Business
- Cultural heritage
- Education
- Improvised settlement
- Recreation
- Social services
- Rivers (mapped within a 1km radius of Project)
- Coastal path (Mountains of the Caucasus Trail)
- Main roads
- Protection area for burial mount
- Boundary of the state nature reserve "Utrish"

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Landfall facilities
- Proposed microtunnels
- Proposed offshore pipelines
- Microtunnel entry shaft
- Microtunnel exit pit
- Construction corridor
- Permanent access road to be constructed by SSTTBV
- Temporary access road constructed by SSTTBV
- Varvarovka bypass road (used by Project during construction only)
- Transfer site

United Gas Supply System

- Russkaya compressor station
- United Gas Supply System Pipelines
- Permanent access road to be constructed by Gazprom Invest
- Gazprom Invest temporary bypass road to be utilised by SSTTBV

Projection: Lambert Conformal Conic

Revision Details	By Check	Check Date	Suffix

Purpose of Issue

For Information

Client

South Stream Offshore Pipeline ENERGISING EUROPE

Project Title

SOUTH STREAM OFFSHORE PIPELINE PROJECT

Drawing Title

SOCIAL, TOURISM AND RECREATIONAL INFRASTRUCTURE

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Figure 14.12	

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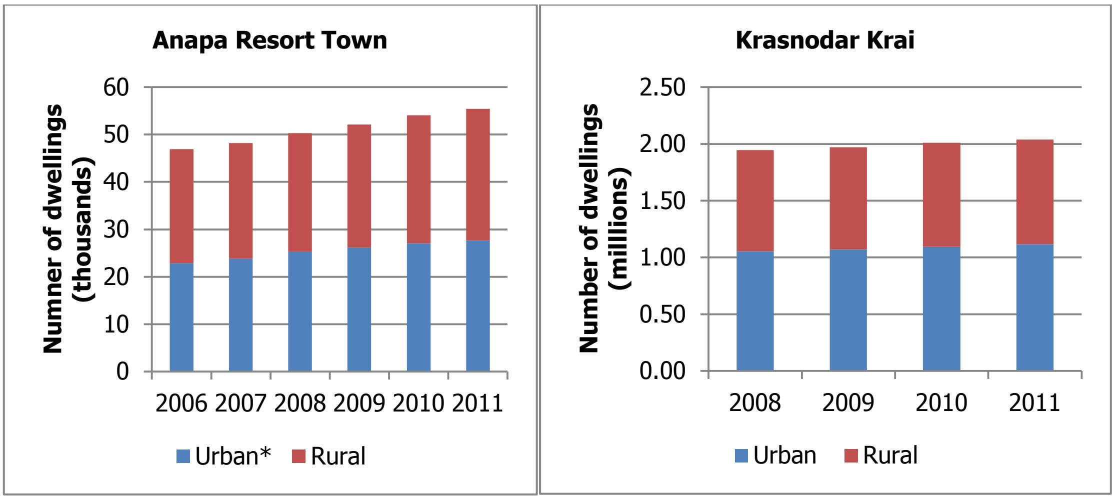
File Name: I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 14 Socio-Ec\Figure 14-12 Social, Tourism and Recreational Infrastructure within the Local Communities.mxd

14.5.9.1 Housing

Figure 14.13 shows that the number of dwellings reached almost 2.04 million in Krasnodar Krai municipal district in 2011. It also shows that the number of dwellings in the Anapa Resort Town municipal district reached 54,400 in 2011, evenly divided between the urban district (town of Anapa) and the 10 rural districts.

Thus, from 2006 to 2011, the total housing stock grew by approximately 18% in Krasnodar Krai and approximately 40% in the ART municipal district level, i.e. more than double the growth rate at the regional levels. The considerably higher rate of growth at the municipal district level is evidence of a construction boom related to the strong rates of growth as a result of inward migration and the development of local tourism.

Figure 14.13 Number of Dwellings, Rural and Urban



*Town of Anapa
Source: (Ref.14.15)

Field observations indicate that most houses in the Local Communities are well built and maintained. An example of housing typical in the area is shown in Figure 14.4.

Figure 14.14 Typical Housing in the Local Communities (Examples from Gai Kodzor, Varvarovka, Varvarovka from afar, and Supsekh; left to right, top and bottom)

On average, house prices are higher in the city of Krasnodar than in the ART municipal district; however, the price of apartments is lower in Krasnodar (Ref. 14.56). In the ART municipal district, the average house price is 45,000 RUB per square metre. Houses in the town of Anapa itself can cost up to 15 million RUB (Ref. 14.21). Prices in the Local Communities are variable.

Location and amenity play an important role in influencing retail house prices as well as rental prices. Property prices rise closer to the town of Anapa, and also depending on the level of amenity. Supsekh, which is relatively well supplied, and as the closest Local Community to the town of Anapa, commands relatively higher prices for rent. At the other end of the scale, Varvarovka, which is more distant and has few amenities, is the cheapest Local Community in the Supsekh Rural District area in which to rent or buy property (Ref. 14.16, Ref. 14.21, and Ref. 14.27).

Rental demand is strongest during the tourist season, which runs from May to September, peaking in June, July and August, when it is near capacity. There is lower demand for rented properties outside the tourist season in all Local Communities.

14.5.9.2 Community Relations

All local officials interviewed agreed that community relations, within and between communities, in the area are generally harmonious and that the area is considered to be a safe and pleasant place to live. The local officials also stated that there are no tensions related to migration and that the various ethnic groups are well integrated (Ref. 14.16, Ref. 14.21, and Ref. 14.27).

14.5.9.3 Utilities

The ART municipal district has a lower standard of utility infrastructure than either the Krasnodar Krai or the Russian Federation as a whole. However, improvements are occurring, and increasing numbers of households are being connected to a mains water supply and the sewerage network.

There is considerable variation amongst the Local Communities with respect to utility provision. All households in the Local Communities have electricity supply. For example, all households in Supsekh and Gai Kodzor have mains water supply compared with 80% in Varvarovka, and only 50% of households in Sukko; the remaining households obtain water from wells on their property (Ref. 14.16 and Ref. 14.27).

Very few households in the Local Communities are connected to public sewers and most households rely on septic tanks. The exception is Supsekh, where approximately 50% of households are connected to the public sewer system, compared to approximately 10% of in Sukko and no households in Gai Kodzor and Varvarovka (where all households are understood to be served by septic tanks) (Ref. 14.16 and Ref. 14.27).

All households in Supsekh, and 75% of households in Gai Kodzor, are provided with piped gas supply. The gas supply has recently been expanded in Supsekh; between 2009 and 2012, an additional 5 km of gas pipelines were installed so that the whole community is supplied with gas (Ref. 14.27). Varvarovka and Sukko, however, do not have piped gas. Residents of these communities would like to be connected to the mains gas supply, and have expressed this wish during public consultations in these communities (see 14.2.2 and **Chapter 6 Stakeholder Engagement**).

14.5.9.4 Education

All the Local Communities have nursery and primary schools, as well as "general" schools that educate children up to age 15. Gai Kodzor and Supsekh each have post-15 high schools.

The public tertiary education system within the ART municipal district offers a wide range of courses with a vocational or technical focus, including construction and engineering. There are no reported skill shortages in the local area (Ref. 14.21).

14.5.10 Tourism, Recreation and Leisure

14.5.10.1 Anapa Resort Town

As noted in Section 14.4.5.2, tourism is a major contributor to the economy of the ART municipal district, accounting for approximately 40% of the ART economy (Ref. 14.35). The two main centres for tourism and tourism infrastructure, including accommodation, in the area are the town of Anapa and, to a lesser extent, Sukko.

Some 4.5 million tourists visited ART in 2012, including 3.5 million in the tourist season (May to September). Tourism is developing rapidly and from 2008 to 2012 the number of tourists coming to Anapa increased more than fourfold (Ref. 14.21).

The ART municipal district has numerous premises to accommodate tourists including sanatoriums, hotels, holiday camps and private houses and apartments for rent. The larger businesses are based in the town of Anapa, and the town is a key focus for tourist activity and accommodation within the municipal district and has a high number of hotels, restaurants and associated infrastructure to support the tourism economy. Smaller-scale facilities are more commonly found in the surrounding communities, including in particular within Sukko (Ref. 14.21). Sukko is the main focus for tourism activity amongst the Local Communities due to its location on the coach behind Sukko beach and its therefore well-developed tourist infrastructure and services including recreation centres, fishing and horse riding facilities. The population of Sukko expands to approximately 12,000 during the peak of the tourist season from July to August (Ref. 14.27).

Information gathered during interviews indicates that Varvarovka and Gai Kodzor do not have commercial holiday accommodation or recreational facilities, nor do local families within these two communities rent out their premises to tourists, as neither community is easily accessible to the seaside (Ref. 14.17 and Ref. 14.25). The population of Supsekh increases by approximately 1,000 during the tourist season; however, this reportedly consists mostly of temporary workers employed in tourism services in the ART who stay there while working in tourism services in the Anapa Resort Town and particularly the town of Anapa itself. Similarly, a small number of people (precise numbers are not known) are also understood to lodge in Varvarovka (Ref. 14.17).

Chapter 17 Ecosystem Services presents information in relation to the municipal district's designation as a health resort town in 1957. As a result, health resort complexes are critical to the area's appeal as a tourism destination and there are apparently in excess of 150 health resort institutions (including 44 recreation facilities for children), approximately 250 hotels, and more than 2,000 vacation rental properties in the sector (Ref. 17.15).

Tourism, Accommodation and Recreation Facilities

Figure 14.12 shows the public, social and recreational infrastructure within and near to the Local Communities surrounding the Project.

In the ART municipal district, the number of beds available in tourist accommodation facilities rose by 62% over the five years to 2011 to a total of 162,000 beds, an indicator of the growth of the tourism sector in ART. The majority of this growth occurred in hotels, where the number of beds approximately doubled. There are many (approximately 200) large-scale facilities including sanatoria, holiday camps and children's camps (the majority of which operate in the summer season only). There are approximately 350 smaller businesses (i.e. up to 50 rooms), as well as more than 4,000 small private accommodation rentals such as houses, apartments or single rooms (Ref. 14.21).

Tourist accommodation facilities in Sukko include over 300 hotels; seven health resorts, sanatoria and health improvement centres; and three children's and tourist camps (Ref. 14.17). During a field visit to the area in August 2012 at the height of the tourist season, it was observed that local residents of Sukko also appear to rent out rooms to visitors; which is likely to help supplement livelihoods for those households.

Hiking

Varvarovka, Sukko and Supsekh are part of the "Mountains of the Caucasus" tourist hiking route. The route begins in Supsekh, bypasses Varvarovka (running over the cliff top and hill that the microtunnel will pass underneath) and passes through Sukko to the Bolshoi Utrish SPNA, where a waterfall is the final destination (Ref. 14.56).

Local Beaches

Sukko has a public beach that is easily accessible (Figure 14.15). It is the principal and only easily accessible public beach between the town of Anapa and the Utrish SPNA and is popular with both tourists and the residents of the Local Communities. The beach is a focal point for a number of summer activities for residents and tourists alike, including swimming, sunbathing and family activities.

In addition to Sukko Beach, two other beaches have been identified in the Project Area:

- The beach in front of the Shingari Holiday Complex is mostly used by guests of the Shingari and Don holiday complexes (Section 14.4.3.3), as well as a few local residents or tourists. This beach is accessible by steps from Shingari, and via a path that runs along the outside edge of the Shingari Holiday Resort grounds; this path is used by guests staying at Don to access the beach. This beach and the Shingari Holiday Complex are shown below in Figure 14.16; and
- Adjoining the Shingari Holiday Complex’s beach is a natural beach in the Varvarovka Rift. This beach is located more than a kilometre from the nearest road. Although it is a public beach, it is not widely used as it can be reached only on foot. It is used infrequently by local residents.

Figure 14.15 Beach in Sukko (Showing Views to Sea and Inland from Northern End of Beach)

Figure 14.16 Shingari Resort and View of the Beach from the Resort

14.5.10.2 Tourism and Recreation Activities

Land-Based Activities

There are approximately 40 companies that organise excursions and other activities for tourists in the ART municipal district. Facilities include diving, yachting and horse riding (Ref. 14.21). There are also tourist attractions such as a dolphin park and an "African village", both in the town of Anapa, and the Bolshoi Utrish nature reserve south of the town of Anapa (Ref 14.27).

Horse riding takes place in and around the Local Communities, including around Sukko, Supsekh (Ref. 14.57 and Ref. 14.58) and around Varvarovka (Ref. 14.56 and Ref. 14.59). There is a business based in Varvarovka, with approximately 30 horses, that offers horse riding tours for both adults and children on at least three different routes (depending on the abilities of the rider) including a route used for novice riders that traverses the Agrifirm Kavkaz fields in the direction of a lake north of Sukko. The business is at its busiest during the summer, when it has approximately 20 customers per day, although the business will operate during winter if there is customer demand; weather conditions permitting. In the summer, it is understood that horse riding in Sukko and Varvarovka is generally more popular with holiday makers.

The horse riding route that traverses Agrifirm Kavkaz land is used for novice riders and children, who make up the majority of the clients for the business. It is possible that the route through the Agrifirm Kavkaz fields may cross areas that may be affected by Project construction activities. South Stream Transport has met with the operator of this business to discuss the Project and potential overlap with horse riding routes; however, at this time, the operator was unable to identify the precise routes and further discussions are planned (Ref. 14.59).

Chapter 16 Cultural Heritage confirms that among local monuments, there is extensive tourist interest in Krasnodar's Bronze Age dolmens, some of which are subject to tourist pilgrimages and offerings (Ref. 16.109). Internal tourism is also linked to local festivities and cultural heritage sites. There is a spring in northern Varvarovka, known as St. Barbara's Source, and an annual procession takes place on the Feast of Theophany (Epiphany / Feast of Lights / Feast of the Manifestation, 19 January). Attendees include local parishioners and pilgrims from further afield (Ref. 16.114; Ref. 16.115). Further information on cultural heritage sites, and intangible cultural heritage such as local celebrations and festivals, is presented in **Chapter 16 Cultural Heritage**.

Water-Based Activities and Attractions

In addition to recreational activities such as swimming and fishing, the coast is also used occasionally for activities including paragliding, jet skiing and diving.

There is a sunken barge named Gordipiya located near the mouth of the Sukko River (location coordinates N 44°46 'E 37°22'), which is a locally known dive site. The wreck itself is in relatively poor condition, as most things of value and interest have been looted from the site, although a field observation in summer 2013 indicated that it is a relatively popular local diving attraction.

Figure 14.18 shows that the location of the wreck is outside of the proposed 3 km marine safety exclusion zone during construction.

In Sukko, special recreational programmes for children are operated by the children's health improvement camps, such as '*Energetik*' and 'Smena'. These recreational programmes include trips out to sea on motorboats, diving, and trail walking (Ref. 14.60). Paragliding was also observed to be taking place from a hill in Sukko (south from the landfall section of the Project) with the flying trajectory being out to sea. Paragliding is understood to be an informal recreational activity rather than a business (Ref. 14.57). Information about the identity of the people and groups paragliding is not known (Ref. 14.17); however, it is likely that at least some of the activity is engaged in by tourists visiting the area.

Figure 14.17 The Bow of the Sunken Barge 'Gordipiya'

14.5.11 Fisheries

14.5.11.1 Industry Overview

Over the past 40 to 50 years, there have been important changes in the Russian Black Sea fishery. For example, annual Soviet Union Black Sea catches reached a maximum in the mid-1970s to mid-1980s, averaging 65,000 to 68,000 tonnes (t) (this included catches from Black Sea ports that are no longer in the Russian Federation since the break-up of the Soviet Union). However, a combination of factors such as pollution, the effects of invasive species, expanding coastal development, and the deterioration of the fishing fleet, onshore infrastructure and facilities following the break-up of the Soviet Union, have resulted in a reduced fishing industry and catch volumes (Ref. 14.61). The Russian catch in 2003 was 21,000t, which is a notable increase from a low point of approximately 700t in the 1990s. This rapid increase was predominately due to the introduction of new trawling technology. Catch has subsequently declined and in 2012 had fallen to just under 4,000t, around a fifth of the Total Allowable Catch (TAC) of 21,000t (Ref. 14.61). The species composition of the catch has also altered due to the environmental changes in the latter 30 years of the 20th century (Ref. 14.62) (refer to **Chapter 12 Marine Ecology** for more information on the historical ecological changes to the Black Sea).

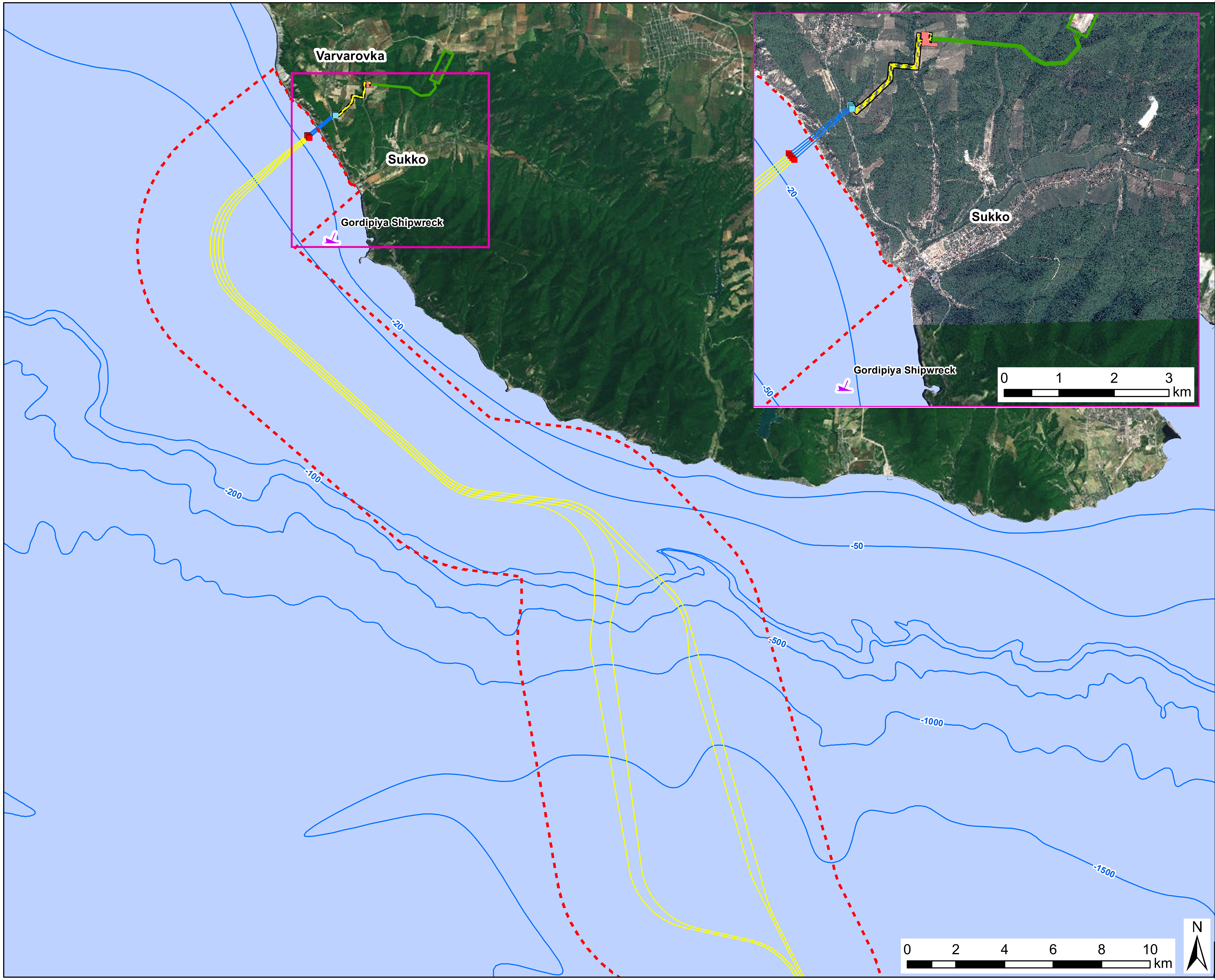
14.5.11.2 Fisheries within the Project Area

An analysis of the fisheries within the Study Area of the Project has been completed, including information on fishing fleets and companies that fish within the Project Area, catch levels and types, as well as commercially important fish stocks and their migration routes (see Appendix 14.1).

Fishing Areas

There are two main fishing areas recognised by the Azov Research Institute of Fisheries: (i) the Kerch-Taman zone, the more northerly zone that extends along the coast from the Kerch Strait to Cape Utrish; and (ii) the Caucasus zone, the more southerly zone that stretches from Cape Utrish south to the mouth of the Psou River, near the border with Georgia. The Kerch-Taman zone encompasses the entire nearshore section of the Project Area (Ref. 14.61). The Caucasus zone, which is predominantly fished by vessels south east of Cape Utrish, overlaps with part of the offshore section. These zones are approximately equal in area, but different in biological resources. Of the two zones, the most productive is the Kerch-Taman zone.

The main fishing ports are the town of Anapa in the Kersh-Taman zone and Novorossiysk (the largest) and Gelendzhik in the Caucasus zone. Russian Black Sea fishing activity is limited to internal and territorial waters of Russia, within 12 NM of the coast (Ref. 14.61).



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Revision Details	By / Check	Check Date	Suffix

Purpose of Issue
For Information

Client
South Stream Offshore Pipeline
Stream ENERGISING EUROPE

Project Title
SOUTH STREAM OFFSHORE PIPELINE

Drawing Title
OFFSHORE CONSTRUCTION PHASE APPROXIMATE 3KM SAFETY EXCLUSION ZONE

Drawn	Checked	Approved	Date
DH	RW	MW	05 Mar 2014

URS Internal Project No.	Scale @ A3
46369082	1:150,000

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Drawing Number
Figure 14.18
Rev

Plot Date: 05 Mar 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA\Chapter 14 Social\Figure 14.18 Offshore construction phase approximate 3km safety exclusion zone.mxd

Within the Kerch-Taman zone, there is an area known as the 'Anapskya Bank' or 'Anapa Bank' which is designated[26] as an important fishing ground. GIS analysis indicates that the Anapa Bank is approximately 695 km^2 of which the Project Area accounts for around 0.6%. Fishing is seasonally restricted, trawl fishing and fishing with stationary nets with a cell size of more than 50 mm is forbidden. Since 2011, sections of the Anapa Bank area have been made available for sprat and anchovy trawling under the Russian Fishery Regulations (Ref. 14.61; and Ref. 14.63). The regulations state:

- Bottom trawling (using any gear) is prohibited over the Anapa bank, in waters less than 40 m;
- Fishing for sprat is permitted between July and September annually in water depths of more than 40 m; and
- Fishing for anchovy is permitted from the beginning of October until the 15 March annually at water depths of more than 20 m.

More information on the Anapa Bank common fish species, fishing activity and fishing restrictions is provided in **Chapter 12 Marine Ecology** and Appendix 14.1.

There are also a number of fixed traps and nets in place close to the coast to target migrating fish such as mullet, they are normally serviced by smaller vessels (<5 m). There is also a mussel farm approximately 4 km to the south, currently producing around 15 tonnes of mussels on an annual basis (see Appendix 14.1).

Fishing Fleet

The Fisheries Study (Appendix 14.1) has found that the Russian fisheries industry in the zone of influence is relatively small; e.g. in Krasnodar Krai it contributed 0.1% of regional GDP in 20091420. The study has further identified that the importance of fishing in the region has declined in recent decades, partly due to the invasion of the predatory comb jelly *Mnemiopsis leidyi* and the consequent ecosystem-wide changes affecting most of the Black Sea, and also in part due to the demise of the USSR.

The majority of the vessels use pelagic or surface gears to catch anchovy. The most common are purse seines[27] which are permitted within the entire Russian Black Sea territorial waters. Trawl nets are also commonly used although only midwater trawling is permitted; the nets must not come into contact with the seabed. There is no pair trawling recorded in the Russian sector of the Black Sea. Some vessels are also equipped to use passive gear, either as their primary or secondary gear type. This will normally consist of a fixed bottom net and will be used to target bottom species such as turbot and rays (Ref. 14.64, Ref. 14.65 and Ref. 14.66).

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[26] The Anapskaya Bank was initially designated in 1986 by Decree of the Ministry of Fisheries of the USSR. The area where fishing was prohibited was reduced by the Resolution of the Scientific Fishery Council of the Azov and Black Sea Basin in 1999. In 2011 the fishing ban was further reduced and it now merely consists of seasonal restrictions to enable the replenishment of fish stock.

[27] A purse seine is a very long net, which falls as a curtain from a floating head rope, that is use to surround shoals of open water fish. After encirclement, the bottom rope is pulled tight to trap the fish in the 'purse'. It never comes into contact with the sea bed.

Accordingly, both the size of the fleet and the number of companies active in the Russian Black Sea has declined. For example, the number of enterprises involved in capture fishing and located in the northern half of Krasnodar Krai's Black Sea coastline[28] has declined from 19 in the period between 2003 and 2006 to 14 in the period between 2007 and 2010. The decline in the number of enterprises has been accompanied by a decline in the number of operating vessels from 30 to 21 over the same period (Ref. 14.61).

In addition to the decline in the number of vessels and companies, the condition of fishing fleet vessels and onshore reception and processing facilities has suffered from underinvestment and the vessels and onshore facilities are generally old and have not been renovated or replaced by modern equipment. The lack of investment is due to the poor financial state of the fisheries sector since the early 1990s. However, catches have been higher in past years compared to the 1990s (Ref. 14.66).

Commercially Important Species

Anchovy (*Engraulis encrasicolus*) and sprat (*Sprattus sprattus*) are the most important species in the fishery, comprising 28% and 25% of the Russian Black Sea catch respectively; red mullet (16%) and whiting (12%) are also significant. Anchovy spawns in the Sea of Azov in the summer months and migrates to the Russian and Georgian shores of the Black Sea as waters cool until the following spring. Thus, in the Black Sea territorial waters of Russia, anchovy form commercial concentrations during the cold season from October to April. Commercially exploitable populations of sprat are found in Russian Black Sea coastal waters from April until September (Ref. 14.61).

From data collected by the Project during meetings with the Zao Moresky Club, Bolshoy Utrish; as of 2013, the commercial species with the highest value per tonnage caught were farmed mussels and turbot which were valued at 300,000 RUB (approximately £5,000). Mullets were 100,000 to 150,000 RUB (approximately £1,600 to 2,500), and horse mackerel, piked dogfish, thornback rays and pontiac shad were valued between 30,000 and 40,000 RUB (approximately £500 to £620) (Ref. 14.4).

Research into fish stocks has found that species diversity declines with depth. For example, a study in 2010 recorded 64 distinct species at depths of less than 25 m (i.e. the continental shelf), whereas in deeper water (50 to 85 m) only eight species were recorded. This finding reflects the known wider characteristics of the Black Sea where the nearshore areas are species-rich in comparison to the deeper offshore waters (see **Chapter 12 Marine Ecology**).

The concentration of Russian Black Sea fishing activity and effort reflects this species gradient, as most commercial fishing occurs in nearshore waters out to a depth of approximately 100 m.

[28] This includes the stretch of coastline between the Kerch Strait and Arkhipo-Osipovka, a town located at the approximate mid-point of Russia's (and Krasnodar Krai's) Black Sea coastline. This stretch of coastline includes the town of Anapa and the ports at Novorossiysk and Gelendzhik (which are over 50 km and 80 km from the location of the microtunnel exit pits) respectively.

14.5.11.3 Fishers Operating in the Project Area

The nearshore section of the Project Area is located within the Kerch Taman zone encompassing the Anapa Resort Town (ART) municipal district.

As set out in Table 14.7, there are approximately 1,000 people working in the fisheries industry in the ART Municipal District. The number of people employed in the fishing industry along the northern half of the Russian Black Sea coastline as a whole is relatively small consisting of two large companies employing up to 100 people, three medium-sized companies employing up to approximately 30 fishermen in the case of the largest company and nine smaller companies (typically comprising a few smaller vessels and fishing brigades using passive gear such as set nets and traps) which may have only as many as 15 employees (see Appendix 14.1).

In order to collect data regarding the companies and their owners and employees, invitations were sent to all fishing companies that are known to fish in the marine Project Area, i.e. in the Anapa municipal district. Of the five companies invited to participate in an interview, three responded positively:

- OOO RAM, Anapa;
- RPK Briz, Anapa; and
- Zao Morskoy Club, Anapa.

Meetings took place in March, August and October 2013 and the data obtained from the interviews is provided below.

RPK Briz Fishing Company

RPK Briz Fishing Company has an office in Varvarovka and stated that they are one of approximately eight companies that are located between the Temryuk area and Novorossiysk, which operate in the area where the Pipeline will be constructed. The company has been operating since 1998 and employs approximately 30 people. They operate one vessel (17 m) in deeper waters and three smaller vessels in coastal waters. The offshore vessel is a bottom trawler and uses both trawl gear and fixed nets. As bottom trawling is banned, the gear used is for trawling in the mid-water, from around 40 m to a maximum depth of 100 m. This vessel also uses fixed nets further offshore.

The majority of their catch is anchovy, with other significant catches including sprat and red mullet. The company previously owned three vessels but this was reduced to one. Traps are used in the nearshore area and all fish caught is processed (smoking, salting, freezing) onsite.

The fishing grounds used by RPK Briz Fishing Company extend from the Strait of Kerch southwards to Sochi, depending on where the fish are. The fixed traps are located between Mali and Bolshoi Utrish. Some fishing is carried out along the proposed Pipeline route (Ref. 14.2).

OOO RAM Fishing Company

OOO RAM Fishing Company, with an office in the town of Anapa, has been operating since 1996 and employs 15 people. The company owns three vessels and leases two (ranging from 4.5 to 15 m). The smaller vessels are used for nearshore nets and the larger vessels are trawlers that trawl in the mid-water depth as bottom trawling is banned. The main species caught is anchovy, as well as sprat and red mullet. Previously, sprat was the main species caught, but the company indicated that stocks of sprat have declined since 2008. The fish are processed onsite and then then sold onto wholesalers regionally and nationally. Fishing also takes place along the coastal area (Ref. 14.3).

ZAO Morskoy Club

ZAO Morskoy Club, based at Utrish, has been operating for nine years and was previously a fishing cooperative. There are 15 fishermen working from the club, for whom the work is their only source of income. In addition to the fishery there is also a small marina with approximately 100 vessels, directly employing between 15 and 50 staff within the marina (yacht repair, etc.) in addition to the captains and crew employed by the owners of the vessels. They operate seven vessels (one 15 m vessel and six 9 m vessels), all of which are over seven years old.

The majority of their catch is red mullet, while other significant species caught include horse mackerel, turbot, piked dogfish and flathead mullet. The fish are caught in traps as they migrate and the high season runs from May to the end of November. They operate five different types of traps, including nearshore and floating (offshore) traps, within a designated and permitted area. The traps remain in the same positions every year, as the migration path of the fish is the same every year. The company's designated permitted area extends between the Sukko River to the lighthouse in Bolshoi Utrish, and no further than 5 km from the shore. Fish are not processed on site but are loaded onto trucks and sold wholesale.

Since 2006, the Club has also owned and operated a mussel farm. Mussels are harvested all year and are sold to a wholesaler in Moscow. The company indicated that there is no bottom trawling off the coast of the ART municipal district as this activity is banned (i.e. within the waters of the Anapa Bank up to 40 m water depth). The company does not consider that fish catches have changed over the past nine years (Ref. 14.4).

14.5.12 Vulnerable Groups

14.5.12.1 Identification of Potentially Vulnerable Groups

IFC PS 1 on Assessment and Management of Environmental and Social Risks states that it is necessary to identify individuals and groups that may be differentially or disproportionately affected by the Project because of their disadvantaged or vulnerable status. Individual or group vulnerability is a pre-existing characteristic that is independent of the Project and may be reflected by factors such as disability, language, culture, gender, and social status. It may also be exhibited by a low level of access to key socio-economic, social or environmental resources or a limited ability to adapt to change. Therefore, vulnerable individuals and groups may be more susceptible to adverse impacts or have a more limited ability to take advantage of beneficial impacts.

Vulnerability is also an important factor in stakeholder engagement as certain groups of people may have less access to information and decision-making processes. For example, low income households may not have access to computers and internet sources, and may have difficulty travelling to consultations.

Using this guidance and in collaboration with two social protection bodies in Supsekh and Gai-Kodzor and the Anapa Resort Town Municipal District administration, potentially disadvantaged or vulnerable groups have been identified in the Local Communities. These are: children; elderly or retired people; disabled or chronically ill people; migrants involved in seasonal work; households with incomes below the subsistence level, and commercial sex workers.

Although there are significant numbers of non-Russians in the ART municipal district, particularly Armenians (but also Ukrainians, Uzbeks and others), evidence from the socio-economic baseline study indicates that they are integrated into the socio-economic and socio-political life of the area, even though they may maintain specific cultural practices (Ref. 14.27 and Ref. 14.33). These minorities are not, therefore, considered to be vulnerable for the purposes of this assessment.

The six groups are described below in relation to their potential vulnerability and their presence in the Local Communities. This analysis considers both the potential for differential or disproportionate impacts of the Project, and potential vulnerabilities in terms of stakeholder engagement (including access to information and participation in decision-making processes). It is important to note that vulnerability is described in the context of the Project, although these groups may also be challenged by other aspects of vulnerability.

The sensitivity or vulnerability of these groups has been considered, where relevant, in the assessment of potential socio-economic impacts in Section 14.6. Other assessments (e.g. Chapter 15 Community Health, Safety and Security) have also considered the vulnerability of these groups. With respect to stakeholder engagement, these groups (and their limitations) have been, and continue to be, considered in the planning of stakeholder engagement activities, including the disclosure of information and the locations of and access to consultation events. Further details are provided in **Chapter 6 Stakeholder Engagement**.

Children

Children, especially those below the age of 15, may be specifically vulnerable to impacts related to changes in environmental conditions; children are generally considered to be more sensitive in comparison to adults, particularly with regard to effects on their learning capabilities related to noise from sources such as road traffic (Ref. 14.67) and to effects on health arising from air pollution (Ref. 14.68) (**Chapter 9 Air Quality** notes that very young children are more likely to be adversely affected by changes in air quality than adults). School age children are also particularly vulnerable as pedestrians to increased levels of traffic and impacts on traffic safety, for example when walking to and from school, especially if unaccompanied by an adult. The interests of children may not always be represented in stakeholder engagement and decision making processes.

Children are present in all of the Local Communities within the Study Area, although precise information on the number of children within each Local Community is not available. However, children are likely to be concentrated in and around kindergartens and schools, as well as community centres and recreational or leisure facilities such as children’s holiday camps. If any kindergartens and schools are located on or near to roads that will be used by construction traffic, then children attending those schools may be at increased risk of exposure to potential traffic safety dangers.

Elderly

Elderly people may be challenged to cope with changes in the surrounding environment as a result of deteriorating physical and/or mental capacity. For example, **Chapter 9 Air Quality** notes that, in general the elderly are more likely to be adversely affected by changes in air quality than middle aged adults. These challenges may also affect the ability of elderly residents to participate in consultation and decision-making processes, not least in terms of physical accessibility to consultation venues, and a typically lower use of computer-based media.

Additionally, elderly or retired people are also likely to be more constrained financially, due to the prevalence of fixed incomes. However, since 2009, the average pension in the ART municipal district has exceeded the official subsistence level (Ref. 14.15). This coincides with an official increase in the state pension designed to improve the economic wellbeing of pensioners across Russia.

Within the Study Area, elderly residents[29] in the Local Communities of Varvarovka, Supsekh and Sukko account for between 15 and 19% of the population depending on the community (equating to over approximately 300, 1,600 and 600 people respectively) (Ref. 14.17).

Disabled or Chronically Ill

Disabled or chronically ill people, which may include individuals who lack physical mobility or who have mental health issues, may experience difficulties participating in consultation processes and decision making.

Data on the number of disabled or chronically ill people within the Local Communities was not available, with the exception of Rassvet and Gai Kodzor (both located within the Gai Kodzor Rural District Administration). The Gai Kodzor Rural District Administration reports that there are approximately 500 people (out of total population of approximately 6,000) living with some kind of disability in the district (Ref. 14.18).

Migrant Workers

Seasonal migrant workers, particularly those working on a seasonal basis in the agricultural or tourism sectors, are generally likely to have lower incomes and less access to resources. They may also have lower levels of resilience to unexpected events, depending on their personal circumstances including in their home communities. In particular, they may be sensitive to a loss or reduction in employment opportunities. As non-residents, their interests may not be represented in local decision making, and it may be difficult to engage these groups due to the seasonal (and often unofficial) employment status.

Seasonal migrant workers in the Study Area include workers from Dagestan who are employed on an annual basis by Agrifirm Kavkaz to work in the vineyards (Ref. 14.40). Seasonal migrant workers are also employed generally within the tourism sector in Anapa Resort Town (Ref. 14.24; Ref. 14.39). However, this will not be true of all companies in the tourism sector,

[29] Defined by the relevant local rural district administration as women aged over 55 and men aged over 60.

e.g. Shingari Holiday Complex reports that most of its seasonal employees during the peak tourism season are drawn from the local area, including the town of Anapa (Ref. 14.19).

Low Income Households

Low income households have fewer financial resources to rely on and are less likely to have savings and/or access to credit, which in turn can make them vulnerable to environmental changes and economic fluctuations. They may also face limitations to accessing information, for example due to limited access to computers and/or the internet, limited transportation options, and financial or time constraints that limit their ability to actively engage in stakeholder consultation. This group is likely to include households with pensioners, unemployed (or underemployed) persons, and people employed seasonally or in low-income occupations. It may also include households with children, seasonal migrant workers and disabled or chronically ill people.

In the Local Communities, low income households are likely to include pensioners and unemployed persons. It may also include households with children; persons employed part time, seasonally or in low income occupations; seasonal migrant workers (see above) and disabled / chronically ill people. People working in the fishing industry (particularly artisanal or small-scale operations) may also have low or variable (and unreliable) incomes.

Commercial Sex Workers

In the context of major construction or resource development projects, commercial sex workers are often vulnerable to the transmission of communicable diseases, including sexually transmitted diseases, particularly from migrant workers if they engage in unprotected sex. They are also likely to have low or unreliable incomes and may have limited social networks and resilience to cope with change. Additionally, people who are deprived, suffer from drug or alcohol addiction and/or suffer from mental illness are particularly susceptible to sexual exploitation.

Precise numbers of commercial sex workers in the Local Communities is unknown; baseline studies, including information from local authorities, have indicated that prostitution is not an issue in this family-focused resort area. However, as noted in **Chapter 15 Community Health, Safety and Security** relatively high numbers of commercial sex workers would not unexpected for the port towns, or in communities spanning or close to major roads such as the M25. Additionally, Chapter 15 has identified that there are relatively high levels of syphilis observed in the ART municipal district that may be due to, amongst a number of other factors, to the presence of commercial sex activities.

14.5.12.2 Stakeholder Engagement with Vulnerable Groups

Stakeholder engagement in Russia began in 2010, when consultation was held in the Krasnodar region, including the town of Anapa, in relation to the Preliminary EIA (during the Feasibility Phase). Since then, South Stream Transport has carried out consultation in relation to both the EIA and the ESIA.

Stakeholder engagement efforts have been adjusted to ensure the participation of vulnerable groups as far as possible, and to ensure access to engagement and consultation methods.

Representatives from local education and health care facilities, local pensioners associations and representatives of community centres for local youth groups and school directors (inviting local youth to participate) were directly invited to public consultation sessions during the Scoping Report engagement stage. Efforts have also been made to disclose information in a variety of ways so as to be accessible to all groups. For example, printed copies of reports have been provided in central community locations, as well as electronic copies on the internet; announcements have been made in local newspapers, and through posters in local shops, bus stops, and other community locations; information has been hand-delivered to schools and pensioner groups; and open meetings have been held in potentially affected Local Communities.

For further information on engagement with stakeholders and vulnerable groups see **Chapter 6 Stakeholder Engagement**.

14.5.13 Baseline Summary and Key Findings

This section provides a summary of key findings and observations arising from the preceding baseline in respect of the ART municipal district and each of the five Local Communities.

14.5.13.1 The Anapa Resort Town Municipal District

The main observations arising from the baseline in relation to the ART municipal district are as follows:

- The ART municipal district includes the Local Communities of the town of Anapa, Gai Kodzor, Rassvet, Supsekh, Sukko and Varvarovka;
- The ART municipal district is a designated 'resort town' which provides for a regime of measures intended to safeguard the district's important tourism attraction features;
- Tourism is the most important industry in the ART municipal district and visitor numbers and accommodation facilities have displayed continuing strong growth over recent years;
- The municipal district has experienced rapid growth in population over the last few years (ca. 9%) compared to the wider Krasnodar Krai region and the Russian Federation;
- The municipal district's strong population growth rate has been driven by high birth rates, lower death rates and higher net in-migration, as well as it's relatively strong economy;
- Armenians and Ukrainians make up the largest minority ethnic groups. Uzbeks are emerging as another minority ethnic group and there is evidence pointing to their importance as workers (seasonal and permanent) in the tourism and construction sectors;
- The ART municipal district administration estimates that the two leading economic sectors are the tourism sector and the retail and services sector. Agriculture is estimated to account for 3% to 5% of economic activity within the municipal district, while the fisheries sector is estimated to accounts for less than 1%;
- The growth in population and the tourism sector appears to have been associated with and/or led to changes in a number of other socio-economic indicators; and
- Overall, growth in a number of different indicators points to changing social conditions and economic growth in the district that appears to be driven by the growth of tourism.

14.5.13.2 The Local Communities

A summary of key findings and observations is provided for each Local Community (in alphabetical order).

Town of Anapa:

- Has the largest population of any community in the municipal district, accounting for approximately 40% of the ART municipal district's residential population;
- Is the centre of tourist activity and accommodation within the municipal district and has a large number of hotels, restaurants and associated infrastructure to support the tourism economy;
- Is the primary hub in the municipal district for services and facilities. The town's social infrastructure is more developed than that of the surrounding rural communities within ART municipal district. All households have mains water and gas supply; and
- Is also an employment hub for many residents of the nearby rural communities.

Gai Kodzor:

- Is located 3 km north-east of the Project Area and 4 km north-east of the Project landfall facilities;
- Is a relatively small community of approximately 3,370 residents;
- Has an approximately 70% Armenian population, a much higher proportion than average in the ART area;
- Has an Armenian community centre, a school, and various shops, located along the main road running through the community; and
- Has relatively good utility provision compared with the other Local Communities. Most households have mains water and 75% of the community is supplied with gas.

Rassvet:

- Is located approximately 4 km north of Gai Kodzor, on the construction access route from the ports;
- Is a small community of approximately 1,400 residents;
- Is flanked on the north by route M25, and adjoined to two other smaller separate communities; one to the west (Tarusin) and to the east (Zarya);
- Falls within the Gai Kodzor Rural District Administration area;
- Nearly 60% of Rassvet population is Armenian, 40% is Russian; and
- Rassvet community does not have a disproportionate number of any of the vulnerable groups: children, elderly, disabled, etc.

Sukko:

- Is located approximately 3 km to the south east of the Project Area, with a small part of the community located within 2 km of the Project;

- Is the only rural district Local Community that is located on the coast, and the Sukko beach is a well-known tourist and public recreational facility in the area;
- Is also bordered to the south by the Utrish SPNA;
- Is the focus of tourism in the Local Communities due to its beach and well-developed tourist infrastructure and services; and
- Has poor utilities provision relative to the other Local Communities, with only 50% of households being supplied with piped water and only 10% being connected to public sewers. Further, no households in Sukko have piped gas.

Supsekh:

- Is located more than 4 km to the north of the landfall section construction site;
- It has a population of approximately 8,760 people and accounts for approximately 6.0% of the population of the ART municipal district;
- Is located close to the town of Anapa and a large proportion of its employed residents work within the town of Anapa;
- Has more developed utilities infrastructure than the other Local Communities: all households have mains water and gas;
- Is not a centre for tourism accommodation although some seasonal workers do reside here during the peak tourism season; and
- Is viewed as a desirable place to live on account of its well-developed infrastructure and proximity to Anapa town, reflected in local house prices.

Varvarovka:

- Is the Local Community located closest to the Project Area;
- Is a relatively small community of approximately 2,300 residents;
- Is not a centre for tourism accommodation although it is used as a base by seasonal workers as accommodation is relatively cheap compared with the town of Anapa;
- Has relatively poor utility provision compared with the other Local Communities, for example, no households in the community are connected to the public sewer system or have piped gas;
- Increases only slightly in population during the tourist season: by an estimated 150 people, comprised of seasonal migrants who stay in the community while working in the ART area;
- Is home to the Kavkaz Winery, a grape producer and wine maker that owns some 80% of the land that will be affected by the Project; and
- Is also the headquarters for Briz, one of two small commercial fishing organisations in the Anapa Resort Town municipal district.

14.6 Impact Assessment

This section identifies and assesses the potential impacts on the existing socio-economic environment arising from Project-related activities. Information within **Chapter 5 Project Description** and the baseline socio-economic characteristics (Section 14.4) have been used to assist the evaluation of the potential impacts and their significance.

14.6.1 Impact Assessment Methodology

This chapter examines the impacts associated with the Project, including economic, community, Project workforce and transportation-related impacts. The methodology specific to socio-economics presented in this section builds upon the general assessment methodology summarised in **Chapter 3 Impact Assessment Methodology**. The methodology has been adjusted specifically in relation to effects on socio-economics arising from the construction and operation of the Project. The Project components and activities for each phase, as relevant to the assessment of socio-economic impacts, are summarised in Section 14.6.1.1. The criteria for the assessment (magnitude and receptor sensitivity) are defined in Section 14.5.1.2, and notes on the methods applied in the assessment are described in Section 0.

14.6.1.1 Project Activities

The Project Description is presented in **Chapter 5 Project Description**. The elements of the Project that are relevant to socio-economics are set out below.

Construction and Pre-Commissioning Phase

Construction of the Project will create employment opportunities and also increase demand for goods and services from construction, port services, and other sectors. However, the majority of the employment opportunities created by the Project will require highly specialised skilled labour, and it is anticipated that these jobs will be filled by the Contractors' existing workforce or specialised sub-contractors from outside the local area. As such, the workforce is expected to consist primarily of non-local workers. Workers employed on the marine sections of the Pipeline (offshore and nearshore) will be accommodated on the construction vessels, whilst workers on the landfall section are likely to be lodged in nearby towns and villages.

Construction of the landfall section including the landfall facilities, pipeline corridor, microtunnels, and temporary and permanent access roads will also require both temporary and permanent land access and/or acquisition. Affected land includes areas currently characterised as forest and vineyard. During construction, access to the construction corridor will be restricted for safety reasons.

Construction of the nearshore and offshore sections of the Project will be based from the pipe-lay barge, supported by a number of other vessels. A safety exclusion zone will be established around the construction vessel spread; this zone is expected to extend 3 km up to 600 mbsl from the pipe-laying barge and 2 km beyond that depth, wherein vessels and activities not related to Project will be restricted.

Roads within or near to the existing Local Communities – including Varvarovka, Rassvet and Gai Kodzor – will be used as access routes for construction traffic to transport equipment and materials to and from the landfall construction site. A bypass road will be constructed along the north eastern side of Varvarovka as part of the Project and used by construction traffic to avoid construction vehicles travelling though the centre of Varvarovka during the Construction and Pre-Commissioning Phase. Also a part of the Project, consisting of a temporary access road, will be constructed a short distance to the east of the Varvarovka village cemetery

Although it is anticipated that there will be no marshalling yards located on the Russian coast, it is likely that the contractor will use the Port of Novorossiysk for some of the activities listed below during the Construction Phase of the Project, including: temporary storage of pipe and other plant, equipment and supplies; load out of pipe to the landfall section via road transport; as a base for supply vessels; re-fuelling and maintenance of construction vessels; and as a base for crew-change vessels travelling to the nearshore and offshore construction spread.

Construction-related activities on land and at sea, including road traffic and marine vessel movements, could result in amenity effects (e.g. changes in air quality, dust, noise, vibration, water quality, and changes to views) which may be noticeable to people in the area and affect the quality of the surrounding environment as they experience it, including residents of Varvarovka and Rassvet, the Shingari and Don holiday complex businesses, as well as people visiting the broader Anapa Resort Town municipal district for the purposes of tourism and recreation.

Construction works within the landfall section of the Project are expected to last 27 to 30 months. Works within the nearshore section will overlap with the latter period of the landfall section construction and are expected to last for approximately 15 months, and the majority of the construction works within the offshore section are expected to last for approximately 30 months or 2.5 years. For further detail on the construction schedule see **Chapter 5 Project Description**.

Operational Phase

Once constructed, the landfall facilities will remain for the duration of the Operational Phase and will comprise the landfall facilities containing buildings and monitoring equipment. The construction corridor will be reinstated; the pipelines will be buried and the corridor will be revegetated. A permanent RoW will be in place; trees and other deep-rooting vegetation will not be permitted to grow within the RoW, but outside this area the land will be reinstated to its former uses.

Operational safety exclusion zones will also be established, and will place certain conditions on the use and development of land in relation to agriculture and construction within 410 m of the two outermost pipelines, although the area will still be accessible. At sea, a safety exclusion zone will also be established (500 m either side of the Pipeline) wherein seabed intrusive activities (e.g. bottom trawl fishing) will be prohibited.

Relevant Activities by Project Phase

For each Project activity, Table 14.10 indicates whether the activity has the potential to give rise to a socio-economic impact within the landfall, offshore or nearshore section of the Project. This represents an initial screening of potential interactions; the potential impacts are further considered and described beginning in Section 14.5.2.

Table 14.10 Screening Matrix – Project Activities and Potential Socio-Economic Impacts

Phase	Project Activity	Landfall	Offshore	Nearshore
Construction and Pre-Commissioning	Mobilisation of survey vessels to and from site and vessel movements within survey corridor		✓	✓
	Anchoring of pipe lay vessel during S-Lay pipe-lay (30-600 m max water depth)		✓	✓
	Vessel operations waste and wastewater generation		✓	✓
	Delivery of pipe and other supplies (including crew change) to pipe lay vessel by supply vessel		✓	
	Compressor operation			✓
	Dredging of trench using dredging vessels (dredging technique depends on seabed conditions) and storage of dredged materials adjacent to trench			✓
	Night time working (use of flood lights)	✓	✓	✓
	Use of power generation sets (for example diesel generator)	✓	✓	✓
	Delivery of construction materials	✓		
	Fencing off of landfall facilities and construction areas	✓		
	Land clearance, grading, top soil stripping	✓		

Continued…

Phase	Project Activity	Landfall	Offshore	Nearshore
Construction and Pre-Commissioning	Use of temporary pre-fabricated facilities (i.e. portakabins, portaloos, etc.)	✓		
	Delivery / removal of temporary pre-fabricated facilities (i.e. portakabins, portaloos, etc.) and pipeline construction materials (pipe sections, welding material, etc.)	✓		
	Vehicle and plant operations on site	✓		
	Land acquisition / Temporary land use	✓		
	Employment of contractors (and related issue/impact of importing workers)	✓	✓	✓
	Employment of a Project workforce	✓	✓	✓
	Consumption of construction equipment and materials and other supplies and services	✓	✓	✓
	Construction of landfall facilities, pipeline installation and access roads	✓		
Operational (including Commissioning)	Mobilisation of vessels to and from pipeline locations and vessel movements along pipeline		✓	✓
	Physical presence of pipeline on seabed		✓	✓
	Clearance of vegetation from permanent Right-of-Way over pipeline.	✓		
	Employment of workforce	✓		

Continued...

Phase	Project Activity	Landfall	Offshore	Nearshore
Operational (including Commissioning)	Imposition and maintenance of landfall section exclusion zones	✓		

Complete.

14.6.1.2 Socio-Economic Impact Assessment Criteria

Identification of Potential Receptors

Two broad categories of potential receptors that have been identified with respect to the potential socio-economic impacts of the Project are:

- Those that would be affected economically or financially (including workers, businesses, residents, landowners, land users, and users of utilities and telecommunications); and
- Individuals and groups within the local communities that could be affected either socially or in terms of their physical and mental well-being, or in terms of their recreational amenity.

Receptors and resources may vary by the type of impact, and different impacts may affect different receptors. A receptor may be an individual, household, group or organisation, or a community. Receptors may be affected by changes in the environment, or by changes to things such as land use, land ownership, transportation, livelihoods, incomes, community values, or the enjoyment of natural areas.

Accordingly, receptors which could experience a socio-economic impact in one or more of these ways as a result of the Project are identified and described in Table 14.11 which shows the key receptors in respect to economic and community related impacts.

Table 14.11 Receptors by Impact Type

Impact type	Receptors	Applicable Phase	
		Construction	Operation
Economic-related impacts	Existing labour force within the municipal district and further afield	✓	
	Existing businesses within the municipal district and further afield	✓	✓
	Fishers and fishing companies	✓	
	Shingari and Don Holiday Complexes	✓	
	Varvarovka horse riding business	✓	

Continued…

Impact type	Receptors	Applicable Phase	
		Construction	Operation
Economic-related impacts	Local Communities including agricultural (vineyard) and tourism sector workers	✓	
	The Anapa Resort Town tourism sector	✓	
	The Russian government and taxpayers		✓
Community-related impacts	Local Communities (related to recreational facilities)	✓	✓
	Recreational beach and water users	✓	
	Varvarovka village cemetery visitors	✓	✓
	Residential occupants (related to amenity impacts)	✓	✓

Complete.

Receptor Sensitivity Criteria Tables

The concept of sensitivity attempts to reflect the degree of response to a change in baseline conditions by a receptor. This degree of response may range from being very susceptible to change (and having little resilience) to being able to absorb or adapt to change (being very resilient).

Within the socio-economic context, receptor sensitivity is difficult to define as it varies significantly within and between individual receptors for any given impact. The degree of sensitivity of a socio-economic receptor is based on an individual's abilities to adapt to changes and maintain their livelihood and well-being (i.e. resilience) and, in situations where an impact may result in a loss or reduction of access to a resource, their ability to access an alternative resource that provides the same service (e.g. a livelihood / employment, recreation, etc.). Sensitivity is not uniform. For example, not all fishing communities are equally vulnerable, and within a community, different individuals may have different levels of sensitivity. Sensitivity can also refer to 'vulnerability'.

In this assessment, sensitivity represents a stakeholder's resilience or capacity to cope with change. There are a range of variables that can influence a stakeholder's sensitivity and should be considered:

- Age, gender, race, religion;
- Land rights and ownership;
- Employment / unemployment / income;
- Livelihood strategies (and livelihood alternatives);

- Location / isolation;
- Public services, e.g. health access and quality;
- Access to, and use of, natural resources including water;
- Food security;
- Education / skills;
- Health or disability;
- Support networks; and
- Marginalisation (e.g. degree of access to services and formalised rights).

When considering impacts on people, sensitivity is typically a complex interaction of some or all such factors. In order to facilitate a comparison of impacts for the purposes of the ESIA, a series of criteria attempting to capture these elements have been established based on professional judgement and Good International Industry Practice. Table 14.12 outlines the criteria for evaluating sensitivity from negligible to high. The sensitivity of receptors will be considered in the context of each individual impact, although only certain criteria may be applicable depending on the type of receptor being assessed.

Table 14.12 Socio-Economic Receptor Sensitivity

Sensitivity	Criteria
Negligible	A receptor with plentiful capacity and means to adapt to a given change and maintain / improve quality of life or that would not be affected in any material or noticeable way by a given change
Low	A receptor with some capacity and means to adapt to a given change and maintain / improve quality of life.
Moderate	A receptor with limited capacity and means to adapt to a given change and maintain / improve quality of life.
High	An already vulnerable receptor with very little capacity and means to adapt to a given change and maintain / improve quality of life.

Magnitude of Impacts

The magnitude of an impact is a measure of the degree of change in the baseline environment as a result of the Project. This baseline could refer to a diverse range of factors (i.e. financial, physical or emotional).

The dimensions affecting the magnitude of an impact are set out in **Chapter 3 Impact Assessment Methodology** and include the duration, frequency, reversibility and extent of an impact. The determination of impact magnitude for adverse impacts is also based on a scale of negligible, low, moderate and high.

The quantification of impact magnitude (e.g. economic appraisals) depends on the availability of adequate data and is not readily applicable across all impact types. The criteria presented in Table 14.13 include a set of qualitative descriptions that characterise different levels of impact magnitude from negligible to high which reflect the dimensions set out in **Chapter 3 Impact Assessment Methodology** and which have been developed based on professional judgement and Good International Industry Practice. For beneficial impacts, the beneficial nature of the impact has been noted but the magnitude of the impact has not been assessed using the same scale; instead, a qualitative description of the benefit is provided.

It is also noted that impacts and outcomes associated with the Project may be either direct or indirect. However, these characteristics, while important to recognise and understand in terms of the application of mitigation measures, do not affect impact magnitude and are not directly considered in the socio-economic impact magnitude criteria.

Table 14.13 Socio-Economic Impact Magnitude

Magnitude	Criteria
Negligible	An impact that is unlikely to have a measurable or noticeable effect on the wellbeing of people so that the baseline conditions will be materially unaffected.
Low	An impact that is likely to affect a small number of people (with number depending on the local context) and which is likely to be temporary (up to two years) and reversible.
Moderate	An impact that is likely to affect a moderate number of groups and/or people or businesses (with number depending on the local context) and which may or may not be reversible.
High	An impact that is likely to affect large numbers of groups and/or people or businesses (with number depending on the local context) irrespective of both time-scale and reversibility.

14.6.1.3 Impact Assessment Methods

Determining Impact Significance

The significance of potential adverse socio-economic impacts has been assessed by taking into account the magnitude of each impact (including their extent, duration, frequency and reversibility) along with the sensitivity of the relevant receptors, as outlined in Table 14.12 and Table 14.13. For beneficial impacts, the beneficial nature of the impact has been noted but the magnitude of the impact and the sensitivity of the receptor has not been explicitly identified, although the context of the potential benefit is discussed. As outlined in **Chapter 3 Impact Assessment Methodology**, the significance matrix provides basic guidance for the determination of impact significance; however, the resulting significance level is also checked against the descriptive definitions for each significance level (**Not Significant**, **Low**, **Moderate**, or **High** significance). The significance is interpreted on the basis of professional judgement and expertise, and adjusted if necessary.

Identifying Mitigation and Assessing Residual Impacts

As described in **Chapter 4 Analysis of Alternatives** and **Chapter 5 Project Description**, the Project design process has incorporated a number of design principles and measures to avoid or reduce adverse impacts. These are defined as design control measures. As a result, to the extent practicable, the Project design has minimised land acquisition, particularly land acquisition from good quality agricultural land. In the case of temporary facilities, the Project design has made maximum use of land likely to cause minimum economic displacement. This chapter has assessed impacts based on the Project design that has already incorporated these design control measures.

Within the respective impact assessment sections below for each phase of the Project, following the initial pre-mitigation impact assessment, a set of receptor-specific mitigation measures and other Project enhancement measures have been identified. These are explained in detail below.

Following assessment of the mitigation measures, the overall significance of the impacts, taking into account the mitigation measures, has been reassessed to arrive at the residual impact. The reassessment has applied the same methodology used to undertake the original pre-mitigation assessment.

14.6.2 Impact Assessment: Construction and Pre-Commissioning

This section identifies the potential socio-economic impacts and risks associated with the Construction and Pre-Commissioning Phase. For those effects where potentially significant pre-mitigation impacts are assessed in Section 14.5.2.1, potential mitigation measures have been identified in Section 14.5.2.2. This is followed by a residual impact assessment, the results of which are set out in Section 14.5.2.3. There are several potential impacts that were 'scoped out' and therefore not assessed for the Construction and Pre-Commissioning Phase and they are described below.

Impacts Considered and Scoped Out

The following potential socio-economic impacts were identified in relation to the Construction and Pre-Commissioning Phase of the Project. However, considering the Project description and the understanding of the baseline socio-economic characteristics presented in Section 14.4, the potential for these impacts to occur has been scoped out for the reasons described below.

Recreational Boating

It is considered that recreational boats (and other non-commercial vessels) will not be impacted by the Project given their ability to easily navigate around the vessel spread during construction of the nearshore and offshore sections. Information on restricted areas will be provided to the relevant authorities to inform navigation charts for marine stakeholders identifying marine exclusion zones through the Construction and Pre-Commissioning Phase.

Commercial Shipping

The Project Area is crossed by shipping routes, as set out in Appendix 9.1. However, due to the small area occupied by the construction spread (and the associated restrictions on navigation in the vicinity of the construction spread, as described in **Chapter 5 Project Description**) and the movement of the spread at approximately 2.5 km per day, it is expected that shipping routes will not be affected as the pipe-laying spread can easily be avoided.

Cliff Walking Trail

Although **Chapter 13 Landscape and Visual** has assessed the potential for adverse visual impacts for the cliff walking trail (also known as the "Mountains of the Caucasus Trail"), these visual impacts will be temporary and short term and, given the way in which the trail is used, it is not considered that these impacts would impair the use or enjoyment of the trail for recreational purposes.

Economic Displacement as a result of Land Acquisition

To the extent practicable, the Project design has minimized land acquisition, particularly land acquisition from good quality agricultural land. In the case of temporary facilities, the Project design has made maximum use of land likely to cause minimum economic displacement.

However, land will still be required for permanent facilities (e.g. the landfall facilities and permanent access roads) and will be leased from the owners for the lifetime of the Project. Land to be used temporarily will be leased from the owners for the duration of the construction activities. Two landowners are affected in this way: a privately owned land parcel is owned by the Russian development company, Fond Yug, whereas the state-owned land is held by the Russian Federal State Forestry Fund.

The Project will secure leases for the land required to construct and operate the Project by way of negotiated settlement in accordance with South Stream Transport's Land Acquisition Plan (covering policy, approach and plan for land acquisition), which includes provision for leasing land and which has been drafted in accordance with Russian legislation and the objectives of IFC PS5, applying the higher of the two standards wherever they are not consistent. The Plan provides for compensation based on a valuation mechanism conducted in accordance with the objectives of IFC PS5 or national legal requirements, whichever is the greater.

There is no provision under Russian Federal law for compulsory purchase in Russia. As such, South Stream Transports cannot expropriate land to make it available to the Project. South Stream Transport must reach an agreement with land owners to acquire or temporarily use land (e.g. by leasing) through negotiated settlement. Any financial impacts on the landowner identified as part of the land acquisition process will be taken into account as part of the negotiated settlement undertaken according to the Project Land Acquisition Plan and national regulations. Further details on the approach to land acquisition for the Project can be found in the Project Land Acquisition Plan, the principles of which are provided below:

- The Project avoids physical displacement and minimises economic displacement by routing and siting its facilities such that no residences are impacted by either direct footprint or buffer areas;
- The Project seeks to enter into negotiated settlements with affected landowners and land users wherever possible;
- Losses are compensated at replacement value;

- Affected people have access to a fair grievance mechanism, including a first tier of internal grievance review by the Project, with the opportunity for aggrieved individuals to resort to independent review of the grievance if a suitable resolution has not been agreed; and
- Vulnerable people, who may be more affected than others by the land acquisition process, will be identified and specifically assisted if and as needed.

Accordingly, it is considered that, as land will be acquired from the two land owners by way of negotiated settlement, within the context of a legal system that does not sanction expropriation or other compulsory procedures, any economic displacement impacts on the respective land owners will be identified and compensated accordingly as part of the negotiated settlement.

Economic Displacement as a result of change in Land Use – Forest Land

Approximately 3.7 ha of forested land will need to be cleared to allow for construction. While the original land use will be restored after construction where possible, approximately 2.1 ha of this cleared area will no longer be forested as trees and other deep-rooting vegetation will not be permitted to grow about the buried pipelines. The remainder of the land, required only during the Construction Phase, will be able to be replanted with trees.

The affected forested land is owned by the Russian Federal State Forestry Fund. Based on information at the time of writing, there is no indication that this land is commercially managed or used (either by the owner or by any third party) for economic or commercial purposes.

As per the Project Land Acquisition Policy, a negotiated settlement with the land owner will be reached, in accordance with Russian Federal law. Any impacts on the landowner identified as part of the land acquisition process will be taken into account as part of the negotiated settlement undertaken according to the Project Land Acquisition Plan.

Accordingly, it is not considered that there would be any economic impacts associated with either the permanent or temporary change of use of the land needing to be acquired.

14.6.2.1 Assessment of Potential Impacts (Pre-mitigation)

The following potential socio-economic impacts are assessed below:

- Economic impacts:
  - Employment generation;
  - Increased demand for goods and services;
  - Potential for Reduced business revenues:
    - Commercial fishing;
    - Shingari and Don holiday complexes;
    - Anapa Resort Town municipal district tourism industry; and
    - Varvarovka horse riding business.
  - Economic displacement of agricultural workers.
- Community impacts:
  - Reduced recreational amenity of Sukko and Shingari beaches;

- Reduced amenity for visitors to the Varvarovka village cemetery;
- Reduced cultural and aesthetic value of landscape; and
- Reduced residential amenity for residents of Varvarovka.

Employment Generation

At the peak of construction, the Project will employ approximately 2,000 people on the construction of all three sections (landfall, nearshore and offshore). The estimated peak labour numbers during the Construction and Pre-Commissioning Phase for each Project section are presented in Table 14.14, although each Project section peak will not occur simultaneously.

Table 14.14 Estimated Labour Levels during the Construction Phase

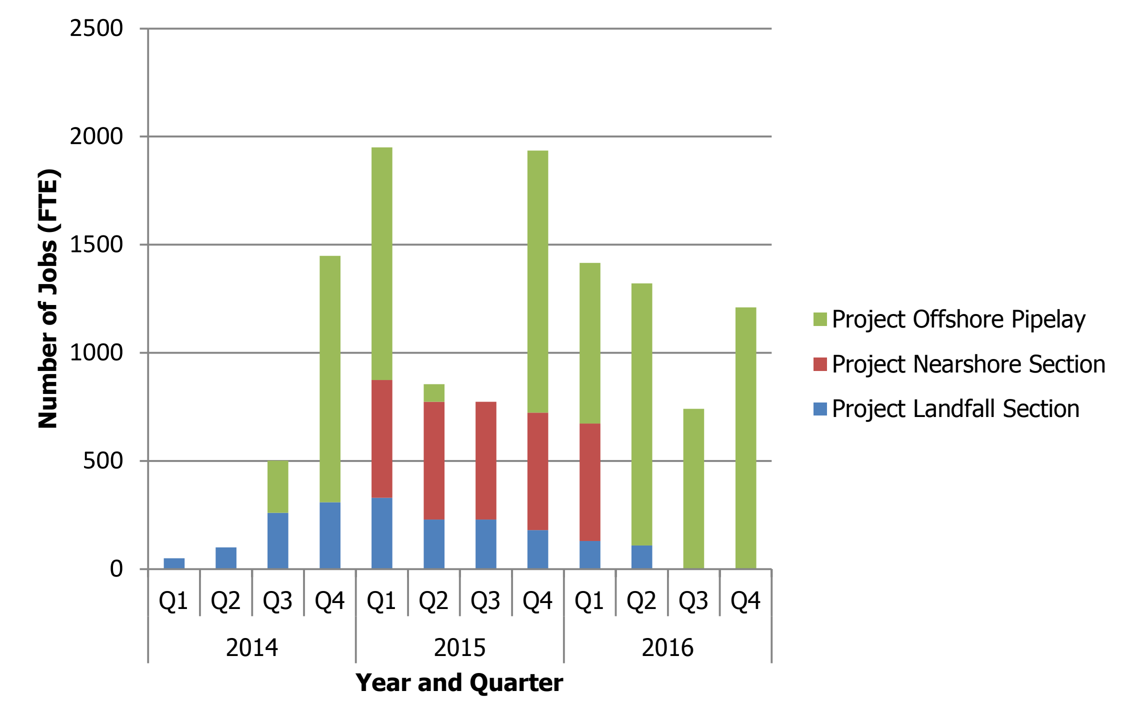
Project Section	Peak Labour Numbers
Landfall	330
Nearshore	544
Offshore	1,211

Most jobs on the Project will be relatively short or medium-term, lasting between several months and up to approximately two years, although a portion of the jobs may last throughout the Construction and Pre-Commissioning Phase. Figure 14.19 shows the anticipated profile of direct employment for the Project during construction. The figure demonstrates how employment will vary as construction progresses.

The construction of the landfall section will generate an estimated 330 temporary jobs during the peak of construction over a two quarter period (i.e. around the fourth and fifth quarter of landfall section construction activity). This estimate includes approximately 115 unskilled jobs (i.e. approximately 35% of jobs). Managerial and skilled jobs associated with the landfall section construction activity are likely to be filled by non-local workers brought on by the Contractor (i.e. approximately 215 jobs). However, it is possible that local workers will be hired to fulfil the unskilled and semi-skilled jobs; however, hiring will be at the discretion of the construction Contractor.

The construction of the nearshore and offshore sections will generate an estimated maximum of approximately 1,750 temporary jobs during the peak of construction approximately half way through the total construction programme. Given the specialised and technical nature of the offshore construction, it is expected that the Contractor will entirely provide the workforce for all nearshore and offshore construction and that few, if any, local people will be employed for this work.

Figure 14.19 Anticipated Profile of Direct Employment for the Project during the Construction and Pre-Commissioning Phase



Source: URS Analysis
Notes: The number of jobs shown per quarter and per section is an estimate; and does not indicate that employment will last for the entirety of the quarter concerned (i.e. the full three month duration).

In addition to any potential direct construction employment generated by the Project itself, through the construction Contractor, there will be an increase in local employment arising from indirect and induced effects of the construction activity. Indirect employment includes the procurement of goods and services from local companies which could generate jobs with these companies. Employment growth may therefore arise locally by way of indirect or supply linkage employment multiplier effects. The beneficial impacts of an increase in demand for goods and services are covered in the assessment of Increased Demand for Goods and Services below, including the use of the port at Novorossiysk. Additionally, part of the income of the construction workers and suppliers will be spent within the Local Communities and throughout the municipal district, generating further employment by way of induced employment multiplier effects[30].

[30] The scale of the multiplier effects will depends on the size of the strength of internal local (both Local Community and ART municipal district) supply linkages and also the degree of income leakage that occurs from the area beyond its boundaries. It is considered that the ART municipal district is likely to have medium supply linkages based on the size and nature (i.e. sectoral composition) of its economy. However, it has not been possible to identify a quantitative multiplier by which to estimate the scale of indirect and induced employment that would be generated locally.

In summary, it is estimated that up to approximately 30% of the landfall section employment, or approximately 115 jobs, could be available to local workers, including workers from the Local Communities. However, local hiring will be at the discretion of the construction Contractor (as employment will not be directly with South Stream Transport). Although the number of local hires is likely to be limited (up to approximately 115 jobs), the Construction Phase will be likely to result in a short term and temporary, **Beneficial** economic impact for Local Communities as a result of the increase in available job opportunities.

An increase in job opportunities, albeit limited, in the Local Communities is a potential benefit of the Project. However, there is also the potential for negative sentiment to be generated within the community in relation to the employment of non-local labour. Specifically, this may arise in relation to:

- Unfulfilled local employment expectations and resentment between local people who are employed by the Project and those whose applications were unsuccessful, and between local and non-local workers if local people perceive that foreign workers are receiving better pay or conditions for the same job;
- Unfulfilled skill development and training expectations as the positions to be filled by workers local to the area are likely to be unskilled (or potentially semi-skilled) and short-term, and training of local workers associated with the Project – if it occurs – will be limited to the training required for these unskilled (or potentially semi-skilled) positions; and
- Increased tensions within the local communities over access to jobs and due to the presence of non-local workers in the area.

Enhancement and mitigation measures related to the benefit of local employment, potential expectations related to this and the potential for negative sentiment, are described in Section 14.5.2.2.

Increased Demand for Goods and Services

The Project will require the procurement of materials and equipment from locations in Krasnodar Krai, Russia and outside of Russia, resulting in a direct increase in the demand for goods and services. Therefore, the Project may result in opportunities for local suppliers and contractors to seek sub-contractor roles and/or supply materials and equipment to the Project and in Russian suppliers winning contracts to supply equipment (such as plant and construction vehicles) and materials, assuming they can meet the required Project specifications. At the time of writing, decisions regarding the supply of steel pipe are still under discussion. It is anticipated that the pipe to be used for the installation may come from pipe mills in Europe, Russia, Japan, and/or India. Accordingly, there is a good probability that pipe mills in Russia will supply at least some of the pipe required for the Project.

Based on the availability of existing suppliers, it is anticipated that contracts for construction activities, materials and shipping services that are fulfilled within Krasnodar Krai and Russia are likely to be from national businesses, with the possibility of some concentration within Krasnodar Krai.

Accordingly, the types of businesses that are likely to see an increase in demand for goods and services as a result of the project are:

- Construction material and equipment suppliers;
- Accommodation suppliers in the town of Anapa;
- Support services suppliers such as transport, catering and cafés / restaurants, cleaning and security; and
- Port-related businesses that serve the port of Novorossiysk, including shipping businesses, associated with the use of the port for the transport of materials, supplies and workers.

Additionally, there will be a requirement to accommodate the non-local Project workforce. **Chapter 5 Project Description** states that such workers will be lodged in nearby communities (i.e. not in a workers camp setting). This assessment assumes that they will lodge in the town of Anapa, given the broader and larger availability of accommodation options there compared to the much smaller Local Communities. It is estimated that, at the peak of construction activity in the landfall section up to 115 jobs will be unskilled / semi-skilled and potentially hired locally; this means that a peak of approximately 215 jobs would be filled by non-local workers needing accommodation in the area.

Local accommodation suppliers are likely to benefit from the demand for accommodation of the incoming workforce. This increased demand is expected to persist, at varying levels, for approximately two years. It is not expected that the number of non-local workers likely to lodge within Local Communities will be high enough to have any significant adverse impact on accommodation, food or other markets given the relative size of the municipal and regional markets, and the prominence of tourism in the area. Several million tourists visit the area annually, and no adverse impacts on housing, tourism, and leisure infrastructure or other markets are anticipated.

Demand for shipping services is likely to be limited, as many of the vessels required for the Project will be specialised and sourced internationally. However, there is likely to be demand for vessels to supply food, waste disposal and crew change services which could be sourced from the region's ports. Additionally, the use of the ports will provide an economic stimulus for any port that is used and port-related services and supply chain businesses that will benefit in turn.

Considering all of the above, the increased demand for goods and services amongst national, regional and municipal district / local businesses will be a temporary but **limited** and **Beneficial** contribution to the economy.

Potential for Reduced Business Revenues

Commercial Fishing Businesses

The Fisheries Study (see Appendix 14.1) examined the three potential risks to fisheries industry target species, as well as the potential for impacts on fisheries, that could arise as a result of construction of the nearshore and offshore sections of the Project. This study concluded that it is unlikely that there will be any distinguishable impact on the resource (i.e. fish stocks) or on the commercial fishing industry in general (individual employment or local business impacts) due to construction of the Project in the nearshore and offshore sections. A discussion of the key findings of the study follows below.

Potential impacts on fish and fishing could arise from construction activities through increased sedimentation, potential disturbance to fish due to noise and light, and the temporary establishment of a marine safety exclusion zone wherein access for vessels and activities unrelated to the Project will be restricted. The Fisheries Study has considered these potential impacts and concluded that there is unlikely to be any distinguishable impact on the resource (i.e. fish stocks) or on catch levels.

Sediment modelling (Appendix 12.2) was undertaken for all seabed intervention activities, such as dredging. The modelling showed that there will be some disturbance of sediment from dredging activities however the plume generated during dredging activities, disperses rapidly over 4 to 5 days from the activity ceasing and concluded that it will not be at an intensity or duration that would influence either the fish or the fishing. Underwater noise modelling (Appendix 12.3 UW Noise) was undertaken specifically for the Project which showed that sound levels generated by Project activities in Russia are insufficient to cause mortality or injury to fish. In addition, noise will only affect a localised group of individual fish over a short time period. Light from night-time works may affect fish, either by direct attraction or through alterations in the distribution of planktonic prey. However, the extent of the impact is limited to the immediate vicinity of the Project vessels. As such, the magnitude of impact on commercial fisheries is considered to be negligible (consistent with the conclusions reached in Appendix 14.1).

The 3 km-radius safety exclusion zone that will be in place around the pipe-lay vessel spread during construction of the nearshore and offshore sections will overlap with an area of fishing grounds. The safety exclusion zone will restrict navigation and fishing within the zone. However, the safety exclusion zone will only take up a small part of the existing fishing grounds at any one time, and will move with the progress of the pipe-lay vessel. In any given area, the safety exclusion zone will only be present for a short period (i.e. a few days during construction of the exit pits, and approximately 9 to 10 days per pipe-lay process from the exit pit to the edge of the fishing grounds at ca. 100 m water depth). Therefore, any fluctuations in effort and catch should be within, and indistinguishable from, normal annual variations.

Small scale commercial fishing companies are known to operate in the vicinity of the Project Area, in the Anapa district and could potentially fish within the Project Area (see Section 14.4.11). These fisheries companies include RPK Briz and OOO Ram which operate between one to three vessels and employ 15 to 30 people.

Given the information provided in Appendix 14.1 regarding the limited extent and duration of potential impacts, it is very unlikely that there would be a distinguishable impact, significant or otherwise, on any Russian fisheries, including the small scale commercial fishing companies operating in the ART area. Accordingly, the magnitude of impact on commercial fisheries is considered to be negligible.

Given the reliance of the fishing industry on the availability of fish stocks to support industry revenues and the livelihoods of workers in the fishing industry, the sensitivity of the commercial fishing industry is assessed as moderate.

Given the negligible magnitude of impact and the moderate receptor sensitivity, the impact on commercial fishing businesses in the Local Communities and those from the wider Krasnodar

Krai region will be **Not Significant**. This is consistent with the definition of a Not Significant adverse impact in Table 3.4 in **Chapter 3 Impact Assessment Methodology**, which states that "any impacts are expected to be indistinguishable from the baseline or within the natural level of variation". Accordingly, no impacts on livelihoods of those working for commercial fishing businesses are expected.

Shingari and Don Holiday Complexes

If customers of the Shingari and Don holiday complexes are deterred from staying at the two complexes by impacts such as noise, dust or impacts on the seascape, then the businesses could in turn suffer deterioration in trade. For this reason the overall effect on amenity, as it would be experienced by guests at the complexes is relevant and is considered below.

Assessments have been undertaken to assess potential impacts related to air quality, dust, noise, vibration, changes to views and changes in water quality. For further information, refer to the respective Construction and Pre-Commissioning Phase impact assessments within Appendix 12.2, **Chapter 9 Air Quality**, **Chapter 10 Noise and Vibration**, and **Chapter 13 Landscape and Visual**. The following points summarise the residual impact findings of those assessments (based on the residual impact conclusions of the assessments, unless otherwise stated).

The air quality and noise and vibration assessments have not identified significant adverse residual impacts specifically in relation to Shingari and Don holiday complexes during the Construction Phase. However, the noise impact assessment has identified the potential for residual Low significance impacts during the Pre-Commissioning Phase on several receptors, including Shingari and Don holiday complexes. This impact is associated with the cleaning, drying and gauging of the Pipeline, and will last for 20 days and nights. The assessment is arrived at on the basis of impacts that will be experienced by residents during the night time.

The visual impact assessment (**Chapter 13 Landscape and Visual**) identified a potential adverse impact of moderate significance on the visual amenity for recreational visitors to the seashore, including the private beach in front of the Shingari and Don holiday complexes[31]. Shingari and Don holiday complexes are the only tourism accommodation businesses specifically identified in the visual assessment with the potential to be directly affected due to their proximity to the nearshore section of the Project during construction activities.

In this case, the impact is related to the temporary presence of non-recreational vessels (i.e. the nearshore and offshore construction vessels) in the waters off the coast; at their closest, during the construction of the microtunnel exit pits, these vessels will be over 1 km away[32]. The impact will be temporary and short-term as the construction vessels, in particular the pipe laying barge, will only be visible to visitors at Shingari and Don holiday complexes for a few

[31] These are the only two businesses identified in the visual impact assessment; the customers of which would be directly impacted by the Project. Therefore, it is not considered that there would be significant impacts on any other tourism related businesses.

[32] The landscape assessment takes account of two activities that will lead to this impact: firstly, the transfer of materials and equipment by vessel to the pipe-laying spread, and second, the operation of marine construction vessels.

days (or a week at most) during construction of each pipeline. With regard to the timing of the impact, it is potentially likely to occur on a single occasion during the main summer peak period, when occupancy of the holiday complexes would be at its highest.

Chapter 13 Landscape and Visual confirms that potential views inland towards the landfall section are prevented by the intervening coastal landform and woodland and so would not affect the visual amenity of visitors to the holiday complexes.

The Sediment Dispersion Study (Appendix 12.2) has modelled the dispersion of sediment plumes that could arise from construction in the nearshore section. This has shown that sediment is dispersed from each proposed dredging and disposal operation, a process that lasts 1.3 days per pipeline operation. Dredging activity could affect the quality of the water at the beach in front of the holiday complexes for short periods of time under certain conditions depending on the prevailing currents and the level of sediment suspension in the water. However, the modelling indicates that, even in a worst case scenario, any sediment plume impact on the beach would be minor and concentrated in any one area for less than 3 to 5 days per pipeline dredging activity. Accordingly, the potential that increased sediment in seawater would detrimentally affect guests at the holiday complexes is limited as the occurrence of any sediment plume will be limited in extent, dependent on tides, highly localised and occur over a very short term, with any impacts (if occurring) only lasting several hours or a few days at most.

The Shingari and Don holiday complexes are relatively small resorts that provide guests with use of a relatively private beach. The potential for adverse visual or water quality impacts on beach users could conceivably reduce the amenity experience of guests staying at the holiday complexes. This could in turn lead to reduced business revenues (e.g. if the company faces reduced bookings or needs to offer rate reductions as compensation). It is considered that this is unlikely given that both resorts mostly provide services for corporate groups and that individuals and families staying at the resort are less likely to have paid personally for their stay as many are organised under the corporate booking arrangement (see Section 14.4.3.3).

Impacts could potentially extend beyond the Construction and Pre-Commissioning Phase of the Project if guests are deterred and do not return for future trips. However, the limited duration of construction works in waters closest to the holiday complexes will in turn limit the duration of any impacts; as noted above, impacts on both views and the turbidity of the water are not expected to last more than a few days. As such, it is considered that the magnitude of impact on the Shingari and Don holiday complexes from a potential downturn in trade, due to visual and water quality effects on guests would be short term and of low magnitude.

Any construction vessels viewed from the beach would be seen in the context of commercial vessels on the existing shipping lanes and the impact of construction activity is unlikely to be of an extent which could prevent the holiday resorts from attracting and retaining guests. These changes are very short term (no more than a few days duration) and are not expected to cause hardship, degradation, or impair the function and value of the resource / receptor. However, given the importance of the holiday complexes' setting and the private beach to the holiday complexes' appeal to prospective guests, the sensitivity of the holiday complex to any adverse effects which might deter holiday makers from staying at Shingari and Don holiday complexes is considered to be moderate.

Given the low magnitude of impact and the moderate sensitivity, the overall impact significance will be **Low**.

Anapa Resort Town Tourism Sector

If tourists were deterred from visiting or staying in the Anapa Resort Town municipal district (and the tourist facilities of the town of Anapa and Sukko) by noise, dust or impacts on views, then the local tourism sector could in turn suffer deterioration in trade. For this reason the overall effect on the area's amenity, as it would be experienced by tourists, is relevant and is considered below.

Other chapters have assessed the potential impacts of:

- Sedimentation affecting water quality along the coast (i.e. increasing the turbidity of coastal waters) as a result of construction in the nearshore section;
- Decreased air quality, including increased dust levels as a result of construction activity in the landfall section;
- Increased noise and vibration; and
- Changes to views

For further information refer to the respective construction impact sections within Appendix 12.2, **Chapter 9 Air Quality**, **Chapter 10 Noise and Vibration**, and Chapter **13 Landscape and Visual**. Following is a summary of the residual impacts and conclusions of these assessments.

The Sediment Dispersion Study (Appendix 12.2) has modelled the dispersion of sediment plumes that could arise from construction in the nearshore section. This has shown that sediment will be dispersed from each proposed dredging and disposal operation, a process that lasts 1.3 days per pipeline operation. Dredging activity could affect the quality of the water at the nearby beaches for short periods of time under certain conditions depending on the prevailing currents and the level of sediment suspension in the water. However, the modelling indicates that even in a worst case scenario, any sediment plume impact along nearby beaches will be minor and concentrated in one area for less than 3 to 5 days per pipeline. Accordingly, it is considered that the risk of increased sediment in seawater detrimentally affecting the enjoyment of the beach for recreation will be limited; the occurrence of any sediment plume at the beach will be dependent on tides, highly localised and occur over a very short term, with any impacts (if occurring) only lasting several hours or a few days at most. **Chapter 9 Air Quality** and **Chapter 10 Noise and Vibration** do not identify any significant residual impacts on tourism areas or activities in the vicinity of the landfall or nearshore sections.

Chapter 13 Landscape and Visual identifies impacts of a moderate residual significance on a number of receptors. In each case, the visual impact assessment states the impacts will be temporary and short term. While these impacts may temporarily reduce the aesthetic value of the area, which could affect the enjoyment of some recreational activities for some people, they are unlikely to be of an extent which alter visitors' use of any recreational or tourism resources in the area.

In regard to scuba diving, **Chapter 17 Ecosystem Services** identifies that there is a potential risk to scuba dive operators if sediment dispersal reduces seawater quality and clarity at diving spots used by diving tour operator businesses off the coast from Sukko. However, the extent of sediment blooms are likely to be small and of short duration (a matter of days). Alternative dive sites are also available and, as such, the significance of any impacts on divers and dive operators are likely to be low and easily avoidable. Further, while there is one dive site (the Gordipiya barge) located close to the nearshore section of the Project although the site lies outside of the safety exclusion zone and access will not be restricted. Therefore, there are unlikely to be impacts on scuba diving (commercial or recreational).

The concentration of the tourism sector in the town of Anapa and Sukko, with further attractions in the Bolshoi Utrish Nature Reserve, all places that are at some distance from the Project Area, means that visitors to the area are unlikely to experience any significant adverse impacts on their use or enjoyment of the area due to the Project's construction. Accordingly, it is unlikely that the construction activity associated with the Project could restrict the ability of any individuals or businesses to derive a livelihood from tourism. As such, it is considered that the magnitude of the potential impact on the tourism sector due to construction of the Project will be low.

Given the importance of the tourism sector to the local economy and the value placed on the quality of the local environment by local tourism operators, the sensitivity of the tourism sector to any adverse effects which might deter tourists from visiting the area is considered to be moderate.

According to the matrix, given the low magnitude of impact and the moderate sensitivity, the overall pre-mitigation impact significance of the Project on the tourism sector will be **Low**.

Potential for Reduced Business Revenues (Varvarovka Horse Riding Business)

The operator of a horse riding business in Varvarovka has indicated that a novice trail riding route runs through the lands owned by Agrifirm Kavkaz. However, the operator was unable to indicate the precise route, and it has not yet been confirmed if this route overlaps with the Project Area. If the route crosses the construction corridor or any of the construction areas, access will be restricted during the period of construction, and the business will need to find a suitable alternative (beginning in Varvarovka and following a route that stays off the roads and stays in quiet, open country).

As it has not been possible to confirm the exact alignment of the novice route used by the horse riding business, the remainder of this assessment is based on a worst-case scenario, whereby it is assumed that the novice horse riding route will be severed during the Construction and Pre-Commissioning Phase. If this happened, the horse riding business would be directly impacted for the duration of this Phase, a period of approximately 15 months. The impact would most likely be temporary and reversible; although depending on the exact route used by the horse riding business and its intersection with the RoW and associated maintenance access roads; some minor adjustments to the route in the Operational Phase may be required. Overall, the magnitude of impact would be moderate.

Given that the novice route is only one route used by the horse business, and that there are other routes that the business may be able to utilise; the sensitivity of the receptor is considered to be moderate.

Taking this potential worst-case scenario into account, and given the moderate magnitude of impact and moderate sensitivity of the receptor; the potential impact significance is assessed as **Moderate**.

Economic Displacement of Agricultural Workers

Approximately 71 ha of land will be taken up (including temporary land use agreements) at the commencement of construction of the Project, including approximately 4 ha of forested land, 8 ha of meadows or shiblyak[33], and 54 ha of agricultural land. The remainder of land is used for existing roadways. This impact assessment considers the potential that land take associated with the Project could result in a loss of productive agricultural areas (i.e. productive vineyards), which could in turn trigger a loss of employment for the people who work these lands. As noted in Section 14.4.7, the vineyards in the Project Area belong to one owner, Agrifirm Kavkaz, owned in turn by a commercial residential development company, Fond Yug. Any potentially affected workers are employed by these owners.

Of the agricultural land that will be affected by the Project land take:

- In total approximately 11.8 ha of confirmed productive vineyards will be removed from productive use due to the Project, including 4.6 ha of vineyard within the potential transfer site[34], and 7.2 ha within the temporary construction area for the Varvarovka Bypass Road:
  - The majority (10.1 ha) of this removal will be temporary and limited to the duration of the construction works in the landfall section of the Project: a period likely to be for up to two years. Once construction is completed, it will be several years until mature, productive vineyards can be re-established on the land; however, during this time the replanting of vineyards will also require labour; and
  - The remaining 1.7 ha of currently productive land will be permanently lost due to road widening for the Varvarovka bypass road. However, these productive vineyards fall entirely within the proposed Chateau Club Village residential development; as such, without the influence of the Project, these vineyards would likely be sold to buyers within a number of individual plots after the completion of construction of the Project.
- The remainder of the agriculturally designated land is currently comprised of scrub, fallow fields and currently non-productive (apparently derelict) vineyards that have been abandoned for at least two to three years:
  - Of this land, approximately 7.0 ha will be permanently transferred to non-agricultural land uses in association with the landfall facilities; and

[33] Evergreen and deciduous scrub and short trees.

[34] The total area of the Potential Transfer Site is 5.38 ha. The difference between the total area and the figure cited for the area of confirmed productive vineyard that would be lost is due to the alignment of the Varvarovka Bypass Road through the Optional Transfer Site; accordingly that area is accounted for under the figure cited for the bypass road.

- A further approximately 23.8 ha of land will fall within the permanent RoW, which will include provision for a small service track for the purposes of pipeline maintenance and inspection (accessible by 4x4 vehicles only). After construction, vegetation within the RoW will be reinstated, and access to the RoW will not be restricted by the Project. However, it is unlikely that vineyards will be replanted within the RoW, although seasonal crops may be established[35]. As a result, the RoW land is likely to be removed permanently from productive use for a vineyard, but still available for other agricultural uses. The track could also be used by agricultural vehicles to facilitate access through and around the fields / vineyards.

Accordingly, although the majority of the affected 54 ha of designated agricultural land has been used for viticulture in the past, less than one quarter of this area is currently in productive use. It is further understood that there is sufficient land under production, with related tasks that can be undertaken, on the land cultivated by Agrifirm Kavkaz to ensure that the land take from the Project would not result in the displacement of workers, as activities and workers would be absorbed elsewhere in the vineyard. The total area of vineyard currently under cultivation by Agrifirm Kavkaz is 416 ha, whereas the area of productive land affected by Project land take amounts to only 11.8 ha, i.e. less than 3% of the area of vineyard currently under cultivation, not including other non-productive and fallow land nearby owed by Agrifirm Kavkaz . Other areas of vineyard owned by Agrifirm Kavkaz were abandoned (i.e. removed from active cultivation) two to three years ago; at this time workers moved to focus on other areas of the overall vineyard property and were not displaced as a result of the change[36].

Considering the total area of Project-related land take (temporary and permanent); the fact that affected productive land represents less than 3% of the landowner (Agrifirm Kavkaz) holdings; the past experience that has shown that vineyard activities and workers can be adjusted throughout the larger vineyard area; the duration of the impact and the fact that much affected land will be returned to its original use following construction; and the possible conversion of land within the RoW from vineyard to other agricultural purposes, it is not anticipated that there will be any economic displacement of agricultural workers (migrant or otherwise) as a result of the Project. As such, the magnitude of impact associated with the potential for the displacement of agricultural workers as a result of Project land take is assessed to be negligible.

In relation to potential economic displacement, the receptor is considered to be the workers who currently tend the productive vineyards. Although their employment is unlikely to be affected by the Project due to the capacity of their employer (Agrifirm Kavkaz) to utilise them on other areas of land, if an impact were to occur then these workers – particularly migrant

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[35] According to existing Russian regulations, it is unusual for anything except grass to be allowed to grow over a pipeline within a RoW of this kind. Although, it is understood that a potential precedent exists for replanting vines or other crops over the pipelines, it is considered unlikely that the land owner or manager would replant vines or other long term cultures over the pipelines because of the possibility that they may need to be dug up at any time in the Operational Phase to allow for maintenance of the pipelines, thereby causing substantial disruption. Therefore on balance, it is considered that the land that would remain within the permanent ROW would not be likely to be replanted with vines (even if the precedent can allow for it) but will be able to be planted with seasonal crops.

[36] This was confirmed during the meeting with Fond Yug and Agrifirm Kavkaz (Ref. 14. 40) in which it was confirmed that the same workers come from Dagestan each year and that the number of workers had stayed reasonably constant over time.

workers from outside Russia – could face hardship in terms of lost income and livelihood. As such, the sensitivity of the workers employed by Agrifirm Kavkaz (including migrant workers) to a potential loss of employment is considered to be high.

Given the negligible magnitude of impact and the high sensitivity of the receptor, it is assessed that potential economic displacement, as a result of the Project land take and / or changes in land use, is an impact of **Low** significance.

Potential for Reduced Recreational Amenity of Sukko and Shingari Beaches

At its closest point, where it crosses under the shoreline within the microtunnels, the Pipeline alignment would be constructed approximately 3 km from Sukko beach; while the distance between the Pipeline alignment and Sukko beach, if measured looking perpendicular directly out to sea from the shoreline, is approximately 6 km (see Figure 14.18 which shows how the distance of the Pipeline alignment from Sukko beach varies along the Pipeline's route).

From a socio-economic perspective, this assessment is concerned with whether impacts on amenity would materially compromise the ability of Sukko and Shingari beach users to use the beaches. Impacts on the amenity of the beaches may be associated with changes to the seawater at the beach (e.g. increased turbidity, making it less appealing for swimming), as well as changes in the views seen from the beach. These issues have been investigated within other assessment chapters and are summarised below.

Appendix 12.2 has modelled the dispersion of sediment plumes that could arise from construction in the nearshore section. This has shown that dredging activity could affect the quality of the water at the nearby beaches for short periods of time under certain conditions depending on the prevailing currents and the level of sediment suspension in the water. However, the modelling indicates that even in a worst case scenario, any sediment plume impact along nearby beaches would be minor and concentrated in one area for less than 3 to 5 days per pipeline. Accordingly, it is considered that the risk of increased sediment in seawater detrimentally affecting recreational beach users will be limited as the occurrence of any sediment plume will be dependent on tides, highly localised and occur over a very short term, with any impacts (if they occur at all) only lasting several hours or a few days at the absolute most.

Chapter 13 Landscape and Visual has identified a potential moderate adverse residual impact in terms of the view from the seashore, including Sukko Beach and Shingari Beach, as a result of construction activities in the nearshore and offshore sections. This impact considers the fact that people on the beach will be able to see the construction vessels working in the sea, when these vessels are closer to shore. This impact will be temporary and short term, as the marine construction vessels, and in particular the pipe laying barge, will only be visible to beach users for a few days (or a week at most) during the construction of each pipeline; following construction, the impact will cease and beach users will not experience any impacts in relation to the operation of the Pipeline. Furthermore, commercial shipping vessels can often be seen in the shipping lanes off the coast; therefore, the presence of the Project's construction vessels (anticipated to be an average of three vessels at any one time) is not expected to be unique or particularly intrusive.

Considering the inputs from the sediment dispersion and visual impact studies, the potential impact on the recreational amenity of the Sukko and Shingari beaches is expected to be of low magnitude.

The receptor for this impact would be recreational beach users. The nature of the coast in this area means that users of Sukko and Shingari beach have little alternative to those beaches unless they travel over 10 km to the town of Anapa to use the beaches there. However, it is considered that amenity-related visual impacts do not materially compromise beach users' ability to enjoy recreational activities such as swimming, playing, sunbathing, etc. As such, the sensitivity of Sukko and Shingari beach users to amenity-related impacts is moderate. It is noted that recreational beach users are likely to include children staying at the Smena Children's camp. However, it is not considered that they are disproportionately vulnerable given the nature of the impact, compared with other beach users.

Given the low impact magnitude and the moderate sensitivity of the recreational beach users, the overall impact significance is assessed as **Low**.

Reduced Amenity for Visitors to the Varvarovka Village Cemetery

The landfall section of the Project will be constructed approximately 400 m southeast of the Varvarovka village cemetery (a Russian Orthodox and Armenian cemetery). Additionally, the cemetery will be located approximately 10 m south of Gazprom Invest Road and approximately 100 m west of South Stream Transport temporary microtunnel access road. The alignment of the South Stream Transport temporary access road has been designed to avoid running close to the cemetery.

This assessment is linked to the assessment in **Chapter 16 Cultural Heritage** on the Varvarovka village cemetery. However, from a socio-economic perspective, this assessment is concerned with whether impacts on amenity features (including noise and visual quality) would materially compromise the ability of visitors to the cemetery to use or enjoy the cemetery.

Chapter 10 Noise and Vibration has confirmed, in relation to Varvarovka village cemetery (identified as Receptor 13 in that assessment), that there would be no significant residual impact in relation to noise or vibration during the Construction Phase. However, the noise impact assessment has identified the potential for Low residual significance impacts during the Pre-Commissioning Phase.

Chapter 13 Landscape and Visual has identified a short-term Moderate residual visual impact on visitors to the cemetery, as visitors may be able to see construction activities on land and in the sea, including the construction and use of the access road along the northern and eastern boundaries of the cemetery.

Chapter 16 Cultural Heritage, taking account of the results of Chapter 10 and Chapter 13, has assessed that there could be a Low adverse residual impact on the tranquillity of the Varvarovka cemetery.

Given the potential for the Project to give rise to noise, vibration, visual and cultural heritage impacts on Varvarovka village cemetery users, as well as the extent, duration and reversibility of these impacts, the magnitude of impact is considered to be low.

The receptor for this impact would be visitors to the cemetery. Given that users of the cemetery are likely to value and also place significant importance on the existing quality of amenity provided for by the surrounding environment, it is considered that the sensitivity of visitors to the cemetery to amenity-related impacts would be high.

Given the low impact magnitude and the high sensitivity of visitors to the cemetery users, the overall impact significance is assessed as **Moderate**.

Reduced Residential Amenity for Residents in Local Communities

Introduction

The construction of the Project has the potential to affect the amenity of (i.e. the overall quality of the surrounding environment as experienced and enjoyed by) residential receptors in Local Communities. Amenity-related features include issues such as air, quality, dust, noise, vibration, and visual impacts. Accordingly, these impacts have been assessed in other chapters of this Report including **Chapter 9 Air Quality**, **Chapter 10 Noise and Vibration**, and **Chapter 13 Landscape and Visual**.

The potential for amenity impacts has been considered for all the Local Communities by having regard to these other chapters. However, a socio-economic residential amenity impact assessment is only considered warranted where there is more than one contributing amenity-related impact (i.e. air quality, dust, noise, vibration and/or visual impact) occurring simultaneously or continuously. Where this is not the case, there is no potential for such impacts to act in combination with one another to impact on residential amenity; the standalone impacts are assessed in their respective chapters.

The air quality, noise and vibration, and visual impact assessments have identified some Low residual adverse impacts and some Moderate residual adverse impacts on residential receptors within the Local Communities (for details, please see **Chapter 9 Air Quality**, **Chapter 10 Noise and Vibration**, and **Chapter 13 Landscape and Visual)**. However, there is only one circumstance where two or more amenity-related impacts would be experienced by the same receptor and where that impact would also occur simultaneously or continuously. This is related to the construction and use of the Varvarovka Bypass Road and impacts on residents in North East Varvarovka. Accordingly, consideration of residential amenity impacts in this chapter is solely concerned with that circumstance and follows below.

Reduced Residential Amenity for Residents in North East Varvarovka

The Varvarovka Bypass Road will be constructed immediately to the southeast of residential dwellings in the north-eastern end of Varvarovka. Assessments have been undertaken to examine the likelihood of significant air quality, dust, noise, vibration, and visual impacts of the Project. For further information refer to the respective construction and pre-commissioning effects sections within **Chapter 9 Air Quality**, **Chapter 10 Noise and Vibration**, and **Chapter 13 Landscape and Visual**. Following is a summary of the residual effect findings of those assessments.

Chapter 9 Air Quality does not identify any Moderate or High significance residual air quality impacts on residential receptors at the north east of Varvarovka. With regard to dust from the

Varvarovka Bypass Road, this finding is based on the consideration that the implementation of good site practice and the stringent use of dust mitigation measures throughout all elements of the construction activities would be capable of controlling emissions, to the extent that the effect of any impact will not be significant.

Chapter 10 Noise and Vibration has assessed that there will be a Low adverse residual impact on residential dwellings (at Receptor 4, as identified in that assessment) due to traffic on the Varvarovka Bypass Road during the Construction Phase under Scenario 3 when the greatest road traffic flows will be experienced on the Varvarovka Bypass Road. The assessment has also assessed a Low adverse residual significance impact on the same receptors, together with receptors 1 and 3 at the southern tip and eastern edge (mid-way between the north and south of the community) of Varvarovka respectively, during the Pre-Commissioning Phase. This impact is associated with the pre-commissioning activities required for the Pipeline, and will last for 20 days and nights per pipeline. The assessment is arrived at on the basis of impacts that will be experienced by residents during the night time. It is important to note that this impact will not occur at the same time as the impacts from road traffic flows.

Chapter 13 Landscape and Visual has assessed Moderate significance residual impacts on residents due to disruptive views of the proposed acoustic barrier along the access road and limited views of construction work on the landfall section. In each case, the visual impact assessment states the impacts will be temporary and short term.

Taking account of the potential for the Project to give rise to noise, vibration, and visual impacts on residents in northeast Varvarovka, as well as the extent, duration and reversibility of these impacts, the magnitude of impact is considered to be low.

The receptor for this impact is the residents of Varvarovka. The degree to which amenity impacts will affect the quality of life of residents may vary depending on the nature of the impact. For example, noise impacts (particularly if occurring at night) and air quality impacts, may detract more from the quality of life for residents than noise impacts during the day or visual impacts. Therefore, the overall sensitivity of residents to amenity impacts is considered to be high; particularly in respect to the potential for night time effects. At other times, the sensitivity of residents to amenity-related impacts may be moderate.

Given the low impact magnitude and the high sensitivity of residential receptors, the overall impact on the amenity of residential receptors, based on the potential for significant night time noise impacts, is of **Moderate** significance.

14.6.2.2 Mitigation and Enhancement

Mitigation measures to address adverse impacts and enhancement measures which have the potential to enhance beneficial outcomes of the Project are set out below.

General Measures

Grievance Procedure

South Stream Transport has developed a Grievance Procedure for the South Stream Offshore Pipeline, which will guide the management of grievances[37] throughout the Project lifecycle. The Grievance Procedure is referred to in **Chapter 6 Stakeholder Engagement** and further described in the Project Stakeholder Engagement Plan.

The Grievance Procedure will be implemented for the community by South Stream Transport and will ensure that grievances are brought to the attention of the appropriate Project staff and addressed in an appropriate and timely way, following a standard procedure of investigation, analysis, and resolution. It will also ensure that resolutions are documented and communicated to the appropriate stakeholders.

The Grievance Procedure will include recourse to a Compensation Management Framework, to ensure that cases requiring some form of compensation are evaluated consistently and equitably.

Compensation Management Framework

In certain circumstances, where it has not been possible to adequately mitigate for a significant adverse impact by avoiding or minimising the impact, it may be appropriate to provide compensation. In other cases, new or different impacts may arise as the Project progresses, as a result of changing baseline characteristics, third-party actions beyond the control of the Project, and/or changes to the assumptions contained within this assessment. While South Stream Transport will monitor environmental and socio-economic conditions (see "Monitoring" below) and adjust or implement mitigation measures as needed, there may be circumstances requiring compensation, or outright claims for compensation, as a result of impacts that have occurred.

South Stream Transport will develop a Compensation Management Framework to guide the evaluation and determination of compensation measures. The Compensation Management Framework will capture the process and requirements for assessing compensation claims and implementing compensation measures. Compensation measures may include financial compensation or in-kind contributions.

Compensation may also comprise livelihood restoration measures, which will be specifically defined under a separate but related Livelihoods Restoration Framework (below). The Compensation Management Framework will be closely tied to the Grievance Procedure (above). Additionally, a specific component of the Construction Management Plans will also address the issue of compensation, with reference to the Compensation Management Framework and other plans and frameworks as appropriate.

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[37] A grievance is a formal complaint by an individual (or group) who feel they are, or have been, adversely affected by Project-related activities.

Compensation for economic loss would include circumstances where compensation would be able to mitigate the financial impacts associated with reduced revenues or increased costs to a business or individual that can be reasonably attributed to the construction of the Project. The Compensation Management Framework will ensure that possibly affected people or businesses are appropriately compensated for lost assets or access to assets.

As part of the process of implementing the Compensation Management Framework, South Stream Transport will work with the affected stakeholders in order to identify appropriate compensation or restoration measures.

The framework will set out certain criteria to ensure that compensation is paid consistently and equitably.

Livelihood Restoration Framework

It is not anticipated that the Project will result in any livelihood impacts warranting livelihoods restoration measures. However, the Project will develop a Livelihood Restoration Framework to provide for the possibility that livelihood impacts do occur. This Framework will define the process that will be undertaken to identify the need for specific livelihood restoration measures, and the development of these measures in consultation with affected stakeholders and relevant local agencies. The overall goal will be to ensure that affected livelihoods are restored, at minimum, to pre-impact levels.

Ongoing Stakeholder Consultation

South Stream Transport will continue a programme of stakeholder engagement and consultation throughout the Construction and Pre-Commissioning Phase. These engagement activities will be designed to facilitate dialogue with relevant stakeholders, including those potentially affected by the Project, or who are concerned about or interested in the Project. These activities will allow potential impacts, issues and concerns to be identified early on and addressed in an expedient manner. These activities will also inform stakeholders of upcoming construction activities, as well as Project Activities that have been completed, and provide advance warning of any anticipated changes. Ongoing and future stakeholder engagement activities are described further in the Stakeholder Engagement Plan for Russia.

Community Investment Plan

South Stream Transport will develop a Community Investment Plan to guide community investment initiatives and opportunities for the Project. Although not intended to mitigate or compensate for impacts of the Project[38], community investment can offer additional value and benefit to both the Project and local communities and stakeholders, in the form of enhancing or creating socio-economic benefits.

[38] The IFC's Strategic Community Investment Quick Guide (2010) stipulates the following: "Community investment is added-value investment. It should not be confused with a company's obligations to mitigate or compensate local communities for environmental and social impacts caused by the project. These issues are addressed separately under IFC's Social and Environmental Performance Standards. Nevertheless, the two are interrelated components of a holistic approach for managing company-community relationships."

As such, South Stream Transport views community investment as a key mechanism to support community development and to establish a mutually beneficial relationship with the Local Communities. Under the Community Investment Plan, South Stream Transport will work with local stakeholders to identify potential community investment opportunities and initiatives. Local stakeholders will also be integrally involved in the design and implementation of such programmes.

Enhancement of Local Economic Benefits

Labour Procurement

Where practicable, South Stream Transport will encourage the use of local labour for the Project including by requiring its contractors to advertise suitable available positions in local and regional media, use local recruitment agencies and engage in other similar activities, so as to provide the opportunity for local people to access employment opportunities created by the Project. Local employment will also be supported by local business contracts that may arise through goods and services procurement (below).

The intention of South Stream Transport to require its contractors, where practicable, to provide the opportunity for local people to seek employment opportunities on the Project, will also assist in addressing the potential for tensions related to unmet employment opportunities. To mitigate further these risks, South Stream Transport will keep communities informed about Project activities; in addition, the Grievance Procedure will provide a means by which the Company will receive and resolve any grievances arising from Project activities.

Goods and Services Procurement

Where practicable, South Stream Transport will encourage the procurement of local goods and services for the Project including by requiring its contractors to advertise suitable available contracts for the provision of goods and services in local and regional media, establish contacts with the local Chamber of Commerce and business associations and engage in other similar activities, so as to provide the opportunity for local suppliers and contractors to seek sub-contractor roles and/or supply materials and equipment to the Project.

Mitigation Specific to Potential Adverse Impacts on Businesses, Livelihoods and Local Communities

Mitigation for Potential for Reduced Businesses Revenues for Commercial Fishing Businesses

The General Measures at the start of this section, Section 14.6.2.2, will apply as appropriate.

Potential impacts on fishing businesses will be mitigated through ongoing stakeholder engagement, the Grievance Procedure, and the Compensation Management Framework, as well as the following measures:

- The coordinates and timing of temporary marine exclusion zones will be communicated to vessel operators through the routine channels of the appropriate maritime authorities; and
- Additional meetings with marine area users (including fishers), as required, to further explain the temporary exclusion zones and address questions and concerns.

Mitigation for Potential Reduced Business Revenues for Shingari and Don Holiday Complexes and Anapa Resort Town Tourism Sector

The General Measures at the start of this section, Section 14.6.2.2, will apply as appropriate.

Plans indicating the Pipeline route and construction phase vessel spread along with timing of construction activities will be provided to the relevant authorities for distribution to local businesses as appropriate, including Shingari and Don holiday complexes.

For visual impacts that have not been avoided through design controls, **Chapter 13 Landscape and Visual** has set out mitigation measures to mitigate visual impacts. Specifically, to mitigate impacts on recreational visitors to the seashore, including the public beaches at Sukko and Anapa, and the private beach at the Shingari and Don holiday complexes, mitigation includes: Phasing construction; avoidance of night-time construction activities as far as practicable; and directional shielding for lighting on vessels, other than navigational lights on vessels.

Additionally, **Chapter 12 Marine Ecology** sets out measures to prevent sedimentation impacts on recreational water users along the coast line.

Mitigation for Potential Reduced Business Revenues for Varvarovka Horse Riding Business

The General Measures at the start of this section, Section 14.6.2.2, will apply as appropriate.

The assessment of the potential for reduced business revenues on the Varvarovka Horse Riding Business has been made on the basis of a worst-case scenario; given that the precise location of the novice route used by the business has not been able to be confirmed at the time of writing. The following mitigation is therefore premised on the basis of the assumption that the route used by the business will be severed for the duration of the Construction and Pre-Commissioning Phase.

The Project will work with the Varvarovka Horse Riding Business to undertake further investigation to check the horse riding route prior to construction to understand whether or not there may be an impact on the horse riding business if the route is not usable during the construction period and, if so, whether mitigation is required.

If access to all or part of the horse riding route is restricted or severed by the Project, South Stream Transport will work with the business owner to identify a suitable alternative. Whether or not an alternative can be found, the Compensation Management Framework and Livelihood Restoration Framework will also apply in the event that impacts on business revenues are evident. South Stream Transport will also engage with the stakeholder prior to and throughout the Construction and Pre-Commissioning Phase to ensure that the stakeholder is informed of Project activities and restrictions, and to understand any concerns the stakeholder may have. The Grievance Procedure will also apply to any complaints related to horse riding and related business impacts.

Mitigation for Potential Economic Displacement of Agricultural Workers

The General Measures at the start of this section, Section 14.6.2.2, will apply as appropriate.

After construction, all land that is not required for permanent aboveground infrastructure in the Operational Phase will be reinstated to a state as near to the original condition as possible or to a form in keeping with the surrounding topography where this is not precluded by risk to integrity of the Pipeline or erosion considerations. All necessary actions will be applied to ensure that reinstated land can function, at minimum, as productively as that prior to land acquisition.

Mitigation for Potential Impacts on the Recreational Amenity of Sukko and Shingari Beaches

The General Measures at the start of this section, Section 14.6.2.2, will apply as appropriate.

Specific to recreational beach users, the Project will provide regular updates to beach users regarding construction activities and schedule, both on land and at sea. Updates and information provided to beach users will also include information about how interested parties can contact South Stream Transport with questions, concerns or complaints.

As set out in respect to the potential for reduced business revenues on Shingari and Don holiday complexes and the Anapa Resort Town tourism sector, **Chapter 13 Landscape and Visual** has set out mitigation measures to mitigate visual impacts. Likewise, **Chapter 12 Marine Ecology** also sets out measures to prevent sedimentation impacts on recreational water users along the coast line.

Mitigation for Potential Impacts on Visitors to the Varvarovka Village Cemetery

Chapter 16 Cultural Heritage presents the mitigation measures to address the moderate adverse significance impact on the tranquillity of cemetery users, including the preparation of a Construction Traffic Management Plan. See Chapter 16 for more detail.

Mitigation for Potential Impact on the Residential Amenity of Residents in Varvarovka

Chapter 10 Noise and Vibration and **Chapter 13 Landscape and Visual** have proposed mitigation to address potential impacts related to noise and visual amenity, respectively, on residential receptors in the north-east of Varvarovka. For noise impacts, this includes the implementation of a three metre high acoustic screen along the boundary of the properties and Varvarovka bypass access road. The visual impact assessment has taken account of the presence of this screen in making an assessment, and has identified the following measures to address the visual impacts, including; the use of suitable vehicles and good vehicle maintenance on a regular basis to reduce visibility of exhaust emissions; removal of acoustic barriers as soon as possible; and the phasing of construction. See Chapter 10 and Chapter 13 for more detail on the mitigation that is proposed.

Monitoring

Monitoring of the socio-economic (and bio-physical) environment will be undertaken in order to ensure that impacts are appropriately managed. An outline of the monitoring that will be undertaken as part of the Project is contained within each of the assessment chapters, including, but not limited to, monitoring of:

- Air quality;
- Noise;

- Landscape and visual amenity; and
- Seabed sediment and marine water quality.

Chapter 22 Environmental and Social Management details the approach that will be taken to monitoring and includes an outline of key monitoring activities. Further information on monitoring including key receptors, monitoring locations and monitoring frequency will be contained within the monitoring program developed for the Project.

Ongoing stakeholder engagement will also serve as a means of monitoring impacts on potentially affected stakeholders, to ensure that the actual level of impact is not greater than predicted. If additional significant impacts are identified and verified, these will be a priority for resolution which will be agreed in consultation with affected stakeholders.

Shingari and Don Holiday Complexes

The results of the relevant monitoring programmes (as measured at relevant monitoring locations) will be communicated to Shingari and Don holiday complexes via the ongoing consultation that will be conducted with the two businesses regarding the Project constructions activities in the nearshore and offshore sections. This will assist with monitoring potential Project impacts and help to determine whether environmental and social changes are attributable to construction activity, and provide a basis for aiding resolution of any grievances.

Sukko and Shingari Beach Users

The users of the Sukko and Shingari beaches are likely to be a diverse, changing and temporary group of stakeholders (a mix of residents, local visitors, tourists from outside the region, etc.) and therefore cannot be specifically contacted. For this group, ongoing stakeholder engagement using communication channels that are likely to reach a diverse range of beach users will be utilised to communicate updates about the Project and activities, relevant monitoring results and ways in interested parties can access further monitoring details, as well as how to contact South Stream Transport with questions or concerns. This will assist with monitoring potential Project impacts and provide a basis for aiding resolution of any grievances.

Land Use and Ownership Monitoring

Monitoring will be undertaken via ongoing consultation with the two affected land owners to ensure that no unexpected land use issues arise during the Construction and Pre-Commissioning Phase. Monitoring will include discussions with Agrifirm Kavkaz to confirm that there is no decrease in demand for labour associated with the Project land take and that Project land take does not preclude use of fields not within the Project footprint.

Community and Local Economy Monitoring

In light of the nature of the Project and existing baseline conditions, the impact assessment has not identified any significant impacts on the Local Communities with the exception of the potential for short term, **Moderate** adverse residual impacts on residential amenity in North East Varvarovka. The impact assessment has also not identified any significant impacts on the economy within the Local Communities that would require a targeted monitoring programme beyond those already discussed.

Nevertheless, regular social and economic monitoring will be undertaken during the Construction and Pre-Commissioning Phase. The key purpose of the monitoring will be to monitor social and economic conditions in case the Project gives rise to any unanticipated social or economic changes within the Local Communities, and if so, to allow for the early identification of these changes and for further mitigation measures to be implemented, as required.

Monitoring will consist of general socio-economic monitoring in tandem with ongoing stakeholder engagement and will cover the following matters:

- Hiring of workers from the Local Communities;
- Procurement of goods and services from local businesses;
- The number of non-local workers employed on the Project, their accommodation status (including type and location of accommodation) and any noticeable increase in demand for local services and facilities (e.g. health facilities) by non-local workers on the Project; and
- Any incidents of anti-social behaviour or crime, associated with the presence of non-local workers within the Local Communities.

In addition, fish catches are also monitored through the official statistics maintained by the relevant fishing authority, VNIRO; this data will be requested if needed to support discussions with stakeholders and/or the resolution of potential grievances. In addition, the Grievance Procedure and ongoing stakeholder engagement will also serve to monitor impacts and perceptions amongst the Project's stakeholders.

14.6.2.3 Residual Impacts: Construction and Pre-Commissioning

Table 14.15 presents a summary of the potential residual socio-economic impacts arising from the Construction and Pre-Commissioning Phase of the Project. These residual impacts are assessed following the application of the mitigation measures identified above.

Beneficial impacts

The Project will result in a number of **Beneficial** but limited residual impacts, *inter alia*:

- Local and regional businesses will benefit from spending on goods and services (including accommodation and related services). Although limited due to the specialised nature of the Project construction, South Stream Transport will encourage the use of local services and contractors where practicable. The use of local businesses may also generate employment for local residents; and
- Local workers may gain employment with the Project. Although limited due to the specialised nature of Project construction, South Stream Transport will encourage local hiring were practicable, particularly in relation to unskilled / semi-skilled positions for the construction of the landfall section. Local hiring will have added benefits in terms of enhancing household incomes.

High Adverse Impacts

No residual **High** adverse impacts are anticipated.

Moderate Adverse Impacts

One residual **Moderate** adverse impact is anticipated:

- The potential impacts on the residential amenity for receptors in north-east Varvarovka arising as a result of noise and visual impacts acting together. The mitigation proposed to reduce noise impacts, specifically a three metre high acoustic screen, has also taken into account the landscape and visual assessment. Mitigation measures specific to these impacts have been identified has been taken account of in the amenity assessment, and therefore the residual impact assessment remains unchanged. It is important to note that the overlap of noise and visual impacts will be short-term and temporary.

Low Adverse Impacts

Three residual impacts of **Low adverse** significance are anticipated in relation to the following impacts:

- The potential for Economic Displacement of Agricultural Workers working on Agrifirm Kavkaz-managed land owing to the take up of approximately 12 ha of vineyard during construction. Although a Livelihood Restoration Framework will be part of the Project ESMS; it is considered that the residual impact would remain unchanged; owing to the nature of the process required to restore livelihoods to pre-impact levels, should that be necessary. It is important to note that, based on the assessment of impact magnitude, it is not anticipated that there will be any economic displacement of agricultural workers (migrant or otherwise) as a result of the Project. However, the significance of the impact has been arrived at based a cautious assessment that has taken account of the potential vulnerability of workers – particularly migrant workers from outside of Russia – and the hardship they could face in terms of lost income and livelihood, if economic displacement were to occur;
- The impact on the enjoyment by recreational users of Sukko and Shingari beaches due to visual disturbance as a result of the view of construction vessels working in the marine area, and also possibly as a result of suspended sediment in the sea water at the beaches over a short term period. However, it is important to note that this impact will be short-term, temporary, and not out of character as the beach has views of existing Black Sea shipping lanes; and
- The potential impact on the amenity experienced by visitors to Varvarovka village cemetery due to noise and visual disturbance associated with construction of the landfall section of the Project, including that arising from the presence of a temporary access road to be constructed by South Stream Transport near the cemetery. The design control of routing the temporary access road in order to leave a land and vegetation buffer between the road and the cemetery, along with the preparation of a Construction Traffic Management Plan, have contributed to a reduced residual impact on cemetery visitors.

Table 14.15 Summary Table – Construction and Pre-Commissioning Phase Residual Socio-Economic Impacts

Activity	Impact	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Significance	Enhancement and Proposed Mitigation Measures	Residual Impact Significance
Landfall and Nearshore construction activities	Employment generation	Economically Active Labour Force in the ART municipal district and within commuting distance of the Project Area	Not identified	Not identified	Beneficial	Where practicable, SST will require contractors to advertise suitable available positions in local and regional media, use local recruitment agencies and engage in other similar activities.	Beneficial
Landfall, Nearshore and Offshore construction activities	Increased demand for goods and services	Businesses in the Krasnodar Krai region and ART municipal district	Not identified	Not identified	Beneficial	Where practicable, SST will require its contractors to advertise suitable available contracts for goods and services in local and regional media, establish contacts with the local Chamber of Commerce and business associations and engage in other similar activities.	Beneficial

Continued…

Activity	Impact	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Significance	Enhancement and Proposed Mitigation Measures	Residual Impact Significance
Nearshore and Offshore construction activities	Potential for reduced business revenues (commercial fishing businesses)	Commercial fishing businesses (operational in the Study Area)	Moderate	Negligible	Not significant	Ongoing stakeholder consultation Provision of construction plans to relevant authorities Grievance Procedure (Compensation Management Framework – if necessary)	Not Significant
Landfall, Nearshore and Offshore construction activities	Potential for reduced business revenues for due to construction activity (Shingari and Don holiday complexes)	Shingari and Don holiday complex businesses	Moderate	Low	Low	Ongoing stakeholder engagement Provision of construction plans to relevant authorities Grievance Procedure Compensation Management Framework Sediment prevention mitigation as detailed in **Chapter 12 Marine Ecology** Visual impact mitigation as detailed in **Chapter 13 Landscape and Visual**	Not Significant

Continued…

Activity	Impact	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Significance	Enhancement and Proposed Mitigation Measures	Residual Impact Significance
Landfall, Nearshore and Offshore construction activities	Potential for reduced business revenues due to construction activity (Anapa Resort Town tourism sector)	Anapa Resort Town tourism sector	Moderate	Low	Low	Ongoing stakeholder consultation Provision of construction plans to relevant authorities Grievance Procedure Compensation Management Framework Sediment prevention mitigation as detailed in **Chapter 12 Marine Ecology** Visual impact mitigation as detailed in **Chapter 13 Landscape and Visual**	Not Significant
Landfall construction activities	Potential for reduced business revenues (Varvarovka Horse Riding Business, due to potential severance of horse riding trial(s)	Varvarovka horse riding business	Moderate	Moderate	Moderate	Ongoing stakeholder consultation Grievance Procedure Compensation Management Framework Livelihood Restoration Framework	Low

Continued...

Activity	Impact	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Significance	Enhancement and Proposed Mitigation Measures	Residual Impact Significance
Landfall construction activities	Economic displacement of agricultural workers due to Project-related use of existing agricultural land	Local communities, including agricultural (vineyard) workers	High	Negligible	Low	Ongoing stakeholder consultation Grievance Procedure Compensation Management Framework Livelihood Restoration Framework	Low
Nearshore and offshore construction activities	Potential for reduced recreational amenity of Sukko and Shingari beaches	Sukko Beach and Shingari Beach recreational users	Moderate	Low	Low	Ongoing stakeholder consultation Grievance Procedure Sediment prevention mitigation as detailed in **Chapter 12 Marine Ecology** Visual impact mitigation as detailed in **Chapter 13 Landscape and Visual**	Low

Continued…

Activity	Impact	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Significance	Enhancement and Proposed Mitigation Measures	Residual Impact Significance
Landfall construction activities	Reduced amenity for visitors to the Varvarovka Village (Russian Orthodox and Armenian) Cemetery	Visitors to the Russian Orthodox and Armenian cemetery	High	Low	Moderate	Ongoing stakeholder consultation Grievance Procedure (Mitigation as per **Chapter 16 Cultural Heritage**): Detailed design routes the microtunnel temporary access road further to the east from the cemetery providing buffer. Preparation and implementation of Traffic Management component of the Russian Landfall CMP and Cultural Heritage CMP	Low

Continued…

Activity	Impact	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Significance	Enhancement and Proposed Mitigation Measures	Residual Impact Significance
Landfall section construction activities	Reduced residential amenity for residents in Local Communities due to: Noise impacts from Varvarovka Bypass Road; Noise impacts from Pre-Commissioning of the whole Pipeline; and Views of the acoustic barrier along the access road and limited views of construction work on the landfall section.	Residents of North East Varvarovka	High	Low	Moderate	Ongoing stakeholder consultation Grievance Procedure (Mitigation as per **Chapter 10 Noise and Vibration**): Noise Barrier to protect properties; Selection of inherently quiet plant; care siting and orientation of plant; use of earth berms and temporary acoustic barriers. (Mitigation as per **Chapter 13 Landscape and Visual**): Use of suitable vehicles and good vehicle maintenance on a regular basis to reduce visibility of exhaust emissions; Removal of acoustic barriers as soon as possible; Phasing of construction; Avoidance of night-time construction activities as far as practicable;	Moderate

Continued…

Activity	Impact	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-Mitigation Significance	Enhancement and Proposed Mitigation Measures	Residual Impact Significance
						Directional shielding for lighting; Construction fencing and screening; Progressive reinstatement of RoW in accordance with the detailed landscape restoration plan following installation of the Pipeline; Rehabilitation and re-vegetation as soon as practicable.	

Continued…

Not Significant Impacts

The remaining residual impacts have all been assessed as being **Not Significant** and are not considered to be of concern to the Project in accordance with the proposed design controls, mitigation measures, management plans, and stakeholder engagement that will be carried out throughout the Construction and Pre-Commissioning Phase. This includes two **Low** adverse impacts on commercial tourism businesses which it is considered would be successfully mitigated for, if required, through the application of the Compensation Management Framework.

14.6.3 Impact Assessment: Operational Phase

14.6.3.1 Introduction

The following section identifies the potential impacts and risks to socio-economic receptors during the Operational Phase. For those effects where potentially significant pre-mitigation impacts are assessed (Section 14.5.3.2), potential mitigation measures have been identified (Section 14.5.3.3). This is followed by a residual impact assessment, the results of which are set out in (Section 14.5.3.4). There are some potential impacts that were not assessed for the Operational Phase and these are described below.

The Project will not create permanent employment opportunities during the Operational Phase. Therefore, any employment will be limited, occasional and temporary. Similarly, any goods and services required will be occasional and short-term. Therefore, these have not been included in the following assessment.

As demonstrated in the Appendix 14.1, the safety exclusion zones will not result in any adverse significant adverse impacts on fisheries during the Operational Phase. Furthermore, the following management measures have been committed to:

- In addition, as part of the Health and Safety Plan that will be prepared by South Stream, information on the position of the pipelines and the marine area exclusion zones / restricted areas will be provided to the relevant authorities to inform navigation charts for marine stakeholders identifying marine exclusion zones through the Operational Phase.
- The Health and Safety Plan will need to be communicated to fishing vessel operators, particularly any trawling companies, to minimise the risk of any accidents involving fishing boats and vessels.

All land that is required permanently by the Project for the establishment of landfall facilities and a permanent RoW along the Pipeline corridor will be acquired prior to the start of construction. Accordingly, the potential for impacts associated with land acquisition on land use have been considered within Section 14.5.2.

14.6.3.2 Assessment of Potential Impacts (Pre-mitigation)

Increased Demand for Russian Goods and Services (gas) and Increased Government Revenues, Taxes and Royalties

The total current gas pipeline capacity between Russia and Europe is approximately 200 bcm/year, which will increase to 318 bcm/year if South Stream and other new projects are completed. This could in turn lead to an increase in Russian gas production and sales. In this case, the Project would give rise to increased tax revenues for the Russian government of several billion euros annually.

As a result, the Project would, under this assumption, give rise to a **Beneficial** impact in terms of increased government revenues.

Fees are also payable for waste transportation and disposal, government approvals and permits. However, these fees are mainly levied to cover administrative costs and do not represent a net additional benefit to the tax base. Additionally, they are relatively modest in the context of overall government revenues so they will not yield a noticeable beneficial increase in national revenues.

Reduced Property Values

In addition to the permanent RoW (the impact of which has been assessed in Section 14.5.2.1[39]), three Safety Exclusion Zones around the landfall section of the Project will be in place throughout the Operational Phase for the protection of public health and infrastructure. These zones will be measured from the centreline of the outermost pipelines for areas and encompassing land within three concentric rings surrounding the Pipeline and landfall facilities. These zones will place differing restrictions on land uses, according to distance from the Pipeline and landfall facilities, on the structures and activities that are prohibited within the zones, as follows:

- Exclusion Zone 1: Between 19 and 260 m from centreline of outermost pipeline: C and E-class: no isolated buildings (1-2 levels), dachas, agricultural farms[40] (covering 166.4 ha);
- Exclusion Zone 2: Between 260 and 345 m from centreline of outermost pipeline: B-class: no cities, settlements, apartments of three levels or more, no developments / buildings with less than 100 people (covering 64.7 ha); and
- Exclusion Zone 3: Between 345 and 410 m from centreline of outermost pipeline: A-class: no airports, railways station, no developments / buildings with population of more than 100 persons (covering 50.1 ha).

[39] All land that is required permanently by the Project for the establishment of landfall facilities and a permanent RoW along the pipeline corridor will be acquired during the Construction and Pre-Commissioning Phase.

[40] It is understood that this relates to buildings but that farming activity, e.g. agriculture, growing vines, etc. will be allowed.

Most of the land that would be included within these zones is agricultural or forest land and accordingly, industrial, commercial or residential development is not permitted. As such, the proposed safety exclusion zones would not constrain the permitted use or development of that land, and there will be no impact associated with the establishment of the safety exclusion zones for the owners or users of that land.

However, the restrictions of the safety exclusion zones could have the potential to reduce land values for private owners of sites upon which existing, proposed or permitted land uses will be precluded by the Safety Exclusion Zones, should such a scenario arise.

A part of the Safety Exclusion Zone 3 to the south of the Pipeline alignment just east of the Anapa-Sukko road, overlaps with a small area of land that falls within the southern extension of Varvarovka allowed for by the Anapa GDP and which is identified as a housing development zone in the Anapa GDP (Ref. 14.14). This land is also within the Anapolis Resort residential project which is proposed for development by Fond Yug. However, the housing zone allowed for by the Anapa GDP allows for 'cottage development' and this type of development is permissible within the development restrictions applicable within the outermost Safety Exclusion Zone 3.

Further, it appears that a very small part of Safety Exclusion Zone 3 overlaps with part of the Chateau Club Village residential and vineyard development. However, it is understood that the development falls outside of the designated boundary (i.e. urban limits) of the Varvarovka community as set out in the Anapa GDP. An illustrative plan of the development available on the development website indicates that, at the most, only one dwelling would be located within the Safety Exclusion Zone 3. Therefore, as with the Anapolis development, it would appear that the proposed development is permissible within the development restrictions applicable within the outermost Safety Exclusion Zone.

Accordingly, the overlap between Safety Exclusion Zone 3 and the land in question that falls within the southeast and northwest extremities of the Project Area will not preclude development as allowed for within the Anapa GDP. Accordingly, there would not be any impact on the land.

On this basis, although the imposition of safety exclusion zones associated with the Operational Phase would be permanent in effect, they would not restrict the development potential of the site as allowed for by the Anapa GDP. Hence, there would not be any impact on land owners.

However, it is understood that the Anapa GDP was recently amended to accommodate the Project and it is possible that the amendments to the plan have reduced the value of the land in question. Additionally, the proximity of the developments to the scheme may reduce the final sale values that the developer is able to achieve. Therefore, the land value may be reduced.

Given the potential for reductions in land value, South Stream Transport will complete a negotiated settlement with the land owner, Fond Yug, in accordance with South Stream Transport's Land Acquisition Plan. The Plan has been drafted in accordance with Russian legislation and the objectives of IFC PS5, applying the higher of the two standards wherever they are not consistent. The Plan provides for compensation, including for any reduction in land values as a result of the Project, based on a valuation mechanism conducted in accordance with the objectives of IFC PS5 or national legal requirements, whichever is the greater. The amount of compensation is being determined by an internationally recognised independent third party and the scope of work for the valuation has been agreed by both South Stream Transport and Fond Yug. Accordingly, any financial impacts on the landowner identified as a result of the establishment of the safety exclusion zones associated with the Operational Phase will be taken into account as part of the negotiated settlement undertaken according to the Land Acquisition Plan and national regulations. Further details on the approach to compensation for any reductions in property values as a result of the Project can be found in the South Stream Transport Land Acquisition Plan.

Taking account of all factors, it is considered that the magnitude of impact would be low. Given that the scale and geographical breadth of Fond Yug's investments, it is considered that the organisation has low sensitivity. As such, it is assessed that any reduction in land value, if occurring, will have a **Low** adverse significance impact on the receptor.

14.6.3.3 Mitigation and Monitoring

The mitigation recommended in relation to each of the significant adverse impacts is set out below. Enhancement measures, which have the potential to enhance beneficial outcomes of the Project, are also addressed.

General Mitigation and Enhancement Measures

The general mitigation and enhancement measures presented in Section 14.5.2.2 in relation to the Construction and Pre-Commissioning Phase (i.e. the Grievance Procedure; the Project Compensation Management Plan; and ongoing Stakeholder Engagement) will all apply in the Operational Phase. Each measure will be tailored as appropriate to the Operational Phase. Further detail in relation to the Grievance Procedure and stakeholder engagement is provided below.

Grievance Procedure

South Stream Transport will continue to implement the Grievance Procedure throughout the Operational Phase with any necessary revisions to ensure it is appropriate to this phase of the Project. As during construction, the Grievance Procedure will ensure that complaints and grievances are brought to the attention of the appropriate Project staff and addressed in an appropriate and timely way, following a standard procedure of investigation, analysis, and resolution. It will also ensure that resolutions are documented and communicated to the appropriate stakeholders. The Grievance Procedure is referred to in **Chapter 6 Stakeholder Engagement** and further described in the Stakeholder Engagement Plan.

Ongoing Stakeholder Engagement

Information on restricted areas under the onshore and marine safety exclusion zones will be provided to the relevant authorities to inform navigation charts for marine stakeholders identifying marine exclusion zones through the Operational Phase.

As for other groups (and the public), South Stream Transport will continue a programme of stakeholder engagement throughout the Operational Phase. These engagement activities will be commensurate with the level of Project activities and all stakeholders will be informed of any significant upcoming activities and changes, as appropriate. The stakeholder engagement activities are described further in the Stakeholder Engagement Plan and in **Chapter 6 Stakeholder Engagement**.

Economic Impacts

Mitigation in case of Reduced Land Values

South Stream Transport will consult the Russian authorities and obtain the necessary permits and consents for all activities. As part of South Stream Transport's Stakeholder Engagement Plan, consultation with affected landowners and implementation of the Grievance Procedure will help to ensure a timely and appropriate response to concerns by landowners and that any issues raised are addressed accordingly.

South Stream Transport will complete a negotiated settlement with the land owner, Fond Yug, in accordance with South Stream Transport's Land Acquisition Plan. The Plan has been drafted in accordance with Russian legislation and the objectives of IFC PS5, applying the higher of the two standards wherever they are not consistent. Any financial impacts on the landowner identified as a result of the establishment of the safety exclusion zones associated with the Operational Phase will be included as part of the negotiated settlement. Further details on the approach to compensation for any reductions in property values as a result of the Project can be found in the South Stream Transport Land Acquisition Plan.

Monitoring As set out in **Chapter 22 Environmental and Social Management**, an overarching Operations Management Social Plan and an Employment Plan will be implemented in the Operational Phase. In light of the nature of the Project and existing baseline conditions, the Operational Phase socio-economic impact assessment has not identified any significant impacts and therefore assessment of those issues which would usually be monitored has been screened out. It is not foreseen that any issues would require a targeted monitoring programme beyond those already discussed.

Nevertheless, socio-economic issues and concerns will be monitored through the ongoing stakeholder engagement program and Grievance Procedure, and solutions to issues or grievances will be developed in consultation with affected stakeholders. If the Project does give rise to any unanticipated social or economic adverse changes within the Local Communities, it will allow for mitigation measures to be developed and implemented, if needed.

14.6.3.4 Residual Impacts: Operational Phase

Table 14.16 presents a summary of the potential Operational Phase residual socio-economic impacts arising from the Project following application of the identified mitigation measures.

Beneficial Impacts

The Project will result in the following **Beneficial** residual impacts, *inter alia*:

- Increased government revenues.

Table 14.16 Summary Table – Residual Socio-economic Impacts during Commissioning and Operational Phase

Activity	Impact	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-mitigation Significance	Mitigation Measures	Residual Impact Significance
Economic Related Impacts							
Operation of the Pipeline	Increased demand for Russian goods and services (gas) and increased government revenues, taxes and royalties	Russian oil and gas industry	Not identified	Not identified	Beneficial	Not applicable	Beneficial
		National government and Russian taxpayers	Not identified	Not identified	Beneficial	Not applicable	Beneficial
Landfall operational exclusion zones	Reduced property values (due to the Project and creation of Operational Phase safety exclusion zones)	Private owners of sites upon which existing, proposed or permitted land uses will be precluded by the Safety Exclusion Zones	Low	Low	Low	Ongoing stakeholder consultation Grievance Procedure Land Acquisition Plan (covering policy, approach and plan for land acquisition) resulting in negotiated settlement with landholder	Not significant

Adverse Impacts

There would be no residual adverse impacts on receptors as a result of the commissioning and operation of the Project.

Not Significant Impacts

The remaining impacts are all **Not Significant** and are not considered of concern to the Project.

14.6.4 Impact Assessment: Decommissioning Phase

The Project will be decommissioned many years into future [41] and impacts during the Decommissioning Phase depend on the alternatives chosen at that time – preservation of the pipelines in place or complete or partial removal. If the latter option is chosen and construction activities (e.g. excavation, removal of pipeline, land rehabilitation) are carried out or construction equipment is used, then impacts are expected to be similar to those assessed in Section 14.5.2 in relation to the Construction Phase – i.e. generation of employment (beneficial impacts), increased demand for goods and services (beneficial impacts), and impacts on land users (potentially adverse, depending on whether or not productive land uses such as agriculture were disturbed). However, such impacts are likely to be at lower levels and short-term. Assuming that the restriction on areas governing the type and scale of development that can take place on land within certain circumference of the Pipeline are removed, there may be beneficial impacts for land owners associated with the liberalisation of development rights.

A careful record and archive of construction and operation activities will be maintained in a suitable format for future users of such information. It will include any special mitigation measures that were applied retrospectively, in addition to those identified prospectively in this impact assessment. It will also record all unexpected events that occurred during the Construction and Pre-Commissioning and Operational Phases of the Project.

14.7 Unplanned Events

The potential impacts associated with unplanned events are discussed in **Chapter 19 Unplanned Events**.

14.8 Cumulative Impact Assessment

The cumulative impacts associated with the Project relating to socio-economics are assessed in **Chapter 20 Cumulative Impact Assessment**.

[41] The Project Life (i.e. the duration of the Operational Phase) is estimated to be approximately 50 years. As such, decommissioning would take place sometime in the mid to late 2060s.

14.9 Human Rights

Terms to Know – Human Rights

Actual human rights impact	An "actual human rights impact" is an adverse impact that has already occurred or is occurring.
Potential human rights impact	A "potential human rights impact" is an adverse impact that may occur but has not yet done so. Potential impacts are analogous to human rights risks, i.e. the risks that an activity may lead to one or more adverse human rights impacts.
Adverse human rights impact	An "adverse human rights impact" occurs when an action removes or reduces the ability of an individual to enjoy his or her human rights.

According to UN Guiding Principles on Business and Human Rights (Ref 14.69), companies should respect Human Rights in projects and operations by seeking to prevent or mitigate potential Human Rights issues that may be caused directly by a Company's projects or operations, or by project partners and suppliers. According to IFC Performance Standard 1, *"each of the IFC Performance Standards has elements related to human rights dimensions that a project may face in the course of its operations. Due diligence against these Performance Standards enables companies to address many relevant human rights issues in its project."* The UN Guiding Principles, the IFC Performance Standards and other International Labour Organisation (ILO) standards are the benchmark for guiding companies in ensuring respect for Human Rights.

Russia is a signatory and party to many International Human Rights Conventions and Legislation which are detailed in **Chapter 2 Policy, Regulatory and Administrative Framework**.

Due to the fact that Human Rights factors are most usually linked with socio-economic factors, this section of the chapter discusses the findings of the Human Rights Due Diligence process.

14.9.1 Due Diligence Process

As previously discussed, the Project is not considered high risk from a socio-economic standpoint and there are no significant socio-economic triggers which would necessitate a Human Rights Impact Assessment separate from the ESIA. However, South Stream Transport undertook a voluntary Human Rights Due Diligence complementary to the environmental and social risks and impact identification process. The Due Diligence process also allows the Project to ensure there is a system in place to proactively monitor potential issues and concerns throughout the Project's lifecycle.

The goals of the Project's Due Diligence process were to:

- Identify, prevent, mitigate and account for actual or potential Human Rights impacts;
- Ensure policies and processes to manage Human Rights issues are in place;

- Express commitment to respect Human Rights through a policy endorsed by senior leadership;
- Ensure communication takes place with stakeholders about how issues will be addressed; and
- Ensure a Grievance Procedure is in place to enable Local Communities and other stakeholders to raise any human rights issues.

A Human Rights register was produced which identified the various elements of the Project and their interaction with actual or potential Human Rights impacts. Wherever possible, Human Rights mitigation and monitoring efforts to address these impacts tie into the Project's existing corporate standards, policies, and procedures as outlined in the Environmental and Social Management Plan (ESMP) (see **Chapter 22 Environmental and Social Management**). A summary of the potential impacts and related Project responses are provided below.

The Due Diligence process recognises that the Human Rights risks may change over time as the Project evolves from the Construction and Pre-Commissioning Phase through the Operational Phase into the Decommissioning Phase. As such, the Project's Human Rights Due Diligence is an iterative process whereby business operations and operating context will be examined on a regular basis.

14.9.2 General Policies and Procedures

During the Due Diligence process, all Corporate and Project policies, plans and procedures were reviewed to ensure a commitment from the senior level of management to protect and manage Human Rights. In addition, contractual language was reviewed to ensure that business relationships, including subcontractors and supplier relationships, are bound by the same policies and procedures.

South Stream Transport abides by its Corporate Social Responsibility and Sustainability Policy which outlines the Company's Guiding Principles and commits to applying the principles by: *"respecting internationally recognised Human Rights in our own operations, and promoting the respect of the aforementioned rights with regard to activities assigned to or carried out with Business Partners and in our relationships with stakeholders;"*

In addition, the Company commits to respecting the UN Global Compact Principles which are *"the protection of international human rights; rights to free association, collective bargaining, and employment non-discrimination; protection and preservation of the environment; and elimination of corruption, including bribery and extortion"*.

Corporate commitments are contained in the Health, Safety, Security and Environment (HSSE) and Corporate Social Responsibility (CSR) requirements outlined for all contractors and suppliers. This ensures that respect for Human Rights is part of contractual relationships and adhered to in direct business activities.

14.9.3 Labour and Working Conditions

Workers are an important group of stakeholders who may be subject to a range of direct impacts, potentially both beneficial and adverse, in terms of access to employment, the terms and conditions of that employment, and their health, safety and welfare whilst working on the Project.

Considering the Project has a robust Health, Safety, Security and Environment Integrated Management System (HSSE-IMS), the Due Diligence process did not identify any potential impacts in relation to labour and workforce health and safety. Instead, it focused on five primary themes in regards to Project labour and working conditions which, if not properly addressed, could lead to Human Rights impacts:

- Freedom of association and effective recognition of the right to collective bargaining;
- Measures to support a diverse workforce and prevent discrimination;
- Processes and measures to ensure safe working conditions;
- Recruitment processes are fair and transparent; and
- Sufficient processes are in place to ensure no use of forced, compulsory or child labour (either directly or in supply or processing chains).

In order to mitigate for potential risks and impacts on the Project Workforce, it was determined that the Project will adopt the following policies and practices:

1. Human Resources Policy: The formulation and implementation of a Human Resource Policy addressing all the requirements of IFC PS 02 will mitigate these risks (and potential impacts). The Human Resources Policy will be implemented via South Stream Transport's ESMP (**Chapter 22 Environmental and Social Management**);
2. Working Relationship: The underlying agreements for all working relationships will be documented by South Stream Transport, and its contractors and subcontractors, and communicated to the Project workforce. All workers will be informed about their working conditions and terms of employment and entitlements to wages and other benefits. All workers will be provided with a written contract containing this information in an appropriate language and/or method;
3. Working Conditions and Terms of Employment: South Stream Transport, and its contractors and subcontractors, will respect the agreed working conditions and terms of employment of the Project workforce (including wages and benefits, hours of work, overtime arrangements and overtime compensation, leave for illness, maternity, public holidays and annual leave);
4. Workers Organisations: South Stream Transport, and its contractors and subcontractors, will allow workers to form and join workers' organisations of their choosing and to bargain collectively in accordance with Russian national law;
5. Non-Discrimination and Equal Opportunity: South Stream Transport, and its contractors and subcontractors, will base the employment relationship on the principles of equal opportunity and fair treatment and ensure that no employment decisions (including those related to recruitment and hiring, compensation, working conditions and terms of

employment, access to training, job assignment, promotion, termination of employment or retirement and discipline) are made on the basis of personal characteristics unrelated to inherent job requirements;

6. Grievance Procedure: South Stream Transport will ensure that a Grievance Procedure for the Project workforce and contractors is implemented (available either directly via South Stream Transport or via contractors) to allow workers to raise reasonable concerns related to working conditions. South Stream Transport, and its contractors and subcontractors, will inform workers about the procedure when they are hired and (again) when they commence work on the Project site or vessels and ensure that the mechanism is easily accessible. The Grievance Procedure will be supported by an appropriate level of management, and address concerns promptly through an understandable and transparent process providing feedback to those concerned without any retribution. Additionally, the Grievance Procedure will not impede access to other juridical remedies or arbitration procedures; and
7. Child or Forced Labour: The minimum age of employment in Russia is 16. In accordance with South Stream Transport's and its contractors' and subcontractors' hazard identification and safety risk management procedures, all parties will ensure that no persons under the age of 18 are employed in hazardous work or in a manner that is economically exploitative, or is likely to be hazardous or to interfere with the child's education or be harmful to the child's health and physical, mental, spiritual, moral or social development. All work of persons under the age of 18 will be subject to an appropriate risk assessment and regular monitoring of health, working conditions and hours or work. Procedures for appropriate risk assessment, regular health monitoring, and for defining working conditions and hours of work for South Stream Transport, contractor and subcontractor employees more generally are addressed in Appendix 15.1 Occupational Health and Safety. South Stream Transport, and its contractors and subcontractors, will not employ forced labour.

14.9.4 Local Communities

To mitigate any potential Human Rights impacts on Local Communities, South Stream Transport has instituted a Stakeholder Engagement Plan as outlined in **Chapter 6 Stakeholder Engagement** which ensures consultation with Local Communities, as well as implementation of a Grievance Procedure to ensure a timely and appropriate response to concerns by Local Communities and that potential impacts are addressed appropriately.

14.9.5 Supplier Engagement

The Due Diligence focused on the fact that Human Rights impacts can be linked to Project activities as a result of the behaviour of parties with which the Project is associated, not only direct impacts caused by South Stream Transport. This is particularly relevant because construction of the South Stream Offshore Pipeline is likely to be undertaken entirely by contractors and subcontractors. It was therefore determined that there could be a potential risk of harmful child labour taking place within the supply chain if not properly managed.

To avoid potential impacts in the supply chain, all mitigation requirements set out above under Labour and Working Conditions will apply to South Stream Transport's contractors, subcontractors, and direct supplier requirements. South Stream Transport will also assess its primary supply chain in relation to this issue on an on-going basis.

14.9.6 Security Provision

The Due Diligence process examined several factors associated with security provision following the guidance as set forth in the Voluntary Principles on Security and Human Rights (Ref. 14.70.) It was determined that a risk of conflict could affect the security environment in a manner that might infringe upon the rights of Local Communities given the history of local security forces in Russia. The track record of public or private security providers in Russia in terms of Human Rights is believed to be weak in the area of training.

In order to reduce the risk of human rights abuses against Local Communities by security forces, whether the security forces are directly employed by the Project, contractors or state security forces, South Stream Transport will ensure training for security forces on escalation of force and protection of Human Rights. Furthermore, South Stream Transport will use its contractual process to ensure that provisions are in place for the conducting of background checks on security staff, as well as monitoring of performance.

Policies, plans and procedures to protect the safety and security of the workforce, community and other Project stakeholders, including provisions for ongoing monitoring and auditing, are documented in the Project HSSE-IMS.

14.10 Conclusions

14.10.1 Summary of Impact Assessment

In terms of economic related impacts, the assessment has identified that the Project will result in limited temporary beneficial economic impacts as a result of additional employment and increased demand for goods and services at the local level during the Construction and Pre-Commissioning Phase. In the longer term, it has also identified beneficial economic impacts at the national level associated with an increase in revenues for both the Russian gas industry and the Russian Federal government, due to the increase in Russian gas exports that the Project will enable.

During the Construction and Pre-Commissioning Phase, there is the potential for **Low** adverse economic pre-mitigation impacts on Shingari and Don Holiday Complexes and the Anapa Resort Town municipal district tourism sector due to potential impacts on the coastal area amenity that may affect customers of tourism businesses in the area, and thereby potentially reduce revenues for tourism-related businesses. However, the implementation of mitigation, including the Compensation Management Framework, would successfully mitigate for financial impacts on any businesses and as a result, it is considered that impacts on any businesses would be **Not Significant**. There is also the potential for a moderate adverse pre-mitigation impact on the Varvarovka Horse Riding Business, in a worst-case scenario if that businesses' access to a riding route is interrupted or severed. However if the worst-case scenario does occur, the application of mitigation including the Compensation Management Framework and Livelihood Restoration Framework, would reduce the impact significance to **Low** adverse.

The requirement by the Project for land on both a temporary and permanent basis will also result in **Low** adverse impacts due to the take up of Agrifirm Kavkaz vineyards and associated economic displacement of vineyard activity; however it is considered unlikely that there would be any loss of employment as the vineyard operator is likely to be able to redeploy workers to other areas and tasks within the vineyard. The application of mitigation, including the Grievance Procedure and, if applicable, access to the Compensation Management Framework and Livelihood Restoration Framework would apply. However, it is cautiously considered that the residual impact would remain unchanged; i.e. a **Low** residual impact, owing to the vulnerability of the migrant workers and the nature of the process required to restore livelihoods to pre-impact levels, should that be necessary. However, it is important to note that, based on the assessment of impact magnitude, it is not anticipated that there will be any economic displacement of agricultural workers (migrant or otherwise) as a result of the Project.

With regard to community-related impacts, the construction of the Project may result in **Low** adverse residual impacts on the amenity enjoyed by recreational users of Sukko and Shingari beach, and also on the amenity experienced by visitors to the Varvarovka village cemetery. During the Construction and Pre-Commissioning Phase, residents of north-east Varvarovka that are proximate to the Varvarovka Bypass Road would experience noise and visual impacts; giving rise to overall adverse impact on their amenity. Mitigation measures specific for these impacts have been identified in **Chapter 10 Noise and Vibration** and **Chapter 13 Landscape and Visual**. However, given these mitigation measures have been taken account of in the amenity assessment, it is expected that the residual amenity impact would remain **Moderate** adverse, short term and temporary.

During the Operational Phase, there would be beneficial economic impacts at the national level in terms of increased demand for Russian goods and services (gas) and increased government revenues, taxes and royalties. There would not be any adverse socio-economic impacts associated with the Project during the Operational Phase.

With regard to Human Rights, there were no significant adverse potential impacts identified that cannot be mitigated through adherence to policies, plans and procedures, as well as through community engagement. Human rights issues within the supply chain will be monitored on an ongoing basis which is provided for in the Project HSSE IMS. Furthermore, the Due Diligence process recognises that the Human Rights risks may change over time as the Project evolves from the Construction and Pre-Commissioning Phase into the Decommissioning Phase. As such, the Project's Human Rights Due Diligence is an iterative process whereby business operations and operating context will be examined on a regular basis.

14.10.2 Overview of Mitigation Measures

This assessment has set out recommendations for mitigation measures. The measures include:

- A range of construction management and environmental and social management processes and procedures to avoid, or where avoidance is not possible, minimise the potential for adverse impacts, including amenity-related (e.g. air quality, dust, noise, vibration and visual) impacts;

- Ongoing stakeholder engagement, including regular community liaison, during construction of the Project to inform and update stakeholders about planned construction activities and the construction programme;
- A Grievance Procedure to allow for prompt, transparent and satisfactory handling of grievances raised by stakeholders, including from within the Local Communities and the Project workforce;
- Appropriate compensation mechanisms, including within the Compensation Management Framework, to compensate businesses, land owners, and other potentially affected stakeholders for any reduction in business revenues or economic losses that arise as a result of the Project; and
- Appropriate livelihood restoration mechanisms, if necessary, included within the Livelihood Restoration Framework, to restore livelihoods to their pre-impact status.

14.10.3 Stakeholder Concerns and Community Investment Programme

Stakeholders have expressed a range of concerns related to the construction and operation of the Project, including concerns related to traffic, the environment, and economic opportunities. The mitigation measures described in this chapter (and in the chapters addressing other types of impacts) are intended to minimise or avoid potential adverse impacts of the Project, and to enhance local benefits. South Stream Transport will implement the measures necessary to reduce adverse impacts as much as practicable, and to enhance benefits, throughout the life of the Project.

It is not possible to address all stakeholder perceptions and concerns within the scope of the ESIA Report. Some concerns fall outside the scope of the Project's influence, such as gas supply, community development, and political or regulatory concerns. However, there may be ways in which South Stream Transport can support positive changes and initiatives in Local Communities beyond the immediate scope of Project impacts. To this end, South Stream Transport has a Community Investment Programme, and will work with local stakeholders and agencies to identify potential themes and initiatives for investment. Although potential areas for Community Investment are not included in the assessment of this ESIA Report (i.e. they are not considered to be 'mitigation' measures), they may complement or build upon Project-specific mitigation measures, as well as existing programmes and initiatives in the Local Communities. Community Investment activities will be developed and implemented in consultation and partnership with the relevant stakeholders.

14.10.4 Conclusions

The mitigation measures identified are intended to systematically avoid and reduce the potential for adverse impacts associated with the Project, or where this is not possible to compensate for adverse impacts on receptors. Assuming that the mitigation measures suggested in this assessment are successfully implemented, it will be possible for the Project to mitigate significant adverse effects associated with the Project to the degree that all adverse impacts after mitigation would be **Low** or **Not Significant** with the exception of short term and temporary impacts on the amenity of residents in North East Varvarovka with a **Moderate** impact.

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Chapter 15: Community Health, Safety and Security

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15 Community Health, Safety and Security

15.1 Introduction

This chapter presents the potential community health and safety impacts arising from Project-related activities, as well as Project security as it pertains to communities. This chapter forms part of the Environmental and Social Impact Assessment (ESIA) Report of the South Stream Offshore Pipeline - Russian Sector ('the Project') that will form part of a system to deliver natural gas from Russia to the countries of central and south-eastern Europe.

This community health, safety and security chapter considers the potential health impacts to national, regional and local population groups, including particularly vulnerable groups who may be disproportionately affected. The approach has been guided by applicable legislative and policy requirements along with relevant guidance including the International Finance Corporation (IFC) guidance on Health Impact Assessment (HIA) (Ref. 15.1) and Good International Industry Practice (GIIP). For example, the approach addresses the two key characteristics required by the IFC guidance, namely: predicting the consequences of project-related actions; and providing information that can help decision makers prioritize prevention and control strategies throughout the project cycle. This has been achieved through: a scoping exercise examining the potential impacts of Project activities; a review of existing baseline health and safety conditions and key trends; evaluation of community views from stakeholder engagement and a health assessment to classify potential health risks before and after the application of mitigation measures.

This chapter has been prepared alongside other assessments that make up the ESIA Report. Where appropriate, this assessment has used relevant data or modelling from other ESIA chapters, as well as information from consultation findings as described in Section 15.4.3.

The consideration of the potential health impacts to the Project's workforce and the regulatory framework that governs safe working practices is assessed in Appendix 15.1 Occupational Health and Safety. An alternative approach has been taken for occupation health and safety which recognises that throughout the Project the workforce will be exposed to a number of different hazards and associated risks. The occupational health and safety issues identified in the scoping stage have been grouped against global accident data categorisations. The occupational health and safety assessment in Appendix 15.1 discusses these categories with Project-specific links where appropriate. Occupational health and safety mitigation considers the due diligence requirements that the Project will need to meet. This more strategic approach for occupational health and safety reflects that the detailed occupational health and safety regulatory regimes will properly be addressed through Project and contractor management plans and systems.

15.2 Scoping

A general Scoping Report for the international ESIA process for the Project was disclosed in Russia in November and December 2012. Disclosure of the report was followed by a series of meetings with a range of stakeholders in December 2012 including Local Communities, local non-governmental organisations and local authorities. A number of comments regarding community health and safety were made during this period (see Section 15.4.3) and these informed the subsequent health studies and the content of this chapter.

An internal Health and Safety Scoping Assessment Report (Ref. 15.2) was prepared in 2013 to focus on community health, safety and security issues which, following IFC standards and guidance, more specifically identified sources of exposure and risk for communities and workers during the various phases of the Project. A discussion of the issues considered and the scoping rationale for including or excluding each issue from the main assessment are contained in the Health and Safety Scoping Assessment Report, which has informed this chapter, including Table 15.12. An outline of the issues which are referred to in other chapters is summarised in Section 15.7 and described in Table 15.12. The issues scoped in are discussed throughout the remainder of this chapter.

15.2.1 Issues and Population Groups Scoped In

The scoping stage examined the ways in which the construction, operation and decommissioning of the Project may affect community health, safety and security. Issues identified as having the potential to give rise to community - and population - level health impacts have been taken forward for further assessment. The scoping exercise included:

- Identifying legislative requirements;
- Gathering and reviewing relevant Project information;
- Evaluating health context, including consideration of: location; climate; endemic diseases; and in-migration;
- Reviewing Project design, including consideration of: water bodies; roadways; pipelines; operational facilities; sources of potential exposure; and transmission-line corridors;
- Identifying potentially impacted geographic areas and potentially affected communities;
- Identifying key stakeholders;
- Setting the geographical, time scale, and population boundaries of the assessment;
- Determining the assessment approach; and
- Collecting baseline data including:
    - Evaluation of existing Russian publication data;
    - Evaluation of data from key stakeholders; and
    - Evaluation of data from other ESIA Report chapters.

In determining the potential health impacts of the Project, the scoping exercise used the World Health Organization's (WHO) definition of health: *'Health is a state of complete physical, mental and social well being and not merely the absence of disease or infirmity'* (Ref. 15.3). Factors that affect health are called the 'determinants of health'. The IFC defines these as: '*individual; social and environmental; and institutional factors, which are directly, indirectly, or cumulatively affected by the proposed project'* (Ref. 15.1).

The scoping exercise uses the four 'determinants of health' themes (individual, social, environmental and institutional factors) (see Section 15.7.2 and Table 15.7 for further detail) to provide a practical framework in which to summarise the areas scoped in for further assessment. The issues scoped in for further assessment are listed below under the remaining headings. These are the issues that form the focus of the community health, safety and security assessment. The brackets after each issue identify whether the effect falls primarily during the Construction and Pre-Commissioning Phase [construction] or the Operational (including Commissioning) Phase [operation]. For information on the approach to the Decommissioning Phase [decommissioning] see Section 15.8.3.

Social factors

- Conduct of workforce in the community [construction];
- Spread of sexually transmitted infections (STIs) due to in-migration of non-local workers [construction];
- Employment opportunities for the local population [construction];
- Public anxiety over large volumes of gas close to Local Communities [operation]; and
- Benefits to the Russian economy from increased gas sales [operation].

Environmental factors

- Construction noise impacts from vehicles, plant and vessels [construction];
- Road transport impacts, particularly heavy goods vehicles (HGVs) [construction]; and
- Mobilisation of historic seabed pollutants during trenching and tunnelling [construction].

Institutional factors

- Local health and emergency service resources due to in-migration of non-local workers [construction].

Unplanned events

- Uncontrolled gas release from pipeline or onshore facilities [operation].

Cumulative impacts

- Russkaya CS construction impacts occurring in tandem with this development [construction]; and
- Future development plans in Varvarovka being affected by exclusion zone restrictions [operation].

The assessment uses the following population age categories when scoping potential health impacts:

- Children and infants < 5 years (childhood illnesses);
- Children ages 5-14 years (older childhood, adolescent health effects);

- Women of reproductive age;
- Adults ages 15-64 (working adults); and
- Elderly > 65 years.

15.2.2 Issues Scoped Out during the Assessment Stage

In addition to the issues which have been addressed in other chapters (Section 15.8), there are two issues (air quality and historic ground contamination) which were initially scoped in to the health assessment but were later scoped out on the basis that no significant impacts were expected at the pre-mitigation stage. The following paragraphs summarise the scoping rationale for this decision.

Air quality impacts from vehicles, plant and vessels

Chapter 9 Air Quality determined that the Pre-Commissioning and Construction Phase of the Project will result in the majority of the Project's emissions and therefore have the greatest potential to affect air quality. Air quality emissions from construction plant, vehicles and materials (including activities related to landfall construction) have potential health impacts. The baseline notes that in Krasnodar Krai, specifically Anapa, Varvarovka and Gostagaevskava, the issue of air pollution is a priority problem for public health, and thus onshore community receptors should be considered. In addition, the issue of dust from increased traffic due to Project activities was raised by stakeholders during EIA disclosure in May 2013 (Ref. 15.4) (see Section 15.4.3).

The air quality assessment modelling includes impacts at the closest two residential community receptors to the landfall section of the Project and concludes that road movements during construction will not give rise to significant impacts to nearby community dwellings. This includes the area of Rassvet and the M25 junction where the largest predicted change in annual mean pollutant concentrations are predicted to occur. Modelling assumptions indicate that health impacts from increased nitrogen dioxide or particulate matter in Rassvet are unlikely and this issue has not been discussed further in this chapter.

Chapter 9 Air Quality reports findings, based on detailed computer modelling provide a strong argument for concluding that the majority of emissions, including benzene, carbon monoxide and particulate matter, from the Construction and Pre-Commissioning Phase of the Project are **Not Significant** health impacts to Local Communities. The only emissions requiring further assessment are nitrogen dioxide and sulphur dioxide.

Chapter 9 Air Quality notes that modelled impact for nitrogen dioxide and sulphur dioxide uses a modelled scenario whereby worst case shipping emissions lasting no more than six days at the closest point to shore, have been combined with the most adverse one hour period of meteorological conditions over five complete years. As such, the impact reported is highly unlikely to occur in practice and this potential impact has not been discussed further in this chapter.

Nitrogen Dioxide

Health impacts associated with oxides of nitrogen may be delayed for one to five hours after inhalation and brief exposure to low concentrations can cause adverse health impacts. However, as determined by the air quality assessment (see **Chapter 9 Air Quality**) the total predicted maximum permissible nitrogen dioxide concentration, including baseline, at the worst affected sensitive receptor, is 158 µg/m^3 (0.158 mg/m^3). This value is well below the reported threshold for adverse health impacts. Furthermore, the modelling suggests a very low frequency of such events and a temporary duration. Based on these assessment findings impacts from nitrogen dioxide have been scoped out.

Sulphur dioxide

The air quality assessment concludes that for predicted change in 24 hour sulphur dioxide concentrations, under worst case scenarios and IFC guideline standard, there is a residual **Moderate** significance impact. The assessment notes that the scenario for this impact is highly unlikely to occur in practice and would be regarded as of **Low / Moderate** significance in the context of Russian national air quality legislation (**Chapter 9 Air Quality**).

From the air quality assessment the highest predicted sulphur dioxide concentration, including baseline, is a maximum 10 minute concentration of 78 µg/m^3 (0.078 mg/m^3). This is a third of the concentration required to elicit an adverse health impact (even for a vulnerable individual, such as someone with asthma). Furthermore, the modelling suggests a very low frequency of such events and a temporary duration. Based on these assessment findings, impacts from sulphur dioxide have been scoped out.

Mobilisation of historic ground contaminants during site clearance and trenching[1]

Chapter 8 Soils, Groundwater and Surface Water reports potential impacts and mitigations for occupational exposure to ground contaminants during site clearance and ground works. This chapter considers the potential for community exposure to ground contaminants from these activities. The exposure dose will generally be less than that of the workforce due to increased distance from the site of contamination; however, population sensitivities may be higher. Two issues were assessed before being scoped out: background radiation levels and soil contamination. These are discussed in the following paragraphs.

Background radiation

Chapter 7 Physical and Geophysical Environment notes that background radiation levels associated with the terrestrial Survey Area (landfall section) were assessed during surveys carried out in 2010, 2011 and 2013. Results of the radiation surveys indicate that background radiation levels within the terrestrial Survey Area (landfall section) meet the requirements of the Russian Standards on radiation protection. Radiation levels measured in the soils do not pose a

[1] Mobilisation of historic seabed pollutants in discussed in Section 15.8.1.2

risk to human health in terms of radiation exposure. Based on these assessment findings, impacts on the community from radiation have been scoped out.

Soil contamination

There is the potential for onshore site clearance and ground works to mobilise existing pollutants. **Chapter 8 Soils, Groundwater and Surface Water** notes that elevated concentrations of contaminants that exceed published standards are known to occur in the soil within the soils Study Area (landfall section) albeit at comparatively low levels. The contaminants locally present in the soil may be harmful to human health under certain exposure scenarios. **Chapter 8 Soils, Groundwater and Surface Water** has concluded that with the following mitigation, which includes undertaking additional desk studies and intrusive investigations, residual impact on human health from soil-bound contamination is **Low**. The assessment includes the provision that:

- In the event that previously unidentified contamination is encountered during construction, works in the affected area will cease and appropriate steps will be taken in accordance with the Contractor's Contingency Plan, developed as part of the Contractor's Emergency Response Plan.

Based on these assessment findings, the mitigation related to soil contamination and as the Project includes appropriate dust control measures (see **Chapter 9 Air Quality**), it is unlikely that community impacts would arise. This issue has therefore been scoped out of further assessment in this chapter.

15.3 Spatial and Temporal Boundaries

15.3.1 Project Description

A detailed description of the Project is provided in **Chapter 5 Project Description**. A brief description of the elements of the Project relevant to this community health, safety and security impact assessment is provided here.

15.3.1.1 Construction and Pre-Commissioning Phase

This phase will involve construction and pre-commissioning activities, which will be undertaken after each of the four pipelines has been installed to ensure that the pipelines meet operational requirements. Key features and activities include:

- Increase in non-local labour (i.e. in-migration from outside the area);
- Temporary and permanent land take within the landfall section construction corridor;
- Construction plant and vehicles operating within the landfall section;
- Vessels in nearshore waters, including an exclusion zone; and
- Dredging and seabed disturbance in nearshore waters.

Works within the landfall section of the Project are expected to last 27 to 30 months, works within the nearshore section are also expected to last for approximately 15 months, and works within the offshore section are expected to last for approximately 3.5 years.

15.3.1.2 Operational Phase

The Project will have an operational design life of 50 years. Key features and activities include:

- Permanent, usually unstaffed, landfall facilities with the capacity for occasional gas venting;
- Permanent Right of Way (RoW) over the pipeline land route;
- Permanent access road to the landfall facilities;
- Reinstatement of other areas to their former uses, but with development restrictions based on the established safety exclusion zones; and
- At sea, the establishment of a safety exclusion zone 500 m either side of the pipeline will preclude fishing within that zone.

15.3.1.3 Decommissioning Phase

The approach to decommissioning, including whether the pipeline will be removed will be determined nearer to the time of decommissioning when more is known about the technologies available to undertake the works and any changes in the sensitivity of surrounding communities. See Section 15.8.3 for further discussion.

15.3.2 Project Location

The Project comprises three sections – landfall, nearshore and offshore. Further information explaining the extent and nature of each section is given in **Chapter 1 Introduction**. The Project phase timeframes are set out in **Chapter 5 Project Description**.

Figure 15.1 shows the Russian national level and the Krasnodar Krai boundaries. The Figure also shows boundary of the ART municipal district and location of Local Communities Varvarovka, Sukko, Supsekh, Rassvet and Gai Kodzor; and the town of Anapa.

15.3.2.1 Study Area

The Study Area, for the purposes of the community health, safety and security assessment, encompasses the areas described in **Chapter 14 Socio-Economics**. In summary, on land the Study Area included the area within 2 km of the landfall section of the Project and also within a 300 m zone either side of potential (existing) access routes. Offshore, the Study Area was based on a 1 km wide zone following the nearshore and offshore route of the pipeline, ending at the EEZ border between Russia and Turkey; this is the area in which the construction vessel spread will operate.

The exception is where the Study Area is extended to that adopted in other chapters of the ESIA Report where those assessments and their respective receptors are discussed.

15.4 Methodology and Data

The baseline has drawn on a variety of sources, including published scientific literature, international health and safety organizations, and general literature searches using Internet search engines and standard textbooks of public health. A variety of secondary health status data sources were used for the Russian Federation, Krasnodar Krai and ART municipal district.

15.4.1 Primary Data and Surveys

Primary baseline data collection was undertaken to inform the socio-economic impact assessment (see **Chapter 14 Socio-Economics**) and the information gathered was analysed to ensure that any health related issues were captured and included in this community health, safety and security impact assessment. In addition, specific health related information was sourced from the ART Municipal Administration in March 2013 and February 2014 to inform the community health, safety and security baseline (Refs 15.5 and 15.6) (see Section 15.4.3).

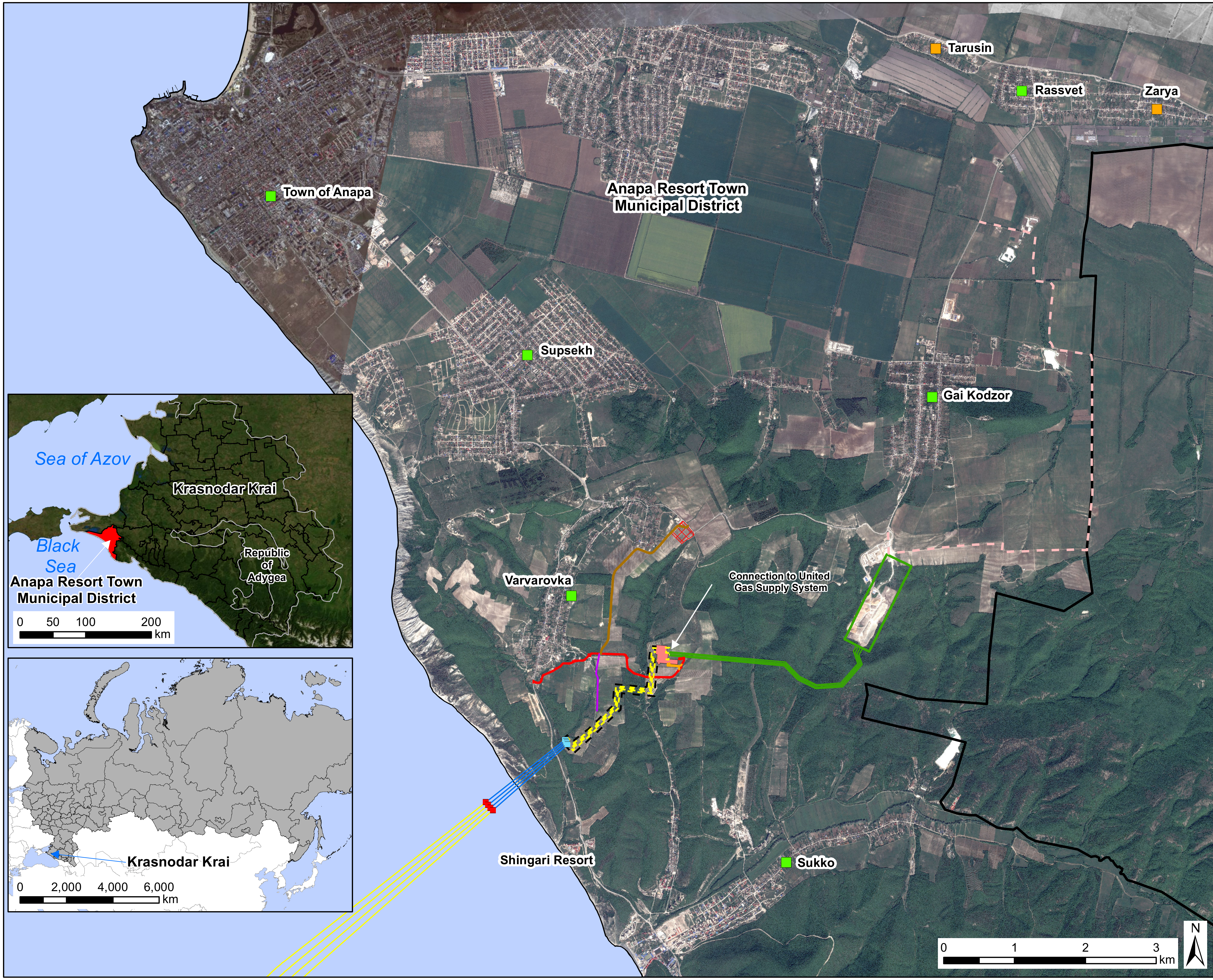
Local officials at the Anapa Resort Town Municipal District Administration (Ref 15.7) and the Gai-Kodzor Rural District Administration (Ref 15.8) provided information in February 2014 related to health facilities in Local Communities which helped inform the baseline (see Section 15.5.3.3). This included information on emergency services, the capacity of local health services and road traffic impacts and road safety issues, specifically in the communities of Rassvet and Gai-Kodzor (Ref 15.8). Information on traffic levels and road safety was also obtained from an interview with the Head of the local school in Rassvet (Ref 15.8).

Data on existing traffic levels was obtained through surveys of potential access roads. The traffic surveys focused on the two most likely approach routes to the landfall site, namely the main roads passing through the communities of Rassvet; Gai Kodzor; Supsekh and Varvarovka. An explanation of the survey methodology, access roads, locations of traffic surveys and the survey results are contained in Appendix 9.1 Traffic and Transport Study.

15.4.2 Secondary Data

The main sources of secondary information were:

- Request No. 543 of 01.02.2012 for morbidity and mortality of the adult, adolescent and juvenile population based on data of the State Public Healthcare Institution Medical Information-Analytical Centre of the Department of Public Health of the Krasnodar Krai (GUZ MIATs), during the period 2006-2010 (Ref. 15.9);
- Statistical guide Health and Healthcare in Krasnodar Krai 2012 of the Ministry of Health Krasnodar Krai (Ref. 15.10);
- Report on sanitary-epidemiological situation and consumer rights 2012 Krasnodarsli Krai Ministry of Health of Krasnodar Krai website (Ref. 15.11); and
- National Priority Project Health Implementation in Krasnodar Krai 2007-2011 (Ref. 15.12).



LEGEND

- Local communities
- Other communities
- Anapa resort town municipal district boundary

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Landfall facilities
- Proposed microtunnels
- Proposed offshore pipelines
- Microtunnel entry shaft
- Microtunnel exit pit
- Construction corridor
- Permanent access road to be constructed by SSTTBV
- Temporary access road constructed by SSTTBV
- Varvarovka bypass road (used by Project during construction only)
- Transfer site

United Gas Supply System

- Russkaya compressor station
- United Gas Supply System pipelines
- Permanent access road to be constructed by Gazprom Invest
- Gazprom Invest temporary bypass road to be utilised by SSTTBV

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Revision Details	By	Check	Check Date	Suffix

Purpose of Issue
For Information

Client
South Stream Transport AG — Stream ENERGISING EUROPE

Project Title
SOUTH STREAM
OFFSHORE PIPELINE

Drawing Title
NATIONAL, REGIONAL AND
MUNICIPAL DISTRICT CONTEXT
OF THE PROJECT

Drawn	Checked	Approved	Date
DH	RW	MW	02 Apr 2014

URS Internal Project No.	Scale @ A3
46369082	1:50,000

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Drawing Number
Figure 15.1

Rev

Plot Date: 02 Apr 2014
File Name: I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Appendix - Health Assessment\Figure 15-1 National Regional and Municipal District Context of the Project.mxd

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15.4.3 Stakeholder Engagement

Stakeholders are individuals, groups or organisations potentially affected by a project, interested in, or with influence over, a project. Stakeholder engagement provides one part of the process for identifying a list of health issues for analysis.

During scoping consultations, stakeholders raised about the issue of noise and vibration from construction activities[2], and the potential impact on Local Communities. Stakeholders also raised the issue of increased traffic during construction and asked whether any additional roads will be constructed.

A meeting was held with ART Municipal District Administration in March 2013 (Ref. 15.13), including with the ART Municipal District Administration Deputy Chief for Health. At that meeting it was confirmed that during the peak season, extra resources including staff (doctors, paramedics, etc.) are mobilised and clinics operate longer opening hours to deal with increased demand arising from the increased number of tourists in the area. It was also confirmed that the local health services offer free medical services to Russian citizens whether or not they are based in the district.

Local officials at the Anapa Resort Town Municipal District Administration (Ref 15.5) and the Gai-Kodzor Rural District Administration (Ref 15.8) provided information in February 2014 related to local health facilities in Local Communities[3]. They reconfirmed that during the tourist season, the numbers of tourists visiting the area means that a range of extra staff and services are provided by the Administration during this time. Emergency facilities are available in Anapa. For more complex cases, patients are transferred to the city of Krasnodar.

The opinion of the Municipal District Administration is that the Project workforce would not unnecessarily strain the local health services as a result of planned Project activities. The needs of any Project related workforce are not expected to compromise the health service provided to tourists and residents during the holiday period (Ref 15.5). In addition, their view is that the services are adequate all year round to cope with the expected numbers of workers related to the landfall section of the Project that are likely to be housed in the area. Further details of the Project stakeholder engagement can be found in **Chapter 6 Stakeholder Engagement.**

15.4.4 Data Assumptions, Limitations and Gaps

The data used in the community health, safety and security baseline has not been assessed for bias or other limitations in its primary collection methodology.

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[2] Stakeholders raised these issues also in relation to the construction of the Russkaya Compressor Station – see Appendix 20.1 Environmental Impacts of Associated Facilities: Russkaya CS.

[3] In addition to the comments in the text, the Administration noted that although they did not have a concern regarding strain on local health facilities in relation to the Project workforce, they are investigating the purchase of mobile health units in order to better service some of the areas outside the town of Anapa.

For some indicators there are no exact definitions, which make the interpretation of the data difficult.

It is noted that in all countries (not just Russia) there is frequent underreporting and misreporting of disease burdens.

Very limited or no data was available for the Local Communities located near the landfall section of the Project. It has therefore been assumed for the purposes of this assessment that the health status in these communities is similar to the ART municipal district within which they are located. It is also assumed for the purposes of this assessment that the Project workforce will be housed in the town of Anapa. This is based on the consideration that it is the town of Anapa, rather than the Local Communities, that is most likely to have a sufficient supply of suitable accommodation options available for requirements.

Given the lack of available local data on health and the lack of specifics at the time of writing in relation to Project workforce accommodation options, the Project will require its contractor to undertake a Rapid Health Appraisal in the pre-construction phase to further understand health conditions (such as disease prevalence) in the Local Communities and including the quality and quantity of local health services. The appraisal will assess the preferred option for the landfall section workforce accommodation, once it is known, as well as potential health impacts relating to the offshore workforce interactions with the town of Anapa and the Local Communities during transit periods. The appraisal may include consultation with applicable local and regional authorities, including health and social service providers.

15.5 Community Health, Safety and Security Baseline

This section provides a summary of the baseline community health, safety and security characteristics of the Project Area.

15.5.1 Demographic Community Profile

The population of ART municipal district was 153,900 people in 2013 (Ref. 15.17). Of these, 40% are urban residents and 60% live in rural areas. Among the entire resident population, men account for 47% and women 53%. The female population of child bearing age accounts for 48.2% of the total female population. Children aged 0 to 17 years account for 19.1% of the total population. Adults (17+) account for 80.9% of the total population. In total, 60.5% of the population are working-age persons and 22.6% are retired (Ref. 15.9).

In the ART municipal district, the birth rate was consistently higher and the death rate was consistently lower than in Krasnodar Krai and the Russian Federation over the period from 2006 to 2010. As a result, and in contrast to the national and regional level indicators, the ART municipal district has had positive net natural population growth since 2007.

At the same time, the ART municipal district has experienced positive net migration at a rate two to three times that of Krasnodar Krai. The main factors contributing to migration growth are the in-migration of non-local labour for the construction, tourism and agricultural sectors as well as a relocation programme run by the Russian military to resettle service personnel to the area on retirement. Together, these factors have contributed to the relatively strong population growth in ART.

In 2010, in Krasnodar Krai, the life expectancy for men was 65.8 years and the life expectancy for women was 76.5 years. Since 2003, there has been an increase in life expectancy in Krasnodar Krai, in particular in the period 2006 to 2010.

Life expectancy depends on the mortality rate and 60% of mortality rate in Krasnodar Krai is associated with social factors, healthcare, alcohol and smoking. Smoking accounts for a reduced life expectancy of 19 to 23 years and alcohol use for a reduction of 20 to 25 years, particularly for men (Ref. 15.9).

The infant mortality rate in Krasnodar Krai was reported to be 6.0 per 1,000 individuals in 2011. The infant mortality rate in ART municipal district was 3.4 per 1,000 individuals in 2011 and is lower than the comparable rate for Krasnodar Krai. The infant mortality indicator is considered to be a very sensitive indicator reflecting the socio-economic status of the population and the quality of health services provided (Ref. 15.10).

The perinatal mortality rate in the Krasnodar Krai region has decreased from 6.3 per 1,000 individuals in 2007 to 5.4 per 1,000 individuals in 2010. The maternal mortality rate has increased from 12.1 per 1,000 individuals in 2007 to 15.29 per 1,000 individuals in 2011 (Ref. 15.10).

The number of reported abortions before week 28 of pregnancy decreased in ART municipal district from 43.9 in 2007 to 27.8 in 2011. This was higher than the corresponding figure for Krasnodar Krai – respectively 34.0 in 2007 and 20.22 in 2011.

15.5.2 Known Community Issues

15.5.2.1 Mortality by Disease

Cardiovascular diseases were the leading cause of mortality in 2011 for Krasnodar Krai:

- 58.4% - cardiovascular diseases, (794.7 per 100,000 individuals);
- 15.3% - neoplasms, (20.5 per 100,000 individuals);
- 8.1% - injuries and poisoning, (109.7 per 100,000 individuals);
- 4.5% - a disease of the digestive system (61.3 per 100,000 individuals);
- 3.4% - respiratory diseases (46.3 per 100,000 individuals); and
- 1.7% - infectious and parasitic diseases (22.4 per 100,000 individuals).

Mortality from all causes declined in the Krasnodar region in 2010 by 0.7%, but remained high at 36% above the target of the national priority programme "Health", which aims to improve quality of healthcare through a focus on primary care, prevention and improved access to innovative technologies (Ref. 15.10).

Deaths from diseases of the circulatory system at 794.7 per 100,000 population in 2011 are two-fold higher than the target of 400 per 100,000 population.

Deaths from injury and poisoning were 109.7 per 100,000 population in 2011, which is 9.7% over the target of 100 per 100,000.

From data on implementation between 2007 and 2011 (Ref. 15.10), according to the ranking applied in the report on the Ministry of Health of Krasnodar Krai, ART municipal district is placed as follows for the indicators (some indicators are per 1,000 population, others per 100,000):

- Total mortality - in the lowest range between 11.5 to 13.4 per 1,000 population (the highest rate in the region is 17.6);
- Mortality by cardiovascular diseases - in the lowest range 539 to 740.6 per 100,000 population (highest 1059.3);
- Mortality by trauma and poisoning - in the middle level 106.6 to 133.5 per 100,000 (lowest 75.3 and highest 152.3);
- Mortality by suicide - in the lowest range 8.8 to 20.6 per 100,000 (highest 54);
- Mortality by murder - in the middle range 8 to 15 per 100,000 (highest 22.3);
- Mortality by alcoholism - in the middle range 41.5 to 75.4 per 100,000 (lowest 4.8, highest 113); and
- Mortality by tuberculosis - in the lowest range 9.8 to 20.3 per 100,000 (lowest 2.5, highest 40.7).

15.5.2.2 Morbidity, Incidence and Prevalence of Disease

The statistical data demonstrates an increase of incidence and prevalence of diseases among the total population respectively from 560.6 per 1,000 individuals in 2007 to 624.27 per 1,000 individual in 2011 and from 1,160.02 per 1,000 individuals in 2007 to 1242.81 per 1000 individuals in 2011.

Table 15.1 Incidence and Prevalence of all diseases by age groups in Krasnodar Krai – Comparison between 2007 to 2011 per 1,000 individuals in the respective age groups (Ref. 15.10)

	Incidence 2007	Incidence 2011	Prevalence 2007	Prevalence 2011
Total population	560.6	624.27	1160.02	1242.81
Children (Age 0-14)	1273.56	1427.19	1731.56	1827.34
Adolescent (Age 15-17)	831.24	1099.67	1469.06	1800.63
Adults (Age 18+)	415.32	466.30	1057.59	1131,64

Any changes in the incidence of a particular disease could be explained by a corresponding change in risk factors pertaining to that condition. It could also be explained by a change in diagnostic methods or changes to the ways on which the disease is registered.

Prevalence of diseases by main types of illness for children

In the structure of morbidity, the leading cause in both Krasnodar Krai and ART municipal district for children are respiratory diseases, followed by diseases of the digestive system. Eye diseases and infectious diseases in ART municipal district rank third and fourth. Diseases of the nervous systems, dermatologic diseases and musculoskeletal diseases are the next leading causes of morbidity in Krasnodar Krai.

For children the prevalence of all diseases in ART municipal district decreased from 2006 to 2008 and after a small increase, it remained at lower levels than the prevalence reported for the same period in Krasnodar Krai.

The prevalence of respiratory diseases has increased in ART municipal district since 2008 and in 2010 became higher than in Krasnodar Krai for children.

Figure 15.2 Prevalence of Diseases by Main Types of Illness for Children Aged 1-14, per 1000 Population in Krasnodar Krai (Ref. 15.9)

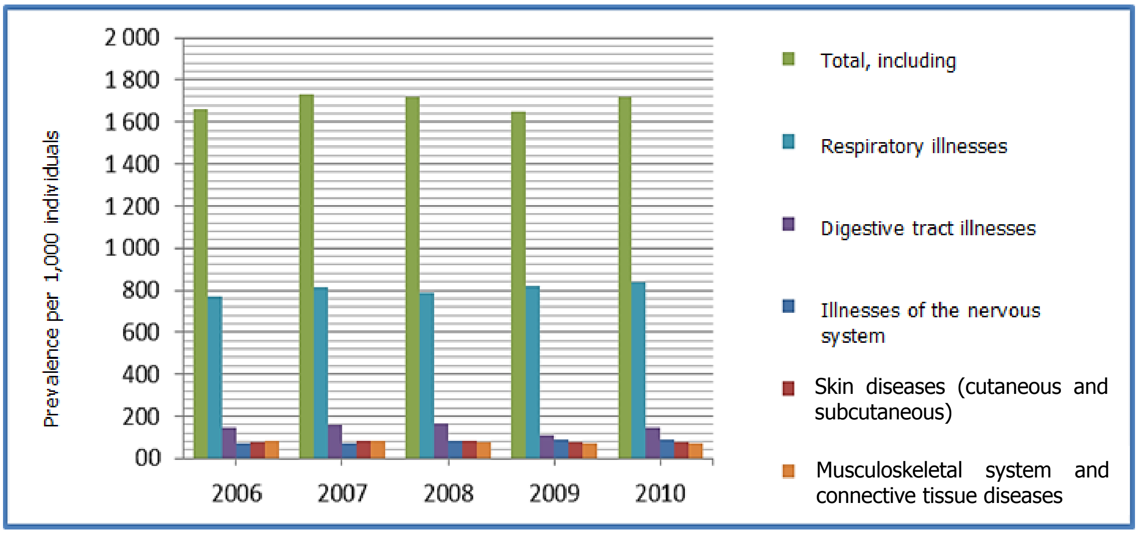
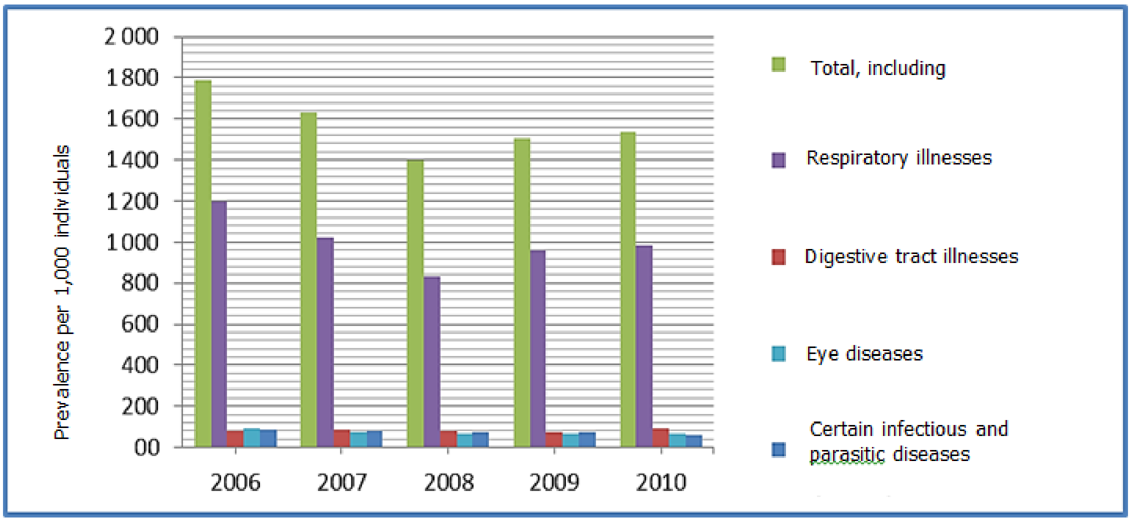


Figure 15.3 Prevalence of Diseases by Main Types of Illness for Children Aged 1-14, per 1000 Population in Anapa Resort Town (Ref. 15.9)



Prevalence of diseases by main types of illness for adolescents

For the age group 15 to 17 years, the prevalence of diseases increased during the period 2006 to 2010 in both Krasnodar Krai and in ART municipal district, but in ART municipal district levels are lower. As with the younger age group, the leading cause of morbidity in both Krasnodar Krai and ART municipal district is respiratory diseases.

Figure 15.4 Prevalence of Diseases by Main Types of Illness for Adolescents Aged 15-17 per 1000 Population in Krasnodar Krai (Ref. 15.9)

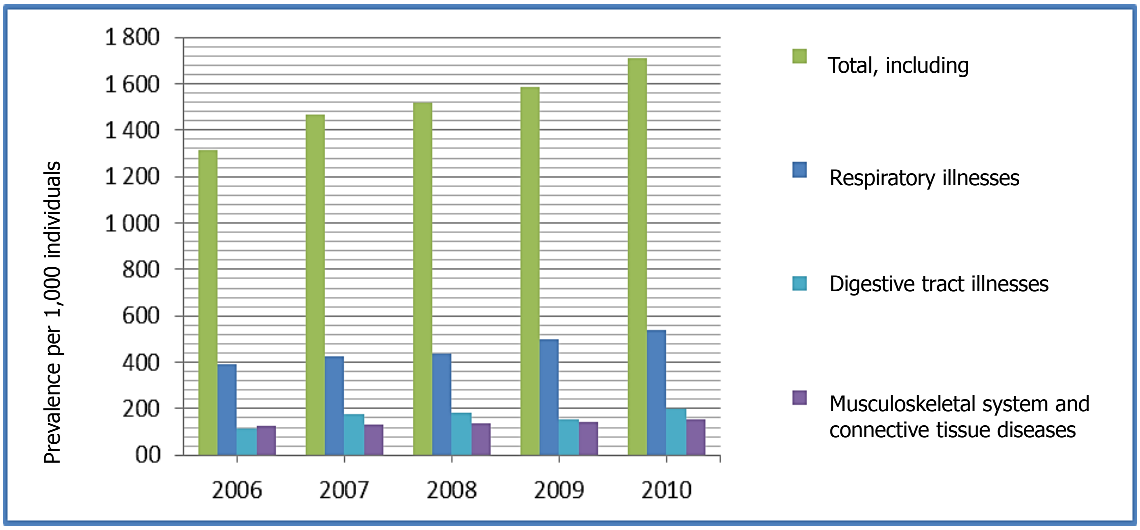
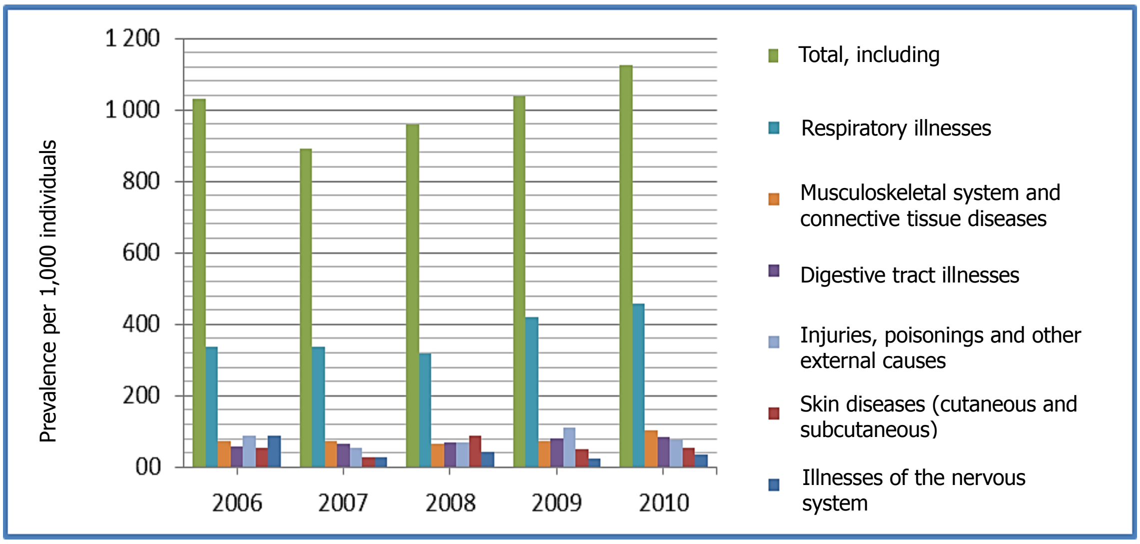


Figure 15.5 Prevalence of Diseases by Main Types of Illness for Adolescents Aged 15-17 per 1000 Population in ART Municipal District (Ref. 15.9)



Prevalence of disease by main types of illness for adults

In ART municipal district, there was an increase in prevalence of all diseases for the age group 18 years and over between 2006 and 2010, at which point the prevalence reached the same levels as Krasnodar Krai. In ART municipal district, respiratory diseases are the leading cause of morbidity in adults, while in Krasnodar Krai the leading cause is circulatory disease.

Figure 15.6 Prevalence of Disease by Main Types of Illness for Adults Aged 18 and Over per 1000 Population in Krasnodar Krai (Ref. 15.9)

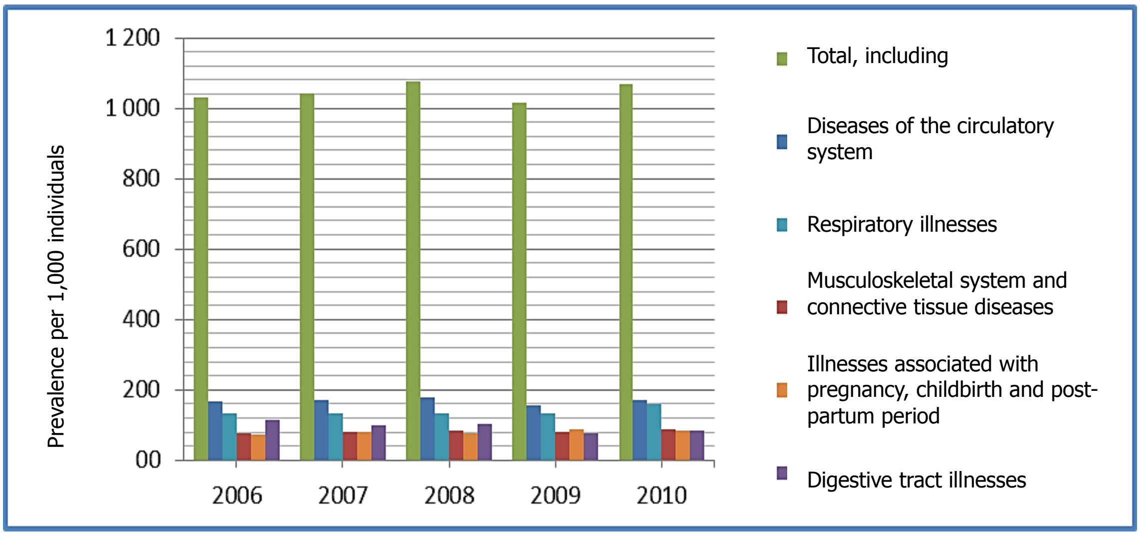
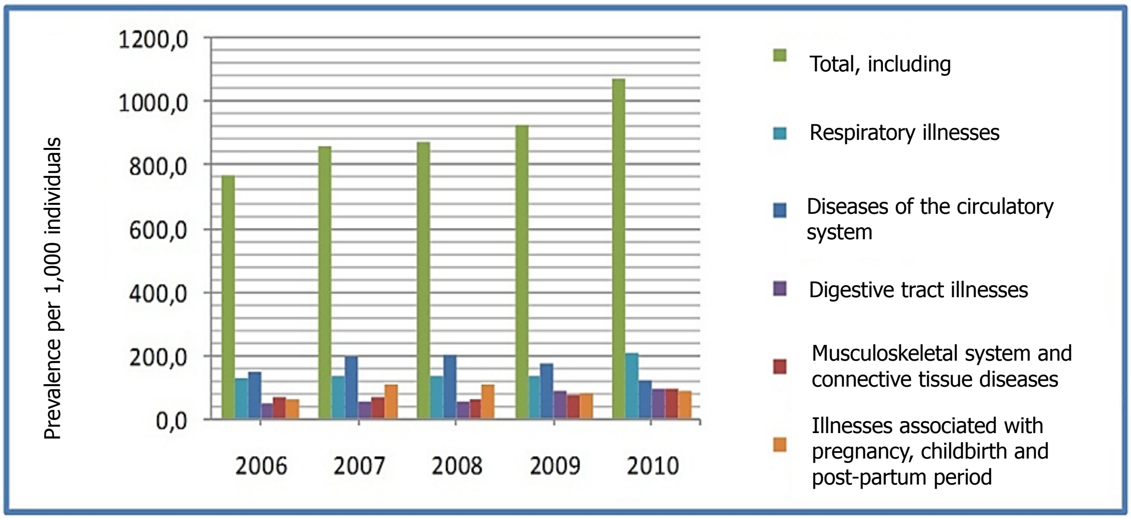


Figure 15.7 Prevalence of Disease By Main Types of Illness for Adults aged 18 and Over per 1000 Population in ART Municipal District (Ref. 15.9)



Prevalence of infectious and parasitic diseases

In ART municipal district, the leading cause for infectious and parasitic diseases is the acute intestinal diseases of unknown causes, while in Krasnodar Krai this is chickenpox. The incident rates of infectious diseases specific to Local Communities were not available for this assessment.

Figure 15.8 Prevalence of Infectious and Parasitic Diseases (including chickenpox) per 100,000 Population in Krasnodar Krai (Ref. 15.9)

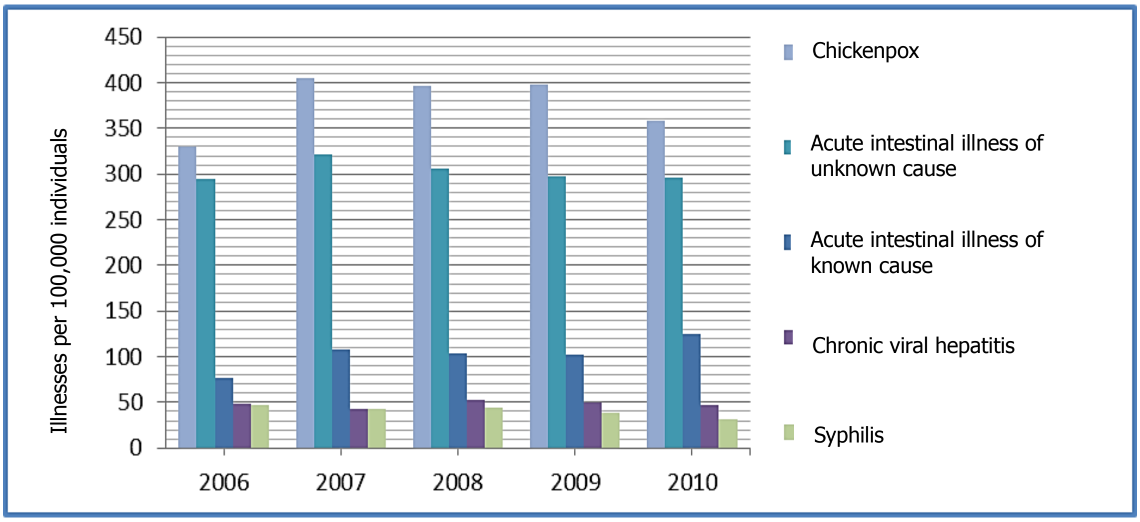
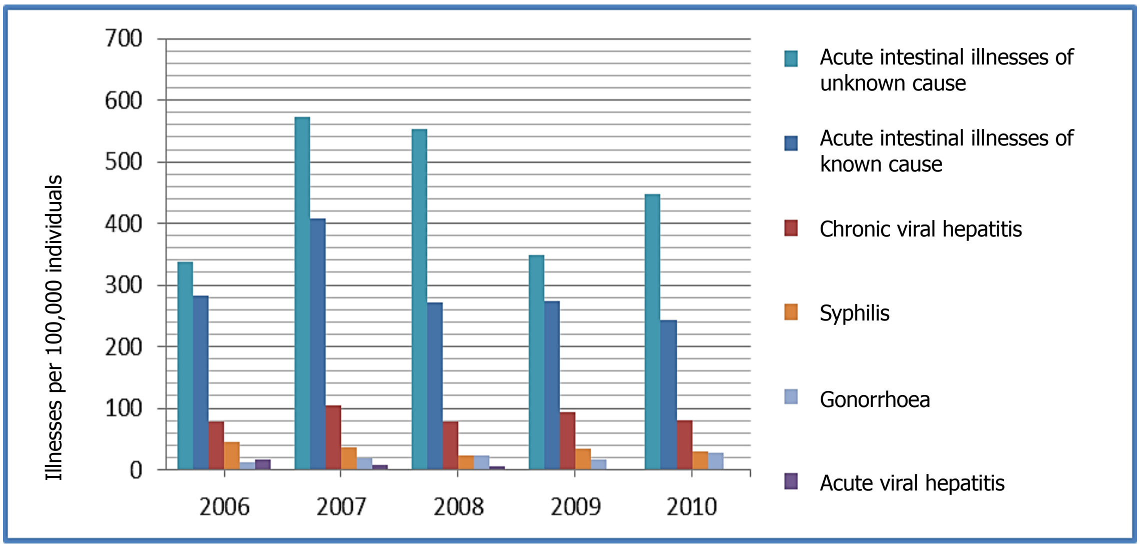


Figure 15.9 Prevalence of Infectious and Parasitic Diseases per 100,000 Population in ART Municipal District (not including chickenpox) (Ref. 15.9)



In 2011, Krasnodar Krai achieved a reduction in 40 types of infectious and parasitic diseases. The most significant reductions occurred in:

- Acute hepatitis A by 75% (compared to 33% reduction in Russian Federation);
- Acute viral hepatitis B by 49% (compared to 21.3% in Russian Federation);
- Viral hepatitis C by 45% (compared to an increase in the Russian Federation);
- Scarlet fever by 66% (compared to an increase in the Russian Federation);
- Bacterial dysentery by 31% (compared to 22.1% in the Russian Federation);
- Acute intestinal infections of unknown aetiology by 14% (the same level in the Russian Federation); and
- Newly diagnosed with syphilis by 19% (compared to 13.9% in the Russian Federation) (Ref. 15.9).

Prevalence of Sexually Transmitted Infections

Syphilis

Syphilis is recorded in the whole of the Krasnodar region. The incidence of syphilis in the past ten years has tended to decline. In 2012, the Krasnodar region recorded 1,474 cases, (28.32 per 100,000 population), including 32 cases of children up to 17 years (3.21 per 100,000 population). The new cases were recorded among all age groups of the population. The incidence of syphilis in urban population is 63.7% of the total (Ref. 15.9).

There is an inconsistent declining trend of incidence of this disease from 45.6 per 100,000 population in 2007 to 34.3 per 100,000 in 2011.

Gonorrhea

In 2012, in Krasnodar Krai the incidence of gonorrhoea decreased by 13% compared to 2009, including among children by 24.5%. During the reporting year 2012, 868 cases were registered, which corresponds to an incidence rate of 16.68 per 100,000 population compared to 14.89 per 100,000 population in 2011 and 17.78 per 100,000 population in 2010 (Ref. 15.9).

There is no stable trend in the incidence of this disease in ART municipal district. The incidence varies during the years from 12.1 per 100,000 population in 2007 to 14.9 per 100,000 in 2011.

HIV / AIDS

Currently, in the Russian Federation and in the Krasnodar region, human immunodeficiency virus (HIV) is spreading among the population. In 2012, there were 12,149 registered HIV-infected citizens of the Russian Federation, of which three were children under 17 years. In 2012, there were 1,469 cases of HIV-infected persons in the Krasnodar region (of which 52 cases were in ART municipal district). This is 23% higher than in 2011 (1,131 cases in 2011 and 1,031 cases in 2010) (Ref. 15.14).

In ART municipal district, an increase in incidence of HIV / AIDS (acquired immunodeficiency virus) was observed from 32 per 100,000 in 2010 to 35 in 2011, as well as in prevalence rates from 22.9 per 100,000 individuals in 2010 to 23.7 per 100,000 in 2011. There were three registered cases of pregnant women with HIV / AIDS both in 2010 and in 2011. The prevalence of the disease both in 2010 and in 2011 among women of fertile age is 8.2 per 100,000 individuals.

The main cause of HIV infection in the Krasnodar region, as well as in Russia, continues to be injected drug use and use of non-sterile equipment, accounting for 54.6% of all new infections in 2012. Sexual transmission of HIV continues to increase. Heterosexual intercourse is the main mode of sexual transmission in 2012, accounting for 40.3%. By the end of 2012, the cumulative number of HIV-infected women had doubled compared to 2005 and amounted to 576 (38.6% of all reported cases of HIV infection).

Closely related to AIDS diseases in Russia is tuberculosis (see 15.5.2.3). This disease is the leading cause of death for more than 45% of all HIV cases (due to being immune suppressed by AIDS).

Tuberculosis (TB)

The incidence of tuberculosis shows decreasing prevalence in Krasnodar Krai, as well as in the Russian Federation. The incidence of active tuberculosis in Krasnodar Krai decreased from 62.2 per 100,000 population in 2007 to 52.2 per 100,000 population in 2011. The prevalence also decreased from 183.8 per 100,000 population in 2007 to 147.8 per 100,000 population in 2011. According to a statistical observation in 2012, the Krasnodar region recorded 3,350 cases of newly diagnosed active TB (Ref. 15.10).

The incidence and the prevalence of tuberculosis in ART Municipal District decreased from 2010 to 2011, respectively from 78.7 per 100,000 individuals in 2010 to 50.3 per 100,000 individuals for incidence; and from 173.6 per 100,000 in 2010 to 149.6 per 100,000 for prevalence. With regard to prevalence of tuberculosis, ART Municipal District falls in the middle range 136.1 to 184.4 per 100,000 (lowest 96.7 to highest 317.0) for Krasnodar Krai.

The mortality from tuberculosis in Krasnodar Krai decreased from 2007 to 2011 from 16.3 per 100,000 population to 10.6 per 100,000 population in 2011. The mortality from tuberculosis in ART Municipal District is 8.9 per 100,000 individuals in 2011 and it is lower than in Krasnodar Krai (10.6 per 100,000 population), but it shows an increase in comparison to mortality levels in 2010 (7.8 per 100,000 individuals).

15.5.2.3 Mental Health

The incidence of psychiatric disorders in ART municipal district increased from 79.2 per 100,000 population in 2010 to 85.3 per 100,000 population in 2011. Psychiatric disorders in ART municipal district are more than threefold lower than in Krasnodar Krai for the same period, respectively 291.7 per 100,000 population in 2010 and 270.7 per 100,000 population in 2011.

The prevalence of mental health disorders in ART municipal district has decreased from 2,415.0 per 100,000 population in 2010 to 2,048.7 per 100,000 population in 2011 and is lower than the reported for Krasnodar Krai which was 3478.2 per 100,000 population 2010 and 3388.6 per 100,000 population in 2011 (Ref. 15.10).

15.5.2.4 Alcoholic Psychosis, Alcoholism, Drug Dependency

There is a decreasing trend in incidence and prevalence of all alcohol and drug related dependency and psychosis in Krasnodar Krai. The available data for ART municipal district for 2011 shows that the levels of alcohol and drug related mental diseases are very close to those in Krasnodar Krai (Ref. 15.10).

15.5.2.5 Traumatism

Traumatism covers injuries caused by external factors. The total traumatism rate in Krasnodar Krai in 2011 per 1,000 population was 78.72 (men 96.98 per 1,000 population; women 64.88 per 1,000 population). In ART municipal district the total traumatism rate in 2011 was 43.54 per 1,000 population (51.46 for men, 36.59 for women) and was significantly lower than for Krasnodar Krai (Ref. 15.10).

15.5.2.6 Invalidity and Temporary Disability

There was a declining trend in primary invalidity in the adult population and in adults of working age in Krasnodar region in the period 2005 to 2010. In 2011, the respective indicators for Krasnodar Krai were: 65.0 per 10,000 people and 47.0 per 10,000 people. In 2011, the primary invalidity in ART municipal district was 76.18 per 10,000 people. It increased from 2010 levels of 75.75 per 10,000 individuals and is higher than the average in Krasnodar Krai.

The invalidity in children (0 to 17 years) in Krasnodar Krai was 19.03 per 10,000 and in ART municipal district 18.85 per 10,000 in 2011. Child invalidity in ART municipal district increased from 127.66 per 10,000 in 2010 to 139.75 per 10,000 in 2011, but remains lower than that in Krasnodar Krai (178.61 per 10,000 population) (Ref. 15.10).

Summary of children's disabilities (in percentage):

- 37.9% psychiatric diseases;
- 22% neurological disorder;
- 14.2% congenital disorders; and
- 25.9% others.

In 2011, in ART municipal district temporary disability was slightly lower than in 2010. In 2011, the number of lost working days was 259,929 and the total number of cases of disability was 23,280.

Temporary disability in ART municipal district by cause per 100 workers in 2011:

- 19.09 respiratory system;
- 11.29 acute respiratory illness;
- 7.25 musculoskeletal disorders;
- 5.84 cardiovascular;
- 5.37 trauma; and
- 3.7 digestive system illness.

15.5.2.7 Road Safety

National Overview

In 2009, the World Bank issued an analysis of road safety in a number of countries of Europe and Central Asia including the Russian Federation (Ref. 15.44). The key findings, with some recent updates (Ref. 15.50), are still likely to be pertinent in 2013, despite considerable efforts made by Russian authorities to improve road traffic safety.

The key findings for the Russian Federation are summarized here and in Table 15.2. About 72% of all car crashes occur in urban areas. Data for 2008 show that the majority of traffic deaths are among car occupants (52%), followed by pedestrians (36%), motorcycle drivers and passengers (5%), truck and bus drivers and passengers (4%), and cyclists and others (4%). The high percentage of pedestrian deaths in the Russian Federation contrasts sharply with other European countries (in France and Germany, for example, pedestrian deaths account for only 12% of total road fatalities). More than 50% of all road traffic deaths are among people aged 15 to 44, the most economically productive age group. Children and the elderly are also particularly vulnerable, especially as pedestrians.

One-third of car crashes in Russia are caused by speeding vehicles. Head-on collisions due to driving into oncoming lanes are a major cause of road crashes. Drunk driving accounts for 10% of all road crashes in Russia; poor road conditions and traffic management also contribute to road traffic injuries and deaths. The use of cell phones and texting devices while driving is another growing risk factor.

In 2010, the governments of the world declared 2011–2020 as the Decade of Action for Road Safety. They invited the World Health Organization to prepare a report (Ref. 15.45) that provided a baseline to assess the state of global road safety at the onset of the Decade, and to be able to monitor progress over the period of the Decade. The report included a Statistical Annex that provided information that included estimated road traffic death rate per 100,000 population for 182 countries. In terms of the death rate, Russia was ranked 115th. A comparison with other countries that border the Black Sea is set out in Table 15.2.

Table 15.2 International Ranking for Road Traffic Fatalities per 100,000 Population for Countries Bordering the Black Sea

Country	Fatalities per 100,000 Population	International Ranking
Bulgaria	10.4	48
Romania	11.1	54
Turkey	12.0	63
Ukraine	13.5	75
Georgia	15.7	94
Russian Federation	18.8	115

Regional and Local Road Safety

According to the ranking applied in the report on the Ministry of Health of Krasnodar Krai (Ref 15.10), mortality by transport incidents in the ART municipal district is in the middle range at 19.9 to 29.3 per 100,000 (the lowest in the region is 10.3 and the highest 50.1).

In Krasnodar Krai, since 2006, the number of traffic accidents has fallen; in 2011 there were 6,728 accidents, down 5% on 2006 (Ref. 15.46). In the ART municipal district, in 2011, there were 4,655 traffic accidents and 39 traffic-related deaths (Ref. 15.53).

Table 15.3 shows the number of road traffic deaths in the Russian Federation, Krasnodar Krai and the ART municipal district. For both the Russian Federation and Krasnodar Krai, there was a reduction in road traffic deaths over the period 2007 to 2009, but since then an increase has occurred.

Table 15.3 Number of Road Traffic Deaths (to nearest hundred)

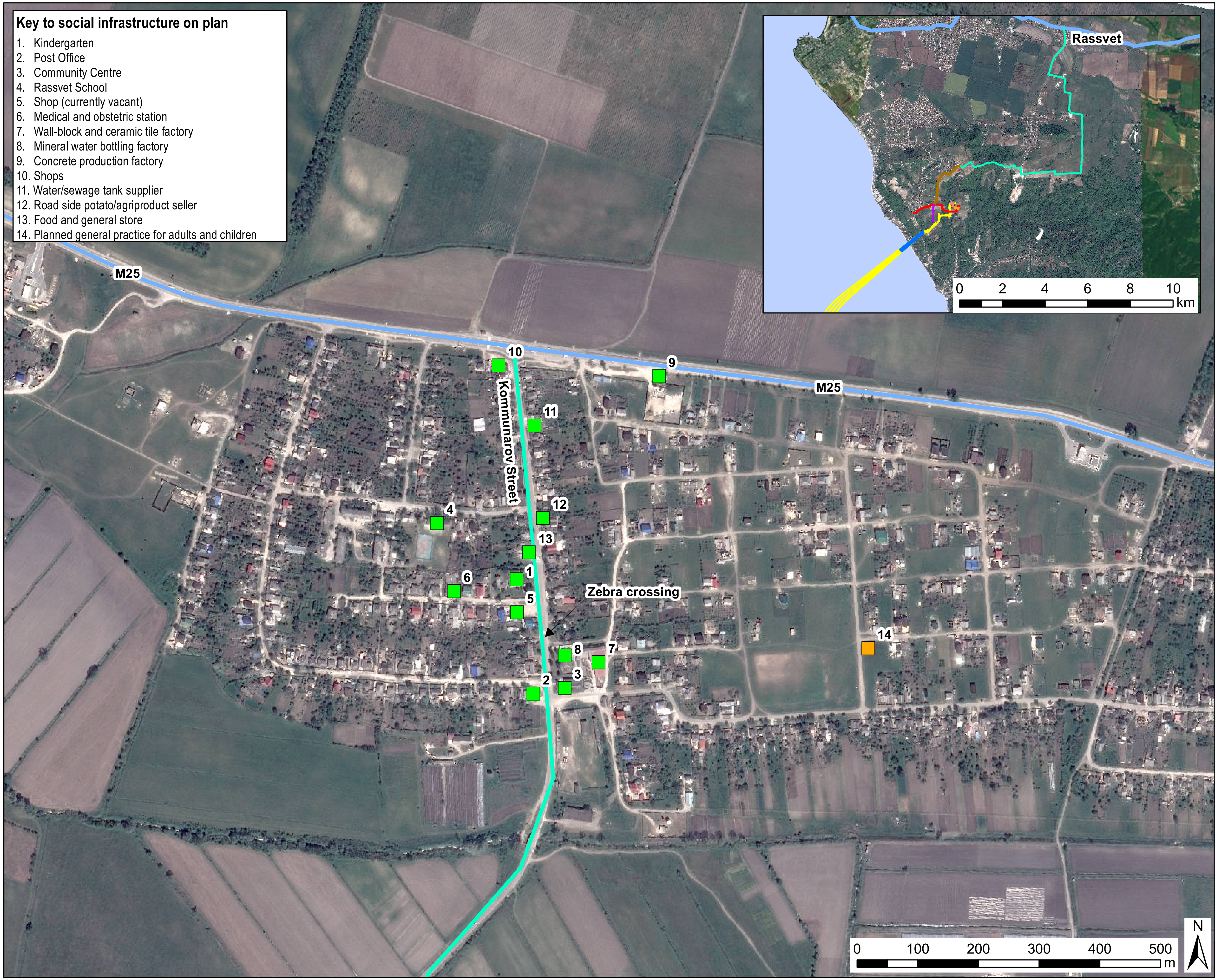
Location	2007	2008	2009	2010	2011	2012
Russian Federation	32,700	29,900	26,100	27,900	27,900	28,000
Krasnodar Krai	1,193	1,143	1,155	1,175	Not available	Not available
ART Municipal District	Not available	Not available	Not available	Not available	39	Not available

Source: Ref. 14.54; Ref. 14.55; Ref. 14.56; and Ref. 14.57.

Stakeholder engagement (Ref. 15.49) has identified that road traffic and road safety are issues for the Local Community of Rassvet (Ref. 15.48 and 15.49) which is spread either side of a main north-south road. The adjoining small community of Zarya lies immediately to the east. To the west, separated by a thin strip of open land, is the much smaller community of Tarusin. This layout suggests that high traffic volumes could cause community severance. Site visits to Rassvet indicate that there do not appear to be footpaths, cycle lanes, controlled crossing points or other traffic management, as illustrated in Figure 15.10 on the main road through Rassvet which runs from the junction with the M25 (Figure 15.11) towards the community of Gai-Kodzor. It is reported that speeding vehicles are an issue on the road with vehicles travelling at speed on the downhill slope of the road as it runs north from Gai Kodzor into Rassvet (Ref. 15.48) (Figure 15.12). It has also been reported that the community has experienced an increase in road traffic connected to the construction of the Russkaya CS.

Information contained in Appendix 9.1: Traffic and Transport Study and site visits confirm that Rassvet has sensitive receptors that could be affected by traffic increases. Figure 15.10 indicates that there are approximately thirty residential properties lining the road, with additional properties accessed from side roads. Site visits have confirmed that there is a kindergarten, a number of shops and businesses, a post office and a local community centre on the main road through Rassvet. The local school is nearby. Pedestrians walk along the edge of the road. A number of school children cross the main road each day on their way to and from school. All children at the school are regularly trained regarding traffic safety issues (Ref 15.49).

In 2012, the community of Gai-Kodzor was experiencing an increase in traffic related to the construction of the Russkaya CS (Ref 15.51) (Appendix 20.1 Environmental Impacts of Associated Facilities: Russkaya CS). In 2013, a bypass was constructed by Gazprom Invest to allow traffic related to the Russkaya CS construction activities to avoid the community of Gai-Kodzor. In February 2014, the Gai-Kodzor Administration confirmed that the bypass has been effective and road traffic issues related to construction traffic have been resolved (Ref 15.50). The bypass constructed around Gai-Kodzor will also be used by the Project construction traffic in order to avoid road traffic impacts on the town of Gai-Kodzor (Ref 15.56). A similar bypass to avoid passing through the centre of the community of Varvarovka will be constructed and used by Project related construction traffic (see **Chapter 14 Socio-Economics**).



LEGEND

- Social infrastructure
- Planned social infrastructure

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Proposed microtunnels
- Landfall facilities
- Proposed offshore pipelines
- Permanent access road to be constructed by SSTTBV
- Temporary access road constructed by SSTTBV
- Varvarovka bypass road (used by Project during construction only)
- Proposed delivery route from Novorossiysk Port
- Federal road
- Transfer site

United Gas Supply System

- Permanent access road to be constructed by Gazprom Invest

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue
For Information

Client
South Stream
Offshore Pipeline
ENERGISING EUROPE

Project Title
SOUTH STREAM
OFFSHORE PIPELINE

Drawing Title
CONSTRUCTION TRAFFIC ROUTE
THROUGH COMMUNITY OF RASSVET
FROM M25

Drawn	Checked	Approved	Date
BB	RW	MW	22 Apr 2014

URS Internal Project No.	Scale @ A3
46369082	1:6,000

URS Infrastructure & Environment UK Limited
Scott House
Alencon Link, Basingstoke
Hampshire, RG21 7PP
Telephone (01256) 310200
Fax (01256) 310201
www.ursglobal.com

Drawing Number
Figure 15.10

Rev

Plot Date: 22 Apr 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Appendix - Health Assessment\Figure 15-10 Construction Traffic Route Rassvet.mxd

Figure 15.11 Junction of M25 (foreground) and Rassvet (top right) (Ref. 15.40)

Figure 15.12 Construction Route Looking North towards Rassvet showing Cyclists (Ref. 15.39)

15.5.2.8 Crime and Security

Table 15.4 shows that over the period from 2006 to 2009, the crime rate in Anapa Resort Town decreased by approximately one quarter. Since 2009, through to 2012, the rate has remained relatively constant. In 2012 a total 1,959 crimes were reported within the ART municipal district, representing an increase compared to the preceding three years (2009 to 2011) but still lower than the annual numbers from 2006 to 2008).

In 2011 and 2012, theft accounted for almost half of total crimes. The second highest ranking type of crime, accounting for approximately one third of crimes in 2012, is crime committed in public (the definition of which includes vandalism, amongst other things).

The highest crime levels are registered during the tourist season (June to September), when the population swells with tourists and seasonal workers. The number of crimes can increase by up to three times during this period compared with the remainder of the year with a focus on theft and other petty crimes; however, there are no incidences of serious disorder. Additional police are brought in from Krasnodar Krai during the summer high season (Ref 15.68).

Although data are not available, interviews with local officials indicated that Local Communities experience relatively lower levels of crime compared with ART as a whole and that crime tends to be concentrated within the town of Anapa rather than within the more rurally located Local Communities (Ref. 15.58).

Table 15.4 Crimes by Type, Anapa Resort Town, 2006-2012 Crimes by Type, Anapa Resort Town, 2006-2012

Indicator / Location	2006	2007	2008	2009	2010	2011	2012
Total crimes per 1,000 people	16.7	15.4	14.6	12.6	12.4	12.8	12.7
Total crimes including:	*2,200*	*2,101*	*2,032*	*1,790*	*1,827*	*1,907*	*1,959*
Homicide	27	12	15	16	23	13	14
Actual / grievous bodily harm	35	36	45	36	32	34	39
Theft	989	974	893	616	723	905	921
Robbery with violence	28	24	20	21	16	27	20
Robbery	129	104	91	78	62	74	80
Fraud	194	211	217	198	159	108	137
Crimes involving a firearm	0	0	0	3	1	4	3
Crimes committed in public places	439	479	452	373	452	605	668

Source: (Ref. 15.68)

15.5.3 Baseline Data by Determinant of Health

15.5.3.1 Individual Factors

Alcoholism reflects social disadvantage and brings considerable damage to health. On average in Krasnodar Krai, alcohol accounts for 10% of mortality. In some districts this impact can be significantly higher and range from 20 to 30%. In Krasnodar Krai, 50% of mortality is due to interrelated socio-economic factors and alcohol (Ref. 15.9).

For most districts of Krasnodar Krai, the main reason for elevated mortality is alcohol use, together with smoking, low salary and unsatisfactory capacity of the health systems (Ref. 15.9). Health system capacity is an institutional factor which is discussed further in Section 15.5.3.4.

In 2011, the 'health without smoking' programme (Ref. 15.15) was implemented in Krasnodar Krai aimed at banning smoking in public places.

15.5.3.2 Social Factors

In the ranking applied by a State Report on Sanitary Epidemiological and Consumer Protection in the Krasnodar region (Ref. 15.9), in 2010 ART municipal district was ranked as follows:

- Salary – in the middle range 13,399 to 17,683 Rubli per person (lowest 11,530, highest 23,144);
- Investment – in the middle range 32,325 to 71,212 Rubli per person (lowest 5,115, highest 264,853);
- Healthcare expenditure – in the middle range 4,339.1 to 5,846.6 Rubli per person (lowest 3,478.8 - highest 9485.8);
- Coverage with physicians per 10,000 population – in the highest range 25.7 per 10,000 – 49.7 per 10,000 (lowest 15.2 per 10,000); and
- Unemployment – in the highest range 1.2 to 1.9% of working population (lowest 0.3%).

Social factors and individual way of life determined more than 50% of the mortality rate (socio - economic more than 20%, healthcare 10%, alcohol 10% and smoking 10%) while the influence of environmental factors is estimated at 10%. This gives a ratio of 5 to 1 for social factors prevailing over environmental factors.

Comparison of socio-economic indicators of well-off and disadvantaged mortality in Krasnodar Krai in 2010 revealed that there is a very high association between the levels of investment in the area and the wellbeing of the population. Coverage by physicians, salary, and healthcare expenditures also play a key role in population wellbeing.

15.5.3.3 Environmental Factors

Air quality

There has been an increase of air pollution between 2000 and 2011 in Krasnodar Krai. ART Municipal District is among the sites with a concentration of air pollutants higher than the permissible levels (Ref. 15.9) (see **Chapter 9 Air Quality).**

The deterioration is likely linked to the increase in the number of cars in Krasnodar Krai (300 cars per 1000 population or more than 1.5 million cars), which accounts for about 80% of the total emissions from both transport and stationary sources of emission (Ref. 15.9).

The main emission substances measured and controlled on a quantitative basis on the territory of Krasnodar Krai between 2007 and 2011 are nitrogen dioxide, carbon monoxide, sulphur dioxide, hydrocarbons, and formaldehyde (Ref. 15.9).

The results of health risk assessments in Krasnodar Krai indicate the issue of air pollution as a priority problem for public health (Section 15.2). The combined effects of air pollution pose a risk to the body's systems, including: respiratory, immune, central nervous system, blood, eyes, systemic exposure, development, carcinogenic, nervous system, cardiovascular system (Ref. 15.9). However, as discussed in **Chapter 9 Air Quality**, the baseline reported concentrations of nitrogen dioxide, carbon monoxide and sulphur dioxide in the Project Area are below the long term and short term Russian limit value and adopted Project Standards. Concentrations of total particulate matter reported for Anapa and Gostagaevskaya are in excess of the long term Russian limit value but below the maximum peak maximum permissible concentrations (MPC) value.

Quality of the Water in the Black Sea

Analysis of the laboratory tests for recreational waters of the Black Sea over the last five years has shown that the sea water quality has improved. The proportion of samples taken to monitor bathing water standards that do not meet regulatory requirements, decreased (Ref. 15.9):

- Chemical indicators from 2.2% in 2007 to 0.2% in 2011; and
- Microbiological indicators from 4.0% in 2007 to 1.8% in 2011.

ART municipal district is one of the cleanest areas with full compliance with Russian water quality standards in 2011 (Ref. 15.9).

Drinking Water Quality

The drinking water supply source for ART municipal district is the Kuban River. The river runs through virtually all of the major population centres of the Krasnodar Krai. The largest share of the contaminants in the river comes from Krasnodar (66%), Armavir (8.6%) and Kropotkin (2.3%). Kuban river waters coming to Anapa are contaminated by micro-organisms, eggs and larvae of worms and protozoa, chemicals (iron, copper compounds, petroleum hydrocarbons, nitrites, nitrogen, organic compounds, chlorine and phosphorus-containing pesticides) (Ref. 15.9).

The quality of drinking water supplied to the distribution networks of the town of Anapa and 13 surrounding communities is monitored by Anapa water utility. Water samples are taken monthly in accordance with the timetable agreed with ART municipal district in accordance with SanPin 2.1.4.1074-01 "Drinking Water. Hygienic requirements for water quality of centralized drinking water supply. Quality Control" (Ref. 15.18).

15.5.3.4 Institutional Factors

As noted in Section 15.5.3.1, for most districts of Krasnodar Krai, one of the contributing factors to elevated mortality is said to be unsatisfactory capacity of the health systems (Ref. 15.9). The consultation feedback from the ART Municipal District Administration Deputy Chief for Health (Ref. 15.13) suggests that the unsatisfactory capacity issues do not extend to ART Municipal District, a conclusion which is supported by the figures reported for healthcare expenditure and coverage with physicians in Section 15.5.3.2.

Health Workforce Capacity

In 2011 the number of doctors per 10,000 individuals in ART municipal district was 34.5. There was a 20% rise in this indicator in ART municipal district in seven years, while in the Krasnodar Krai this indicator fell by 1.6% (Ref. 15.10).

The number of hospital beds in ART municipal district during this period fluctuated slightly and in 2011 was 1,055 units or 68.5 units per 10,000 individuals. The number of hospital beds in the Krasnodar Krai in 2011 was 90.8 for 10,000 individuals (Ref. 15.10).

Based on 2011 data, seven hospitals were operating in ART municipal district (as in 2006), as well as 18 outpatient clinics (the number of these institutions gradually increased between 2006 and 2011) (Ref. 15.10).

Table 15.5 Health Workforce in Krasnodar Krai and ART municipal district in 2005 – 2011

Subject	2005	2006	2007	2008	2009	2010	2011
Number of physicians, individual							
ART municipal district	383	393	420	470	500	510	531
Krasnodar Krai	21,700	22,000	21,800	22,000	22,300	22,000	22,200
Number of physicians per 1,000 individuals							
ART municipal district	28.7	29.1	30.5	33.6	35.1	34.5	34.5
Krasnodar Krai	42.6	43.1	42.6	42.9	43.3	41.9	41.9

Continued…

Subject	2005	2006	2007	2008	2009	2010	2011
Number of secondary medical personnel, individual							
ART municipal district	836	813	884	1,024	1,060	1,107	1,096
Krasnodar Krai	47,300	47,200	47,100	47,600	47,700	47,500	47,000

Complete.

There was a considerable increase in the number of physicians and secondary medical personnel in ART municipal district in 2006 to 2011; whilst there has not been a significant change in the number of physicians in the Krasnodar Krai region as a whole: it fluctuated within 21,700 to 22,300 individuals. The number of physicians for 10,000 individuals in 2011 is 41.9, which is higher than in ART municipal district (34.5).

The number of physicians in the Russian Federation rises every year with a higher number (51.2 for 10,000 population) compared to ART municipal district and the Krasnodar Krai.

The number of secondary medical personnel has been falling since 2009 in the Russian Federation. In the Krasnodar Krai there are 89 for 10,000 individuals, which is higher than in ART municipal district. In regards to the number of secondary medical personnel in the Russian Federation, there is no general pattern of increase or decrease in this category of individuals and the figure changes every year (Ref. 15.10).

Healthcare Services

According to the data published on the Ministry of Health of Krasnodar Krai website (Ref. 15.17), primary care stations, dental and emergency healthcare facilities ensure access to healthcare for the residents of ART municipal district.

Primary Care

The 17 primary care stations with assistant physicians to provide obstetrics care are listed in Table 15.6.

Table 15.6 Health Workforce in Krasnodar Krai and ART municipal district in 2005 – 2011

Outpatient medical practices	Specialized Centres	Hospitals (with polyclinics)
Anapskas station, 230 visits per shift	Trauma center in Anapa Resort Town	Central City Hospital with 580 beds (with a polyclinic for 500 visits per shift);

Continued...

Outpatient medical practices	Specialized Centres	Hospitals (with polyclinics)
Varvarovka, 20 visits per shift	Oncological, cardiovascular and perinatal centres in Novorossiysk town	Children City Hospital with 150 beds (with a polyclinic for 580 visits per shift);
Gaykodzor, 65 visits per shift		Maternity Hospital 140 beds (with a polyclinic for 200 visits per shift);
Tsybanobalka, 60 per shift		UHospital number 1 in Grape for 40 patients (with a polyclinic for 190 visits per shift);
Sioux Pseh, 150 visits per shift		UHospital number 2 in Gostagaevskaya for 40 patients (with a polyclinic for 120 visits per shift); and
Vitjazevo, 175 visits per shift		UHospital B number 3 Day for 40 patients (with a polyclinic for 205 visits per shift).
Medical and Prevention Centre (and Polyclinic), 35 per shift		

Complete.

The number of hospital beds, including day care beds in hospitals in the district was 990 in 2013. ART municipal district has a lower number of hospital beds per 10,000 population (61.6) than Krasnodar Krai (average 80.8 per 10,000 population).

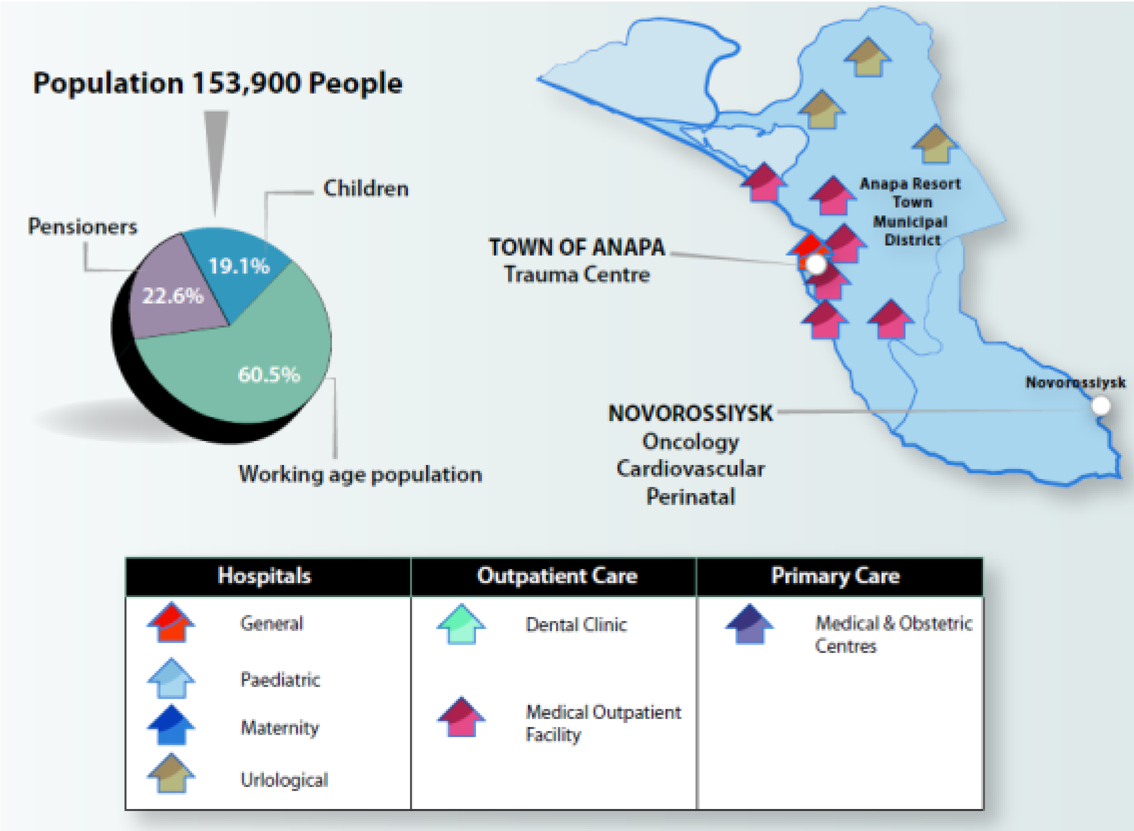
Dental Care

The Ministry of Health of Krasnodar Krai lists one dental clinic which has 350 visits per shift; no further information on the clinic is provided.

Emergency Care

The average of visits per shift for outpatient clinics in the district is 2,880. The average time required for an ambulance to arrive in Krasnodar Krai to the patient in 93.2% of cases was under 20 min.

Figure 15.13 Healthcare Facilities in Krasnodar Krai (Ref 15.10)



The total hospital mortality in ART municipal district is 1.21%, which is lower than in Krasnodar Krai (1.38%). The leading causes of hospital mortality are: cardiovascular diseases 55.13%; diseases of digestive system 12.81%; cancer 7.91%; trauma 7.88%; respiratory diseases 4.72%; and infectious diseases 11.55%.

Indicative Health Performance of ART Municipal District

The indicative health performance in Krasnodar region includes indicators of medical and social performance, of resource use, and satisfaction from the delivery of health care (Ref. 15.9).

The most problematic indicators reflecting the medico-social performance are the incidence of alcohol psychosis, acute hepatitis and exacerbation of chronic diseases. Other unfavourable indicators are those relating to child and adolescent mortality. These indicators will be influenced by access to health services and also by wider social and economic factors (Ref. 15.12). Despite good coverage with doctors and nurses, the high number of emergency care calls suggests that access to primary healthcare remains a challenge.

To receive specialized high technological medical care the residents of Krasnodar Krai (including ART municipal district) are referred to federal clinics in Moscow, St. Petersburg, Obninsk and Ufa. As a result of the investment made by the national priority project "Health" in Krasnodar

Krai (Ref. 15.10), the number of residents of the region, who have received high-tech medical services in 2011 increased by 4 times compared with 2006.

The integrated rating for medico-social performance, 'effective use of resource and satisfaction with medical services' ranks ART municipal district 17 out of 44 districts. Although ART municipal district is showing a good effective use of resources (10 out of 44) and relatively good medico-social performance (22 out of 44), the population of ART municipal district does not appear to be satisfied by the quality of medical services provided (Ref 15.9).

Capacity and Type of Local Medical Facilities

Local officials at the Anapa Resort Town Municipal District Administration (Ref 15.5) provided information in February 2014 related to local health facilities in the Local Communities and in the town of Anapa. The Anapa hospital has over 700 doctors and nurses and 720 patient beds. The ART municipal administration officials stated that mobile health units are needed in order to service the local population outside the town of Anapa.

Due to the Anapa Resort Town area being a tourist destination, provision is made for extra capacity in the summer months to accommodate increasing demand. In each resort area, at least three additional ambulance cars are added during peak season in Anapa. There is an estimated 30 percent increase of staff – including up to 12 doctors working in 3 shifts. At local hospitals, including in the town of Anapa, there are 2 to 4 additional doctors in the peak season. There is a sufficient number of nurses and, if required, medical staff numbers can be supplemented with senior graduates of the local medical college and commercial clinic personnel. Some doctors have medical posts on the beaches which are affiliated with the health sanatoriums in the area. It is viewed by health professionals as prestigious to work in the town of Anapa area due to the high quality facilities, and level of education of personnel.

The hospital in the town of Anapa (which is classified as a trauma two hospital) has specialised units for trauma, cardiology, neurology, blood vessels, infections, general paediatrician, psychiatry, and has x-ray, CAT scanners and other similar level equipment. If the hospital cannot assist patients requiring more specialized treatment, they are sent to Krasnodar, or to the blood vessel centre in Novorossiysk. For eye emergencies, the town of Anapa hospital can provide treatment but eye surgery is deferred to Krasnodar. In Krasnodar, the hospital has helicopter capability (the trip from Anapa to Krasnodar is 40 to 45 minutes), a burn unit and full surgery capabilities (including for heart and joints). There is also a hyperbaric centre in Krasnodar.

During the high season, the most common ailments treated in the town of Anapa hospital include trauma, food poisoning, and head colds. For children, the most common diagnosis is digestion and related food issues, and trauma from a fall or other accident.

In the community of Gai Kodzor there is a laboratory and a physiotherapy room. In the community of Rassvet, there is a medical point with a doctor and nurse on duty although there is no ambulance or emergency facility. The municipal district administration is planning in 2015 to build a general practice in Rassvet for both adults and children.

Ambulances originate from the Anapa emergency facilities or from emergency sub-stations located in the surrounding communities, including Supsekh which is the closest emergency substation to the Local Communities. Patients requiring emergency service are taken to health facilities in the town of Anapa.

15.5.4 Emergency and Disaster Response

Emergency and Disaster Response is discussed in **Chapter 19 Unplanned Events**. Specifically, South Stream Transport will ensure that contractor Emergency Response Plans appropriately integrate with the Disaster Management Plan for Anapa municipality and the National Disaster Management Plan with regard to command and control systems, points of first contact during emergencies, local capabilities and capacity.

15.6 Legal and Policy Context

The community health, safety and security assessment has considered relevant Russian federal (national) and regional legislation, applicable standards and guidelines for international finance, and international agreements to which the Russian Federation is a signatory. All applicable standards relevant to the ESIA are presented in **Chapter 2 Policy, Regulatory, and Administrative Framework**, with those of particular relevance to health, safety and security summarised below.

15.6.1 IFC Performance Standards (PS)

Performance Standard 1

PS 1 is addressed across the entire ESIA (see **Chapter 2 Policy, Regulatory, and Administrative Framework**); however the following points are noted with regard to the community health, safety and security impact assessment. Climate change is included in the consideration of cumulative impacts. The methodology includes stakeholder engagement and assessment of vulnerable groups who may be disproportionately affected (Section 15.4.2). In adopting mitigation measures the mitigation hierarchy has been used (Section 15.10). Emergency response planning is discussed as part of the assessment of resource demands on health and other emergency services.

Performance Standard 2

PS 2 (Ref. 15.18) recognizes that the pursuit of economic growth through employment creation and income generation should be accompanied by protection of the fundamental rights of workers.

The aspects of PS 2 most relevant to occupational health are linked to discussions in the socio-economic assessment which can be found in **Chapter 14 Socio-Economics**. **Chapter 22 Environmental and Social Management** also discusses the Grievance Procedure, an important aspect of the management of occupational health and safety issues. Appendix 15.1 assesses the requirements for a safe and healthy work environment and occupational health issues are discussed further within that Appendix and are not addressed further within this chapter.

Performance Standard 3

PS 3 (Ref. 15.20) recognizes that increased economic activity and urbanization often generate increased levels of pollution to air, water, and land, and consume finite resources in a manner that may threaten people and the environment at the local, regional, and global levels.

The following points in relation to PS 3 are noted with regard to the health, safety and security assessment. The assessment takes into consideration the current baseline conditions of affected areas and populations such that impact significance and mitigation measures are sensitive to the level of current environmental degradation. The assessment sections review the potential for pollution, disturbance and resource use to impact human health and where appropriate include technically and financially feasible mitigation measures which aim to avoid (and where this is not possible, minimize) such adverse impacts.

Performance Standard 4

PS 4 (Ref. 15.21) recognizes that project activities, equipment, and infrastructure can increase community exposure to risks and impacts and recognizes the responsibility of the project to avoid or minimize the risks and impacts to community health, safety, and security that may arise from project related-activities, with particular attention to vulnerable groups.

The following points are noted with regard to the health, safety and security assessment in relation to PS 4. The assessment evaluates risks and impacts to the health and safety of Local Communities throughout the Project life-cycle and where appropriate outlines control and mitigation measures consistent with GIIP. The mitigation measures specified in this chapter are commensurate with the nature and magnitude of the impacts that they aim to avoid (or where this is not possible, minimize). The assessments and **Chapter 19 Unplanned Events** consider community exposure to hazards. Mitigation measures have been included to minimize exposure. The assessment has included consideration of disease associated with water and communicable diseases (including the potential for impacts on vulnerable groups) (See Ref. 15.2 and Section 15.10). Vector-borne diseases were considered but scoped out (see Section 15.8 and Appendix 15.2: Potential impacts discussed in other ESIA chapters and scoped out of the community health, safety and security assessment).

15.6.2 National Legislation

Public Health Policies

National Priority Programme "Health" (Ref. 15.10) is the overall strategic document at the federal level in Russia until 2020. Its main priorities have been implemented also at the regional level in Krasnodar Krai and include:

- Promoting Healthy Lifestyles – decrease smoking, alcohol use, prevent infectious diseases;
- Strengthening primary healthcare and disease prevention;
- Improving access and quality to specialized and high technology healthcare; and
- Improving maternity and paediatric health care.

Communal Infrastructure

The concept of health risk has been reflected in a number of laws (Ref. 15.22) and regulations (Ref. 15.23 and Ref. 15.24). These include resolutions by the Chief State Sanitary Doctor of the Russian Federation (Ref. 15.25, Ref. 15.26 and Ref. 15.27), which concern sanitary protection zones and classifications.

Risk assessment methodology currently represents the best analytical tool for the characterization of the influence of environmental factors on the health status of the population and is based on criteria that reflects the direct impact of chemicals on the human body. Currently, a health risk is defined as the probability of the threat to life or human health due to exposure to environmental factors. These types of exposures are considered in the assessment.

15.6.3 Regional / Local Policy

Specially Protected Natural Area and Sanitary Control Zones of ART Municipal District

The ART municipal district was designated a health resort town in 1957 (Ref. 15.52) and is designated at a Russian federal level as a specially protected natural area[4] (SPNA) (Ref. 15.53), under the category of 'health improving (spa) resort area' known as the Anapa Sanitary Protection Area (SPA) (Ref. 15.54). The Anapa SPA designation entails a series of development control regimes that apply to three different sanitary protection zones (SPZs) within the SPA, the general purpose of which is to protect the area from any activities that may adversely affect the natural therapeutic resources and sanitary conditions of the resort town area (Ref. 15.55).

The three SPZs within the Anapa SPA are:

- Exclusion zone (the first zone of the SPZ);
- Limitation zone (the second zone of the SPZ); and
- Monitored zone (the third zone of the SPZ).

The regime of commercial use and zoning of the territory is determined by the laws of the Krasnodar Krai General Assembly (Ref. 15.28).

The exclusion zone covers territories of mineral waters occurrence on the surface, their withdrawal from wells, locations of therapeutic mud deposits, mineral lakes and coastal salt lakes, which water is used for medical purposes, beaches, and near-shore areas at the distance of 2 nautical miles (3.7 km) from the coast and over 100 m wide territories adjacent to beaches. The territory of the exclusion zone is excluded from any commercial activities not connected directly with studying, use of the natural therapeutic resources of the resort, permanent and temporary residence of citizens, construction of facilities, mining and

[4] SPNA zones can also be designated for a number of other purposes such as wetlands, protected natural landscape, traditional nature use, national parks, natural moments, etc.

earthmoving operations and other activities that may cause adverse impact on the natural therapeutic resources and sanitary conditions of the resort.

Within the limitation zone it is prohibited to construct facilities and structures, perform earthmoving and mining operations other than directly related to development and improvement of the resort, construct drain wells, arrange irrigation fields and subsurface filtration, cemeteries, cattle breeding complexes and farms, burial grounds for animal refuses, landfills (dumps) for production and domestic wastes' disposal, green plants' felling (except of sanitary felling); use land plots, forest lands and water bodies for any purposes, which may bring to quality and quantity loss of the natural therapeutic resources of the resort.

Within the monitored zone it is permitted to perform all works, which cannot impact adversely on the natural therapeutic resources and the sanitary conditions of the resort.

The territory of ART municipal district also includes the State Natural Sanctuary "Utrish" (SPNA of the federal level) and four SPNAs of the regional level.

- Monument of nature 'Karabetova Gora (hill) with mud volcanos';
- The State Natural Sanctuary 'Krasnaya Gorka';
- Monument of nature 'Zheleznyi Rog Cape';
- Monument of nature 'Panagiya Cape'; and

These SPNA also have a special regime of use.

15.7 Impact Assessment Methodology

The following sections set out the methodology for the community health, safety and security impact assessment. Information within **Chapter 5 Project Description** (along with other chapters as relevant) and the baseline characteristics provided above have been used to assist the evaluation of the potential impacts and their significance.

15.7.1 Methodology

The impact assessment methodology follows the International Finance Corporation (IFC) guidance on Health Impact Assessment (Ref. 15.1). The IFC guidance stresses that '*the level of effort to assess health impacts should be proportional to the potential health impacts and risks. It is vital to get a good balance that allows health issues to be integrated into project planning and implementation in a timely and cost-effective manner'*.

Most of the guidance provided by IFC is applicable and consistent with GIIP. The main exception is the categorization of environmental health areas which were designed for developing, non-OECD countries. For example, it emphasizes vector borne diseases which have a prevalence rate in Africa but do not have a high prevalence rate in Russia. The categories of environmental health areas mix health outcomes and health determinants. However, the revised guidance does offer an alternative to distinguish environmental, social and institutional determinants of health. This preferred method of categorization has been adopted for this assessment.

The method of prioritization proposed by IFC and which follows GIIP is based on combining probability and severity to assess significance. By contrast, the methodology utilized for this ESIA combines sensitivity and magnitude to determine significance. In practice, neither method is entirely suitable for assigning significance to health impacts and both are difficult to use consistently across all health issues. In many cases, significance is a judgement made explicitly by the assessor and justified with supporting text. It highlights the issues which are priorities for mitigation. The choice of prioritization method does not change that judgement. The use of sensitivity and magnitude to determine significance is therefore seen as an acceptable departure from the IFC guidance on health impact assessment (Ref. 15.1).

The health, safety and security assessment forms part of a prospective process, which means that it is undertaken in advance of the implementation of the Project, thereby providing sufficient opportunity to enable 'constructive modifications' to be made to the Project should negative potential effects be identified and mitigations required. The presumption has been to draw up a wide scope of the potential health issues and potentially affected population groups. This wide scope was then narrowed to those health issues and population groups that are most affected by the Project. These issues and population groups have been assessed, including a classification of the significance of the potential impacts.

The health, safety and security assessment has included consideration of direct, indirect, and cumulative changes in community exposures to environment-based health risks, such as communicable diseases, equipment incidents, and exposure to hazardous materials or conditions.

The health, safety and security assessment has been framed and informed by work undertaken for other parts of the overall Project impact assessment (e.g. air quality and noise modelling) and has taken into account the findings of other chapters to inform the assessment of impacts on human receptors; including but not limited to **Chapter 14 Socio-Economics**, **Chapter 9 Air Quality, Chapter 10 Noise and Vibration** and **Chapter 13 Landscape and Visual**.

The findings of this chapter are also supported by several appendices including Appendix 9.1 and Appendix 14.1 South Stream Offshore Pipeline Fisheries Study. Additionally, this chapter has also referred to Appendix 12.2 Sediment Dispersion Study.

15.7.2 Determinants of Health

As described in Section 15.2, the Project has the potential to affect a broad range of environmental, social and institutional determinants of health either positively or negatively; examples are illustrated in Table 15.7.

Table 15.7 Determinants of Health (Ref. 15.29)

Categories of determinants of health	Examples of specific health determinants
Individual factors: genetic, biological, lifestyle / behavioural and / or circumstantial. Some of these factors can be influenced by proposals and plans, others cannot.	Gender; age; dietary intake; level of physical activity; tobacco use; alcohol intake; personal safety; sense of control over own life; employment status; educational attainment; self-esteem; life skills; stress levels; etc.
Social factors: community and / or economic / financial conditions.	Access to services and community (health, shopping, support, etc.); social support or isolation; housing; income; distribution of wealth; sexual customs and tolerance; racism; attitudes to disability; trust; sites of cultural and spiritual significance; local transport options available; etc.
Environmental factors: physical.	Quality of air, water and soil; access to safe drinking water and adequate sanitation; disease vector breeding places; land use; urban design
Institutional factors: the capacity, capabilities and jurisdiction of public sector services.	Availability of services, including health, transport and communication networks; educational and employment; environmental and public health legislation; environmental and health monitoring systems; laboratory facilities; etc.

15.7.3 Receptor Sensitivity

Table 15.8 describes the criteria used to assess the sensitivity of community receptors.

Table 15.8 Receptor Sensitivity Criteria for Community Health and Safety

Sensitivity	Description
High	Community groups who are very vulnerable because they have high sensitivity to the impacts of the Project and very limited coping strategies. Groups who are very young, very old or disabled may have high sensitivity to changes in environmental health determinants, such as air quality and noise levels. Groups who are poorer or who have lower social status have high sensitivity to changes in social health determinants because they have less access to medical care, complaint procedures or political representatives. They may be marginalised.

Continued…

Sensitivity	Description
High	Groups who share resources constantly with the Project may be more sensitive to its impact. This could include users of roads, tracks, wild foods and marine resources. It could also include those who live adjacent to a Project component such as a busy road. It could include cyclists and pedestrians sharing roads with construction vehicles more than twice per day. Some groups may normally engage in high risk behaviours which make them more sensitive to changes in risk. For example, members of the community who drive dangerously along roads used by construction traffic; those who purchase or provide unprotected sex. Some receptors may anticipate risks to their health and wellbeing and express high levels of anxiety. They are likely to be very aware of actual changes. The technical hazards of a project component may be unfamiliar and poorly understood by a community; and this could increase sensitivity.
Moderate	Communities with some coping strategies and some vulnerabilities, who are classed as less sensitive than the high sensitivity group. They are likely to experience temporary inconvenience as a result of changes in environmental or social determinants of health. They may share resources occasionally with the project, such as two peak uses of roads each day. They express some concerns and anxieties regarding the impact of the project on their wellbeing. They have some, but not complete, understanding of the technical hazards associated with project components.
Low	Communities with sufficient coping strategies who feel little or no challenge to their wellbeing as a result of project activities. They may share resources with the project occasionally and broadly understand the hazards associated with project components. Most drivers of private vehicles are in this category.
Negligible	Communities who do not share resources used by the project and have not raised concerns about potential impacts. They are generally not inconvenienced by project activities or exposed to project-related hazards.

Complete.

As health impacts may or may not be evenly distributed across the population, the assessment has considered the equity of impacts. Vulnerability is a key consideration within the general discussion of social, environmental, and institutional determinants of health. In many cases, certain subgroups (for example, children, women and the elderly) may be disproportionately affected.

There is also some geographical variation in community sensitivity. The Project is located within an area that is mainly agricultural in nature; the nearest Local Community is Varvarovka, the centre of which is located approximately 2 km northwest of the landfall section of the Project. The other Local Communities are Gai Kodzor, Supsekh, Rassvet and Sukko. The town of Anapa (estimated population 59,000) is the nearest large urban settlement, approximately 10 km to the north of the landfall section of the project. The town of Anapa has been given the status of a health resort town since 1957 and is a specially protected natural area (SPNA) at the federal level (see Section 15.6.3).

The noise, air quality and socio-economic assessments identified a number of specific residential receptors close to the landfall section of the Project or close to proposed construction access routes that may also be affected by impacts related to community health, safety and security (see **Chapter 10 Noise and Vibration**).

Not all of the residences are likely to be occupied during the Project Construction and Pre-Commissioning Phase:

- 'Chateau Club Village' is a proposed residential development covering an area of approximately 69 ha located on the north-eastern edge of Varvarovka, just outside of the officially designated boundary or urban limit of the community. The proposed Varvarovka bypass road for the Project passes partly along the edge of and partly through the middle of the proposed development. This development has been placed on hold as an agreement has been concluded with the developer to use the road through the site as a temporary access road (i.e. for the Varvarovka bypass road) (Ref 15.57).
- Receptor 5: The closest residential receptor to the landfall facilities (excluding the access roads) is the Clearing in the Woods ("Lesnaya Polyana") development which is just beyond the outermost exclusion zone (Exclusion Zone 3 / A-class). Lesnaya Polyana is divided into approximately 160 plots, varying in size from 600 m^2 to 1,700 m^2 (Ref. 15.39). Some internal infrastructure has been completed, however, the date when dwellings will first be occupied is not clear and it has been assumed, for the purposes of this assessment, that the development will not be occupied prior to the completion of the construction of the landfall section of the Project.

As the noise and air quality assessments have also found that all impacts during the Operational Phase are Not Significant, the above, currently unoccupied receptors, are not considered further in this assessment. They have been included in the discussion on mitigation and monitoring measures (Sections 15.8.1.3 and 15.8.2.3).

The remaining occupied specific residential receptors considered in the health, safety and security assessment are:

- Receptor 1: A group of residential dwellings situated in the southern extremity of the nearby town of Varvarovka, approximately 800 m north of the microtunnel entry points;
- Receptor 2: A group of dwellings on the coast, which include the Shingari holiday complex and the Don holiday complex, approximately 1.3 km south of the microtunnel entry points;
- Receptor 4: A residential dwelling situated in the north-eastern part of Varvarovka, approximately 1.5 km north of the landfall facilities, and 50 m to the north of the Varvarovka bypass road. The dwelling is representative of properties that may be impacted by construction traffic;
- Receptor 8: Two log cabins that have recently been built on cleared land, approximately 1.1 km south of the landfall facilities. These have been considered in the noise assessment;

- Receptor 13: Varvarovka village cemetery located to the northwest of the pipeline corridor at a closest approach of approximately 530 m. The temporary microtunnel access road will run near the cemetery at a distance of 100 m to the east; and
- Receptor 16: Residential properties within Rassvet, which are representative of the properties closest to the proposed construction route and which may be impacted by construction traffic.

15.7.4 Impact Magnitude

Project activities can have impacts on the health of receptor groups.

In the case of community health, it is assumed that a wide range of illnesses and disabilities are already present in the population and this is the baseline prevalence rate. There is a risk that the Project causes, or is attributed to cause, an increase in the incidence and hence prevalence rate of some of the existing conditions. As people value their health, even a small increase in the prevalence rate of a disease or disability that is attributable to the Project is classed as a high magnitude event.

Table 15.9 classifies impact magnitude for the community health, safety and security assessment.

Table 15.9 Impact Magnitude Criteria

Magnitude Characteristic	Magnitude Examples			
	Negligible	*Low*	*Moderate*	*High*
Extent (within a defined community)	No additional illness attributable to project	<1% additional cases of morbidity	<10% additional morbidity	>10% additional morbidity
Duration	No time lost to illness or injury	Cannot work for <24 hours	Acute illness <1 month	Chronic disease > 1 month or death
Reversibility	No illness or injury	Minor illness for which full recovery is expected	There is a risk of long term disability	Irreversible / Permanent
Frequency	Never	Very rare	Rare	Occasional

15.7.5 Impact Significance Criteria

In accordance with the methodology adopted for this impact assessment, receptor sensitivity and impact magnitude are combined to assess significance using the matrix shown in Table 15.10. There is no global consensus on the criteria that should be defined and used in community health impact assessments and Good International Industry Practice consists of seeking consistency and transparency. In some cases, professional judgement of significance has to be made without strict adherence to the magnitude and sensitivity criteria, because the criteria do not apply or need to be adjusted to the health issue under consideration.

Table 15.10 shows a significance assessment matrix regarding the relationship between Receptor Sensitivity and the Event Magnitude of Project impact on the receptors in terms of area and time of impact.

Table 15.10 Significance Matrix

		Receptor Sensitivity (vulnerability and value)			
		Negligible	**Low**	**Moderate**	**High**
Impact Magnitude (extent, frequency, reversibility, duration)	**Negligible**	Not significant	Not significant	Not significant	Not significant / Low*
	Low	Not significant	Low	Low / Moderate†	Moderate
	Moderate	Not significant	Low / Moderate	Moderate	High
	High	Low	Moderate	High	High

* Allows technical discipline author to decide if impact significance is Not Significant or Low.
† Allows technical discipline author to decide if impact significance is Low or Moderate.

15.7.6 Impact Mitigation

The ESIA Report uses the impact mitigation hierarchy (**Chapter 3 Impact Assessment Methodology**). The terminology includes avoid, abate, attenuate, remedy and compensate. These terms may not have obvious meanings in a health context. Table 15.11 provides additional clarification and alternative terminology for community health, safety and security. When advocating mitigation, the highest possible level in the hierarchy should be chosen. For example, there should generally be no obligation for the community to change their own behaviour as a result of the Project in order to remain safe and healthy.

Table 15.11 Mitigation Hierarchy

Hierarchy	Examples
Legislation	Standards for noise, air and water quality
Avoid or eliminate	Design out, e.g. reduce risk of sexual transmitted infections by employing local rather than foreign workers
Reduce through engineering controls	Design in, e.g. provide double glazing to receptor, build bypass
Reduce through management controls	Prevent night time driving of project vehicles, condom distribution, grievance mechanisms

Continued…

Hierarchy	Examples
Change community behaviour	Apply evidence based health and safety promotion techniques
Repair	Medical care
Compensate	Financial compensation, rehabilitation

Complete.

In the Section 15.8, impacts are assessed and discussed. Mitigation measures are identified to address these impacts following the application of which, the significance of any residual impact (i.e. impact remaining after mitigation measures have been implemented) is stated.

South Stream Transport has developed a Grievance Procedure for the Project, which will guide the management of grievances throughout the Project lifecycle (**Chapter 6 Stakeholder Engagement.**) The Grievance Mechanism will be implemented by South Stream Transport in partnership with its contractors and will ensure that grievances are brought to the attention of the appropriate Project staff and addressed in an appropriate and timely way. The Grievance Procedure describes the process by which a grievance is documented, investigated, and resolved in coordination with the affected stakeholders.

Monitoring measures and the Grievance Procedure have not been listed individually against impacts in the following sections but can be assumed to apply to all potential Project health, safety and security impacts per the HSSE-IMS (**Chapter 22 Environmental and Social Management**).

15.8 Assessment of Potential Impact: Community Health, Safety and Security

The assessment takes as its starting point the 'residual' impacts and mitigation measures already included in other ESIA chapters. This allows the community health, safety and security assessment to focus on any outstanding issues that have a bearing on community and population health, safety and security and avoids duplication and restatement.

The assessment assumes the successful implementation of mitigation measures described in other ESIA chapters. The mitigations proposed in other ESIA chapters are therefore important to minimising potential impacts and a range of potential impacts have been scoped out on the basis that those mitigations adequately address any potential impact to community health, safety and security. A summary of these potential impacts and the chapters of this ESIA Report where they are discussed is presented in Table 15.12. A fuller explanation of these potential impacts, how they relate to community health, safety and security, along with mitigation measures proposed in the relevant chapters of this ESIA Report and the basis on which these potential impacts have been scoped out of the following assessment is presented in Appendix 15.2.

Table 15.12 Potential impacts discussed in other ESIA Chapters and scoped out the of the community health, safety and security assessment

Potential impact	Relevant ESIA Chapter
Construction phase – onshore, nearshore and offshore	
Disruption of community third party utilities as a result of accidental damage during construction. Use of radioactive sources for weld inspection. Integrity testing of the pipes and their welds may include x-ray tests.	Chapter 5 Project Description
Pre-construction pipeline route surveys causing temporary land loss or disturbance. Construction land take causing permanent change of land use or restriction on land use activities. Risk of house price and food price inflation due to in-migration of non-local workers during Construction Phase. Risk of house price devaluation due to proximity of the development. Adverse impact on local tourism due to disruption and reduced visual appeal and local amenity of the area due to industrial nature of project.	Chapter 14 Socio-Economics
Release of dust from excavation and construction traffic movements.	Chapter 9 Air Quality
Deposition of mud on the local roads from construction vehicles. Fuel and oil leaks and spills from construction vehicles / plant from activities related to the main onshore facility. Waste generation, storage and disposal, including drilling lubricants and waste fluids from construction.	Chapter 8 Soils, Groundwater and Surface Water
Light pollution from construction works from activities related to the main onshore facility.	Chapter 13 Landscape and Visual
Restriction of access / fragmentation of access due to construction works.	Appendix 9.1
Ground excavations, including foundations, trenching and tunnelling.	Chapter 22 Environmental and Social Management
Air quality emissions from marine vessels engaged in nearshore and offshore survey, dredging, pipe-laying and support activities.	Chapter 9 Air Quality
Noise and vibration emissions (airborne and underwater) from nearshore and offshore survey, dredging, pipe laying and support activity engines and on-board plant.	Chapter 10 Noise and Vibration

Continued…

Potential impact	Relevant ESIA Chapter
Physical presence of construction vessels in nearshore area (within sight from shore).	Chapter 13 Landscape and Visual
Increase in vessel traffic restricting recreational / commercial uses of nearshore and offshore zone, including ports and any exclusion zones. Local job creation for nearshore and offshore activities. Unemployment for nearshore and offshore workforce at the end of the Construction Phase.	Chapter 14 Socio-Economics
Dredging and pipe laying activities causing the release of sediments to water column (altering water chemistry and increasing turbidity).	Appendix 14.1
Risk to community and public safety from unauthorised access to construction worksite.	Chapter 22 Environmental and Social Management
Operational Phase – onshore, nearshore and offshore	
Fuel and oil leaks and spills from vehicles / plant engaged in maintenance and repair activities.	Chapter 8 Soils, Groundwater and Surface Water
Air quality emissions from operational plant, vehicles and materials, including commissioning heaters. Controlled venting of natural gas from dispersion stack as part of emergency shutdown procedures.	Chapter 9 Air Quality
Noise and vibration emissions from operational plant.	Chapter 10 Noise and Vibration
Visual impact of industrial complex replacing rural setting. Operational land use change including proposed safety exclusion zones.	Chapter 13 Landscape and Visual
Local job creation.	Chapter 14 Socio-Economics
Site security enforcement.	Chapter 22 Environmental and Social Management
Air quality emissions from marine vessels engaged in nearshore and offshore pipeline surveys and repairs.	Chapter 9 Air Quality

Continued...

Potential impact	Relevant ESIA Chapter
Noise and vibration emissions from nearshore and offshore marine vessels.	Chapter 10 Noise and Vibration
ROV and RTV nearshore survey activity and pipeline maintenance activities causing the release of sediments to water column (altering water chemistry and increasing turbidity).	Chapter 12 Marine Ecology
Physical presence of survey and maintenance vessels in nearshore area (within sight from shore).	Chapter 13 Landscape and Visual
Increase in vessel traffic restricting recreational / commercial uses of nearshore and offshore zone, including ports and any exclusion zones during surveys and repairs. Local job creation for nearshore and offshore activities has the potential for positive physical and mental health outcomes. Unemployment for nearshore and offshore workforce at the end of the Construction Phase.	Chapter 14 Socio- Economics
Construction and Operational Phases – nearshore and offshore	
Waste generation, storage and disposal on-board vessels.	Chapter 18 Waste Management
Collision with other vessels during nearshore and offshore activities resulting in personal injury or fatalities. Fuel and oil leaks and spills from vessels / plant engaged in nearshore and offshore activities.	Chapter 19 Unplanned Events

Complete.

It is important to note that the mitigation measures presented in the community health, safety and security assessment in the remaining sections below are in addition to, and not alternatives to, the measures presented in other chapters and all measures work together in order to achieve the impact rankings presented for residual impacts.

15.8.1 Impact Assessment: Construction and Pre-Commissioning Phase

15.8.1.1 Introduction

This section identifies the potential impacts and risks to community health receptors which require further assessment using the community health, safety and security impact assessment methodology. For those effects where potentially significant pre-mitigation impacts are assessed in Section 15.8.1.2, potential mitigation measures have been identified in Section 15.8.1.3. This is followed by a residual impact assessment, the results of which are set out in Section 15.8.1.4.

15.8.1.2 Assessment of Potential Impacts (Pre-mitigation)

Social Factors

There will be an incoming, temporary workforce required for Project construction (it is not yet known what proportion of this workforce will originate from within the EU). The majority of onshore and offshore workers are likely to be adult males.

The Construction Phase will generate approximately 330 temporary jobs onshore during the peak of construction. It is anticipated that the onshore construction workforce will be accommodated in the local area and that they will interact with local communities. The extent of this interaction will depend on the living, working and recreational conditions for the workforce. Some may originate from the local area having taken up employment opportunities from the Project and so will reside in their own homes.

Offshore construction activities are expected to create 1,185 temporary jobs during the peak of construction. The offshore workforce is anticipated to be specialised teams brought in by the construction contractor and is unlikely to be recruited locally. The offshore workforce will live aboard the vessels on which they work.

The following social factors with community, economic and financial outcomes were identified as potentially giving rise to community and population level health, safety and security impacts:

- Conduct of workforce in the community;
- Spread of sexually transmitted infections; and
- Employment opportunities for the local population.

Each of these is discussed in turn in the sections below.

Conduct of workforce in the community

This issue is relevant to the landfall, nearshore and offshore sections of the Project.

Potential for conflict between the local community and the workforce depends on the living, working and recreational conditions for the workforce. For the purposes of this assessment, it has been assumed that the onshore construction workforce will be housed in their own homes (if local to the area) or in the town of Anapa. In this situation, interactions with the local community are likely to be normalized and they are likely to be regarded as community members. Risks of antisocial behaviour and injury are reduced if normal codes of conduct are followed. During the tourist season the workforce is small compared to the number of tourist visitors. Outside the tourist season the numbers of the workforce may be more apparent.

The baseline suggests that alcohol use may be a problem in the region accounting for 10% of the mortality. In general, excessive alcohol use is associated with increased crime, including assault and criminal damage. However, the baseline further indicates that there are generally no incidences of serious disorder in Anapa Resort Town area, even during the summer tourist season (Section 15.5.2.8).

Although it is not yet known if the offshore workforce will interact with the community during transit, the potential for community impacts relating to the offshore workforce is greatest during periods of leave, such as shift changes, when vessel crews can come ashore for short periods of time.

There is also the potential for conflict between communities and direct or contracted workers who will provide security to safeguard the Project's personnel and property.

The existing mitigation measures to be implemented by the Project include:

- The intention of South Stream Transport is to require its contractors where practicable to provide the opportunity for local people to seek employment opportunities on the Project, which will assist in mitigating the potential for tensions related to unmet employment opportunities.
- To mitigate further these risks, South Stream Transport will keep communities informed about Project activities through on-going stakeholder engagement, and implement the grievance procedure to communicate and resolve any grievances arising from Project activities (see **Chapter 6 Stakeholder Engagement** for further information).

The sensitivity of the local population, including consideration of particular vulnerabilities, is considered to be moderate. If the workforce is housed in smaller communities then it would be harder for the host community to limit proximity to the workforce or to avoid particular venues that are visited by the workforce. The magnitude of change caused by the Project that has the potential to affect health outcomes is considered to be moderate. This is because any altercation, however unlikely, has the potential for serious injury. Applying the scoring of the Significance Matrix the significance of health impacts arising from this activity, without including any additional mitigation or monitoring requirements, is **Moderate**.

Spread of sexually transmitted infections (STIs) due to in-migration of non-local workers

This issue is relevant to the landfall, nearshore and offshore sections of the Project.

It is noted that the size of the workforce will be small relative to the large numbers of tourist visitors that ART municipal district receives each year. However, as the majority of workers are expected to be adult males, and as there is scope for a diverse range of countries of origin (particularly for vessel crews), this poses potential risks in terms of transmission of infectious disease. The only specific risk that has been identified is the potential for an increase in the local incidence of sexually transmitted infections (STIs). The sexual activity of the Project workforce during leave and outside of work hours has potential to introduce or spread infectious diseases, including sexually transmitted infections (STIs). The likelihood of this occurring depends on the living, working and recreational conditions for the workforce.

It is noted in the baseline that in 2011, Krasnodar Krai achieved a reduction in newly diagnosed cases of syphilis (Ref. 15.9). These positive results are attributed, in part, to target health promotion and diseases prevention programmes, including "Stop Infections" and National Priority Project "Health", which are being implemented throughout the region (Ref. 15.10). However, sexual transmission of HIV continues to increase in both the Russian Federation and in the Krasnodar Krai and Injected drug use and heterosexual intercourse are two of the lead causes of the transmission of the infection (Section 15.5.2.2). There is a stable trend in the incidence of gonorrhoea in ART municipal district.

Commercial sex workers (CSW) can be vulnerable to STIs and can also contribute to the transmission of such infections. The number of CSWs in the Project area is unknown; information from local authorities has indicated that prostitution is not an issue in this family-focused resort area (Ref. 15.5) but the presence of CSWs would not be unexpected, particularly in communities spanning or close to major roads, tourist centres or port towns. People who are deprived, addicted to drugs and / or suffer from mental illness are particularly susceptible to sexual exploitation. The high prevalence of HIV among the drug users population makes this group vulnerable to further spread of the disease and increases the risk of sexual transmission to the general population through commercial sex workers.

The sensitivity of the local population, including consideration of particular vulnerabilities, is considered to be moderate. This is because of the potential presence of commercial sex workers (particularly around major haul roads and the town of Anapa) who could become infected themselves, and also spread infections. The magnitude of change caused by the Project that has the potential to affect health outcomes is considered to be high. This is because the infection impacts may go beyond the Construction and Pre-commissioning Phase with wider prevalence implications for local communities and health resources. Applying the scoring of the Significance Matrix the significance of health impacts arising from this activity, without including any additional mitigation or monitoring requirements, is **High.**

Employment opportunities for the local population

This issue is relevant to the landfall section.

Due to the highly specialised nature of sub-sea pipeline construction, the marine pipe-laying contractor will provide their own workforce and few, if any, local people will be employed for this work. Given this, the potential for the contractor to employ local labour to fulfil unskilled and semi-skilled jobs is largely related to the construction activities for the landfall section of the Project. **Chapter 14 Socio-economics** estimates that construction accounts for approximately 9% to 10% of the local economy, suggesting that there is likely to be a pool of people interested in taking up construction employment opportunities. There is also potential for indirect employment in other sectors.

Employment is associated with positive physical and mental health outcomes: the quality of the employment is associated with the health effect (Ref. 15.30), for example the terms and conditions of the contract and the working conditions. Appropriate training has also been found important (Ref. 15.31). Unemployment is associated with increased mortality rates (Ref. 15.32) (Ref. 15.33).

During consultation undertaken as part of the scoping process, creation of local employment was perceived as an anticipated positive benefit of the Project for local communities (Ref. 15.34). This will include sub-contractors and secondary industries providing goods and services. Population groups likely to disproportionately benefit from job opportunities created by construction activities include the unemployed and people with high levels of deprivation, particularly those on low incomes.

The existing enhancement measures in the ESIA Report include:

- South Stream Transport will encourage the use of local labour for the Project including by requiring its contractors to advertise suitable available positions in local and regional media, use local recruitment agencies and engage in other similar activities, so as to provide the opportunity for local people to access employment opportunities created by the Project; and
- South Stream Transport will require its contractors to advertise suitable available contracts in local and regional media, establish contacts with the local Chamber of Commerce and business associations and engage in other similar activities, so as to provide the opportunity for local suppliers and contractors to seek sub-contractor roles and / or supply materials and equipment to the Project.

Whilst the Project will provide opportunities for local labour to access employment and for local firms to secure contracts for the supply of goods and services; the effects of direct employment are expected to be relatively modest as the majority of the construction work force required will be highly skilled and is anticipated to come from outside the local area.

For those individual workers that do benefit from employment and service provision opportunities, the impact on the general health of workers and their families is likely to be beneficial, as wealth and status are important social determinants of health.

Positive impacts are not scored using the significance matrix; however the following points are noted. The sensitivity of the local population, including consideration of particular vulnerabilities, is considered to be high. This reflects the potential for the employment benefits to include vulnerable groups, e.g. families with low incomes. The magnitude of change caused by the Project that has the potential to affect health outcomes is considered to be beneficial and limited.

Environmental factors

The following environmental factors that affect the physical environment were identified as potentially giving rise to community and population level health, safety and security impacts:

- Construction noise impacts from vehicles, plant and vessels;
- Impacts on road safety due to construction traffic; and
- Mobilisation of historic seabed pollutants.

Each of these is discussed in turn in the sections below.

Construction noise impacts from vehicles, plant and vessels

This issue is relevant to the landfall and nearshore sections.

The ESIA assessment of noise and vibration impacts arising during the Construction and Pre-Commissioning Phase in the nearshore and landfall sections has been combined into a single modelling scenario. As such the nearshore and onshore impact are assessed as a single impact to onshore community receptors.

Noise and vibration emissions from construction plant and vehicles, including: piling; excavation; tunnelling; HGVs; loading; and unloading activities; and construction road traffic have the potential to adversely affect health by disturbance to residential dwellings, local workforce (notably shift workers) and visitors.

A source of night-time noise impacts is the microtunneling operation. This will be undertaken on a 24-hour per day, seven day per week basis and the average rate of tunnel excavation will be approximately 10 m to 15 m per day. It is anticipated that each microtunnel will take approximately four months to excavate.

Excessive or persistent noise exposure can have a detrimental effect on health including on cardio vascular disease and on sleep, work or leisure activities. The baseline notes that circulatory illnesses are the second highest class of adult illness in ART municipal district (Ref. 15.9). High noise levels could potentially exacerbate this situation. During consultation, stakeholders raised concerns about noise and vibration that might adversely affect communities, particularly during the Construction and Pre-Commissioning Phase of the Project (Ref. 15.34).

The existing mitigation measures to be implemented by the Project include (see **Chapter 10 Noise and Vibration**):

- Equipment will be throttled to a minimum or switched off when not in use;
- Internal access roads will be kept well-maintained to prevent noise impacts generated by vehicles dealing with difficult terrain;
- Drop heights of materials will be minimised which will reduce the noise levels generated by the collision of materials with the ground or other materials;
- As far as reasonably practicable, sources of significant noise will be enclosed;
- Plant and equipment will be used and maintained regularly in accordance with manufacturers' instructions;
- Where possible, equipment will be located away from noise-sensitive areas. Also, loading and unloading will be carried out away from such areas;
- In consideration of the potential impacts arising from several noisy activities occurring at the same time, activities will be scheduled, where possible, to minimise overall noise levels;
- In order to reduce these noise levels generated by the compressor booster (see below), it is expected that a combination of measures will need to be employed. These include the selection of inherently quiet plant with far lower sound power levels than used in the assessment; careful siting and orientation of the plant to minimise noise emissions at receptor locations; and the use of acoustic berms or barriers close to the pre-commissioning compound; and
- An acoustic screen along the boundary of the properties and Varvarovka bypass road will be installed to mitigate the noise impact. Typically this can be constructed from a timber fence, wall or earth bund, or any combination of the two. For fencing, example design principles to ensure effective mitigation include two layers of staggered boards, giving a minimum superficial mass of 10 kg/m^2, and ensuring that no air gaps exist at the base of the

structure. The specification will be determined based on the number of vehicle movements on the road along with consultation with the owners of adjacent properties.

The noise assessment undertaken for the Project (**Chapter 10 Noise and Vibration**) assesses noise impacts for a range of noise scenarios. The residual impact significance of both noise and ground borne vibration at sensitive receptors during the Construction and Pre-Commissioning Phases is predicted to be Not Significant with the exception of two scenarios:

- During periods of the highest traffic flows there is predicted to be an impact of **Low** impact significance at Receptor 4, the residential dwellings in the north-eastern part of Varvarovka adjacent to the Varvarovka bypass road, following the inclusion of a noise barrier to mitigate noise levels; and
- The activities associated with the use of the compressor booster spread for the cleaning, gauging and drying of the pipelines between the Russian and Bulgarian landfall facilities during Pre-Commissioning, will result in a **Low** impact significance at a number of neighbouring receptors. It is noted in **Chapter 10 Noise and Vibration** that the degree of mitigation feasible for this impact cannot be directly quantified at this point in time.

The sensitivity of the local population, including consideration of particular vulnerabilities, is considered to be moderate. The magnitude of change caused by the Project that has the potential to affect health outcomes is considered to be low. This is due to the fact that, for the traffic noise impacts, these will occur only during the periods of greatest vehicle movements. For the noise impacts generated by the compressor booster, these will be of short term and temporary duration (less than 4 months). Applying the scoring of the Significance Matrix the significance of health impacts arising from this activity, without including any additional mitigation or monitoring requirements, is **Low**.

Impacts on road safety due to construction traffic, particularly heavy goods vehicles

This issue is relevant to the landfall section.

Potential health impacts arise from the increase in traffic flows and increase of heavy and oversize vehicles on local roads due to construction.

Increases in construction road traffic (movement of materials and personnel) through community areas can result in a number of effects for other road users, such as:

- Reduction in real or perceived road safety;
- Overload of junction capacity;
- Driver delay;
- Community severance;
- Intimidation and fear;
- Reduction in pedestrian amenity; and
- Increase in hazardous loads.

If access routes are poorly conceived, difficult to access, poorly maintained or perceived as unsafe, construction traffic can act as barriers to encouraging the use of active transport modes such as walking and cycling (Ref. 15.37). The density of motorised transport can also negatively affect social cohesion within a community either through direct community severance due to road construction or through the impact of high levels of traffic (Ref. 15.37). As discussed in the baseline, compared with other countries bordering the Black Sea there is a high percentage of pedestrian deaths in the Russian Federation and 72% of deaths occur in urban areas indicating that road traffic and road safety are important considerations for Local Communities. Furthermore, increased risk of road traffic collisions from high traffic density can contribute towards the development of long-term mental health problems in drivers, passengers and victims (Ref. 15.37).

For road safety issues children, the elderly, pedestrians and cyclists are considered to be vulnerable population groups.

During consultation in 2012, stakeholders raised the issue of increased traffic, the impact this could have on Local Communities, and asked whether additional roads would be constructed for the Project (Ref. 15.34). In early 2014, interviews with the local administration for the community of Rassvet, and the local schoolteacher, indicated that increased traffic is an issue in Rassvet, particularly in relation to the children attending the local school and in summer when there is more tourist traffic in the area (Ref. 15.49).

The total construction traffic proposed for the Project comprises a maximum of 531 HGV and 27 light vehicle movements per day; this peak will last from August to November 2014. During June and July 2014, there will be 498 HGV and 14 light vehicle movements per day. The existing mitigation measures and design control measures to reduce traffic impacts presented elsewhere in this ESIA Report include:

- Preparation and implementation of a Traffic Management component of the Russian Landfall CMP to manage and coordinate the transport and logistics requirements of the Project. The Logistics Plan will identify agreed access routes, as well as measures and safeguards to minimise interference with local transportation and routes; and
- Two temporary bypass roads will prevent construction traffic from passing through Local Communities. The first bypass road has been constructed by Gazprom Invest as part of the Expansion of the United Gas Supply System. This road bypasses the town of Gai Kodzor and will be used by Project construction traffic as agreed with Gazprom Invest. The second temporary bypass will be constructed for the Project to bypass the town of Varvarovka when accessing the landfall section during construction of the Project.

Appendix 9.1 concludes that with the provision of the two construction traffic bypasses, the highway network is capable of accommodating the additional traffic without there being any perceptible impact on other road users. Based on this, the majority of transport impacts do not require further assessment from a health, safety and security perspective.

However, the Study notes that the exception is the route through Rassvet, a community on the junction of the M25 where the construction traffic arriving from east and west on the M25 will turn south towards the landfall section of the Project.

During the period when construction traffic is at its highest, the increase in the traffic flow on the road through Rassvet immediately south of the junction with the M25 (Point A on Figure A9.1.2) could be approximately 23% with the increase in terms of heavy vehicles being 154%. To the south of Rassvet and north of the start of the temporary bypass to Gai Kodzor (Point B on Figure A9.1.2) the increase in the number of heavy vehicles could approach 200% because of the lower flow of existing traffic. For the majority of the construction period the increases will be much lower over the section of road between these two points, with the increase in total traffic being around 2% and the increase in heavy vehicles between 11% and 13%.

The HGV traffic through Rassvet will be in addition to that of the HGVs associated with the construction of the Russkaya compressor station (CS) so the actual increase will depend on the level of construction traffic being generated at that time by the Russkaya CS construction (see Appendix 20.1 for further consideration of the cumulative traffic effects expected in conjunction with the construction of the Russkaya CS).

Increased vehicular traffic leads to increased likelihood of road traffic incidents and injuries. There is a direct link between number of kilometres driven and the number of incidents, injuries and fatalities caused. The baseline statistics indicate that alcohol consumption, poor road conditions, and bad traffic management contribute most in Russia to road traffic injuries and deaths. The use of cell phones and texting devices while driving is another growing risk factor. Due to the proximity to residential, commercial and community properties lining the road in Rassvet (see Section 15.5.2.7), the number of pedestrians or cyclists encountered by construction traffic is expected to be higher in the community of Rassvet compared to on the M25. Figure 15.14 shows the side of the road through Rassvet being used by cyclists, demonstrating their potential vulnerability to high volumes of HGVs.

Figure 15.14 M25 Pedestrian Crossing just West of Rassvet Turning (Ref. 15.40)

For road safety, the sensitivity of the local population, including consideration of particular vulnerabilities, is considered to be high. This is due to certain vulnerable sub-populations (e.g. children and the elderly) being present among the general population of road users, including pedestrians, motorists and vehicle passengers. The magnitude of change caused by the Project that has the potential to affect health outcomes is considered to be high. This is because although temporary, there is a period of intense activity lasting six months during construction when large numbers of HGV and other vehicle movements will occur. Applying the scoring of the Significance Matrix the significance of health impacts arising from this activity, without including any additional mitigation or monitoring requirements, is **High**.

Mobilisation of historic seabed pollutants during trenching and tunnelling

This issue is relevant to the nearshore section.

There is potential for nearshore dredging and pipe-laying activities to disturb and mobilize existing toxins or pollutants (including chemicals from unexploded munitions (UXO)) within the seabed. Toxins from these activities have the potential to enter the human food chain either directly if consumed whist engaging in marine leisure activities; or if consumed following assimilation (and potentially accumulation) in fish, mollusc or crustacean intermediates. Children and young people's developmental processes are particularly sensitive to exposure to contaminants. As well as the potential illness, there could also be economic loss for businesses reliant on coastal waters. People with high levels of deprivation, particularly those on low incomes would be more sensitive to loss of income due to reduced tourism or commercial marine activity.

ART municipal district has been given the status of a health resort town since 1957 and is a specially protected natural area (SPNA) of the federal level. The SPNA is categorized as "health improving (spa) resort area". Linked to this status there are recreational uses of the beach at Sukko, Shingari and Don holiday complexes and other nearby waters, including swimming, fishing, paragliding, jet skiing and diving. During consultation stakeholders raised the issue of potential environmental damage that may affect fishing and recreation (Ref. 15.34).

An indication of the likely extent of sediment plumes due to seabed disturbance is provided by Sediment Dispersion Modelling (Ref. 15.41). The model shows that a plume will persist throughout the construction dredging activities, gradually dissipating following their completion. The sediment plume travels in the direction of the current along the Russian coastline. The modelling shows the extent of sediment plumes associated with different underwater seabed disturbance activities and how the effect varies with depth and direction of current. For the purposes of this discussion the only activity that is likely to result in an impact to bathing waters is pre-lay dredging at the pipeline exit points from the microtunnel. Under this scenario there is the potential for the sediment plume to affect beaches and bathing waters over a long stretch of coastline to the south, particularly the first 5.5 km including Sukko beach. The greatest effect occurs when seabed disturbance is undertaken during clockwise currents (Scenario 1 of that report).

Figure 15.15 is an illustrative example from the technical report (Ref. 15.41) showing the point with the greatest potential impact on bathing waters during a clockwise current. At the exit points, the proposed dredging and disposal operation lasts for 1.3 days for one pipeline operation. The sediment plume dissipates within 120 hours or approximately 5 days. The situation is considerably improved if seabed disturbance occurs under counter-clockwise current conditions. When this scenario is modelled the sediment plume is greatly reduced and extends to the north away from popular bathing waters. Under these conditions (Scenario 2 of that report) the plume disperses within 60 hours or less than three days. Figure 15.16 is an illustrative example from the technical report (Ref. 15.41) showing the greatly reduced potential impact on bathing waters during a counter-clockwise current.

The modelling suggests that the impact on bathing waters, if any contaminants are mobilized and transported with the plume, would be greatly reduced if dredging at the microtunnel exit points was undertaken under counter-clockwise current conditions. The presence of inert sediment in the water is not anticipated to result in any direct health impacts, but could cause anxiety and reductions in leisure activities including those undertaken by guests of the local tourism businesses.

Figure 15.15 Clockwise Current Sediment Plume Extending South to Sukko Beach (Ref. 15.41)

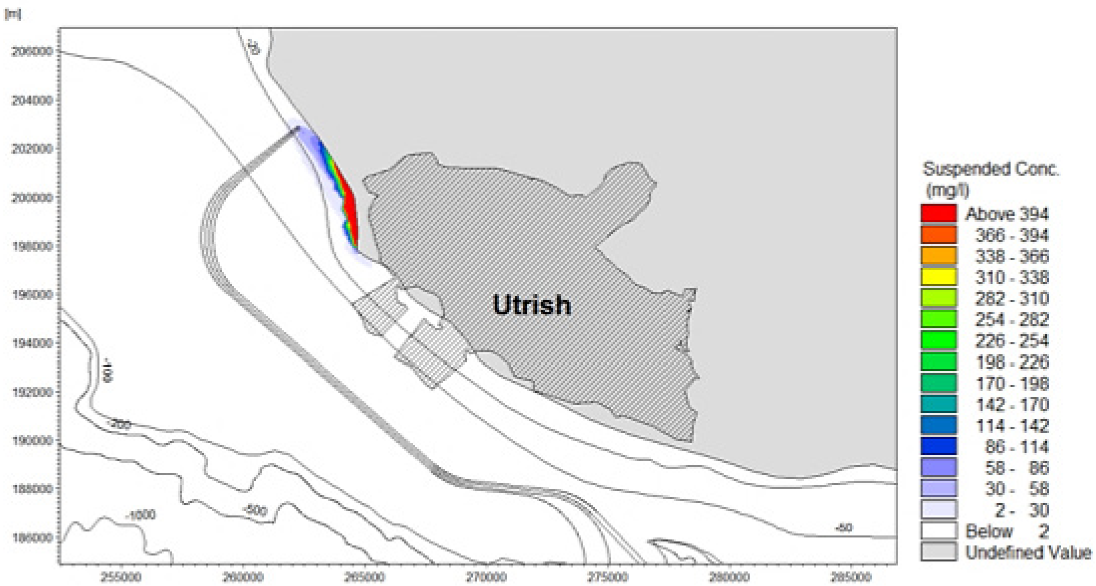
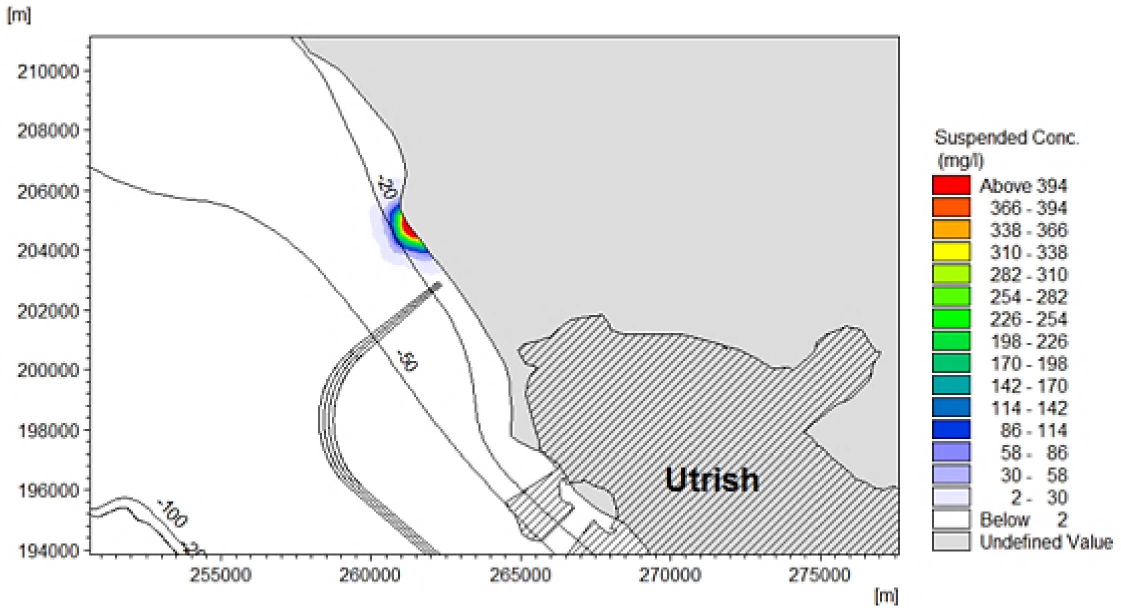


Figure 15.16 Counter-Clockwise Current Sediment Plume Extending North (Ref. 15.41)



The ESIA reports that previous surveys in the area have identified the presence of contaminants in the marine sediments. Contaminants previously identified include petroleum hydrocarbons, phenols, anionic surfactants and heavy metals. Concentrations were typically highest near the coast, particularly in the vicinity of the main towns (**Chapter 7 Physical and Geophysical Environment**). Previous surveys in the Russian Sector of the Black Sea have also identified the presence of contaminants in the sea water itself, including several organochlorine pesticides, petroleum hydrocarbons, phenols, and anionic surfactants. Additionally, elevated concentrations of heavy metals were locally detected, including copper, cadmium, lead, mercury and zinc. Contaminant concentrations varied spatially, but were typically higher near the coast.

As part of surveys for this Project, bacteriological testing was undertaken on two coastal samples collected in summer 2011. The results are consistent with relatively low levels of faecal contamination. Based on the limited testing, the waters meet the microbiological requirements of SanPiN 2.1.5.2582-10 (**Chapter 7 Physical and Geophysical Environment**). Marine water quality surveys were also undertaken in autumn 2010 and spring 2011; and marine sediment sampling from the seabed was undertaken between 2010 and 2011 and in July 2013. The 2013 survey included coring within the area to be dredged and areas of seabed intervention to establish levels of potential contamination within the sediment in these. The sediment samples were visually described before undergoing chemical analysis and grain size distribution analysis.

The existing mitigation measures in the ESIA Report include:

- Undertake UXO survey. If required, a UXO specialist will provide watching brief during excavation;

- Dredged spoil in the nearshore zone (i.e. from microtunnelling activities) will be temporarily stored in designated offshore storage areas. This material will be subsequently re-dredged and used for trench backfill following pipe installation;
- Offshore dredged material will be disposed of at an existing underwater disposal site (no. 923, located on the Russian continental slope);
- In the event that any dredge spoil is identified as contaminated or requires disposal on land, the spoil will be treated as construction waste and appropriately stored, transported and disposed of;
- Implement a Dredging Management Plan to ensure careful spoil handling and minimise release of material to the water column;
- Where dredging is required, the choice of dredger will be made to minimise sediment re-suspension (within engineering constraints). Additional turbidity reduction measures such as silt curtains if feasible, particularly where sediment is to be temporarily re-deposited in nearshore storage areas;
- Spill kits shall be kept in accessible locations at all times during the Construction and Pre-Commissioning, Operational and Decommissioning Phases, and employees will be trained in their use and disposal;
- Avoid use of additives containing hazardous chemicals in slurry as far as is practicable; and
- After completion of the microtunnel works, any remaining slurry will be transported from the used slurry storage tank to a licensed waste facility approved local waste water treatment plants, where it is typically handled as normal soil waste. By undertaking careful calculations of slurry requirements and using efficient slurry recycling systems, the amount of surplus slurry will be kept to a minimum.

The results of the marine water and sediment surveys showed that in the Shallow Water Coastal Area phenol concentrations in excess of Adopted Marine Sediment Standard (AMSS) were identified in 14 of the 15 marine sediment samples. One of six marine core samples also exceeded AMSS for petroleum products. **Chapter 7 Physical and Geophysical Environment** presents information on levels of contamination, but does not conclude on potential impacts. Based on these findings, the only potential concerns to community and population health are from phenol and petroleum product contaminants in marine sediment and these are considered in the following sections.

<u>Phenol</u>

Acute effects of phenol exposure are only expected from contact or ingestion (or inhalation) of concentrated quantities of phenol. Such exposure would only be expected in an occupational setting and is not discussed further in this section.

Non-occupational exposure to phenol may occur by drinking contaminated water. The threshold for exposure via ingestion is 1 to 32g. Phenol in marine sediments samples for 2010 to 2011 in Shallow Water Coastal Areas occurred in the range of 0.05 to 0.40 mg/kg. Phenol in sea water samples for 2010 to 2011 occurred in the range of <0.1 to 6.1 µg/L. As phenol readily dissolves in water, the dilution effect makes it very unlikely that disturbance of recorded concentrations of phenol in the seabed and seawater will affect bathing water quality to the extent required to produce a detectable human health effect. It is very unlikely therefore that the general population will be exposed to a level of phenol high enough to cause adverse health effects (Ref. 15.42).

Petroleum Products

Total petroleum hydrocarbons (TPH) is a term used to describe a large family of several hundred chemical compounds that originally come from crude oil. Crude oil is used to make petroleum products, which can contaminate the environment. Because there are so many different chemicals in crude oil and in other petroleum products, it is not practical to measure each one separately. The collective term of TPH is therefore applied.

The extent of absorption of TPH by dermal routes varies because of the wide range of physical and chemical properties observed for these chemicals. The extent of absorption depends on the volatility, solubility, lipophilicity, and other properties of the specific chemical or mixture. (Ref. 15.43).

It would generally be expected that dermal exposure (e.g. skin contact when swimming) would produce less severe symptoms or toxicity than ingestion. As the contamination would be in seawater, ingestion in any significant quantity can be ruled out. Where petroleum products are dissolved or in suspension within the seawater the potential for high exposure concentrations is considerably reduced by dilution. However where Project activities disturb concentrations of seabed petroleum products, TPHs may congregate as a film on the water's surface, resulting in higher exposure doses to recreational marine users.

Due to the diversity of potential chemical components it is not practical to consider particular exposure concentration thresholds. However the concentrations detected by marine sediment samples do not give rise to obvious concerns, with the highest detected concentration being 407 mg/kg.

Overall historic seabed pollutant impact

The sensitivity of the local population, including consideration of particular vulnerabilities, is considered to be high. This reflects a precautionary approach since certain vulnerable sub-populations may occur e.g. children during some periods when sediment disturbing activities are occurring. The magnitude of change caused by the Project that has the potential to affect health outcomes is considered to be low. Although the sample concentration levels indicate a low level that could be considered to be negligible, there is the potential for more extensive or concentrated contamination to be encountered (e.g. petroleum products) which could either concentrate at the surface or be transported in sediment plumes. Applying the scoring of the Significance Matrix and professional judgement, the significance of health impacts arising from this activity, without including any additional mitigation or monitoring requirements, is **Low/Moderate**.

Institutional factors

The quality and quantity of local health and emergency service resources is an institutional factor identified as potentially giving rise to community and population level health, safety and security impacts.

Local health and emergency service resources due to in-migration of non-local workers

This issue is relevant to the landfall section.

The Construction and Pre-Commissioning Phase may impact on local health and emergency response service providers, as the Project may affect demand for their resources, particularly in the event of an unplanned event that affects large numbers of the construction workforce.

Lack of availability and accessibility of municipal services such as libraries, health facilities, doctors' surgeries, schools and social support can have a negative social impact on communities and affect both physical and mental health (Ref. 15.37).

The baseline notes that in the ranking applied by a State Report on Sanitary Epidemiological and Consumer Protection in the Krasnodar region, ART municipal district is placed in the mid-range for healthcare expenditure and in the highest range for per capita physician coverage.

Chapter 5 Project Description states that first aid and medical emergency response will be available to workers as part of the Occupational Health and Safety procedures (see also Appendix 15.1). However, no on-site medical facilities will be provided. Furthermore the facilities, personnel and resources that will be needed to support the provision of medical services for workers will be provided at local hospitals and clinics. The increase in population (assuming a temporary construction phase landfall section workforce of 330 workers at peak) would equate to a temporary increase in the permanent population of the Anapa Resort Town municipal district of approximately 0.14%.

As discussed in Section 15.4.3, interviews with ART municipal district Administration (including the Deputy Chief for Health) in early 2013 and early 2014 confirmed that there is no perceived shortage of facilities or health professionals; during the peak season the authorities bring in extra medical staff and transport (ambulances); and free medical services are provided to Russian citizens whether or not they are based in the ART municipal district (Ref. 15.13).

On this basis, coupled with data on health infrastructure (Section 15.5.3.4 and Tables 15.5 and 15.6), no existing shortages of local health facility provision were identified and therefore it was concluded that the number of non-local workers likely to lodge within Local Communities is not expected to be high enough to have any significant impact on the demand for local health facilities.

Nevertheless, there is a need for further investigation, prior to construction activities commencing, of health conditions and facilities as part of the assessment of workforce accommodation options. This will ensure that the health needs of the workforce (onshore and offshore) are met in a way that does not adversely affect health services for the town of Anapa and the Local Communities.

No specific mitigation measures to manage potential periods of high demand on local health and emergency service resources have been identified as being included from other ESIA chapters or assessments. However, other existing related mitigation measures in the ESIA Report include:

- The site-specific Emergency Response Plans that will be prepared and maintained by each construction contractor will include measures that aim to protect the workforce and members of the public. These plans will define measures that aim to initially stabilize medical cases (which would be carried out by an on-site first aider, nurse or physician) and then enable evacuation carried out by ambulance or helicopter. The injured party would be evacuated to the nearest designated hospital or accident and emergency centre;

- Each contractor will ensure that sufficient first-aid or medical staff and equipment are located at the construction site to meet the identified occupational health risks; and
- The location and capability of local ambulance stations (public and private) will be identified (and mapped) together with contact details, times of operation, distance and travel times. A qualified occupational physician will inspect and report on the capacity and capability of these services. A designated hospital or accident and emergency centre will also be identified (including contact details, times of operation, distance and expected travel times).

The sensitivity of the local population, including consideration of particular vulnerabilities, is considered to be high as it concerns people seeking medical care. The magnitude of change caused by the Project that has the potential to affect health outcomes is considered to be low. This is because the resource demands of the construction workforce are expected to be small in the context of the local population, particularly when seasonal tourism is considered. Applying the scoring of the Significance Matrix and professional judgement, the significance of health impacts arising from this issue, without including any additional mitigation or monitoring requirements, is **Low/Moderate**.

15.8.1.3 Mitigation and Enhancement

The mitigation measures recommended in relation to each of the significant adverse impacts are set out below. Enhancement measures, which have the potential to enhance beneficial outcomes of the Project, are also outlined.

A Community Health Construction Management Plan will form part of the Environmental and Social Management Plans for the Project. The CHCMP will establish the proposed actions needed to mitigate identified impacts and promote health opportunities in the Project. The CHCMP will assign actions, timeframes, resources, responsibilities and collaborating organizations to the mitigation and enhancement measures identified in this assessment. It will include a monitoring system designed to track implementation progress and selected outcomes. The monitoring system will include appropriate key performance indicators and an early-warning system for any problems occurring at the community level. Evaluation and Verification protocols will also be included to determine when successful implementation has been accomplished. The CHCMP will be reviewed by key stakeholders prior to construction activities commencing. It will incorporate key findings from the Rapid Health Appraisal which will provide additional baseline data and set further parameters for mitigation during the Construction Phase.

Social factors

Conduct of the workforce in the community

- All workers contracted or sub-contracted for this Project will be required to comply with a code of conduct to the extent that contractual requirements governing periods of leave and out of work hours allow;
- South Stream Transport will be guided by applicable law, the principles of proportionality and Good International Industry Practice in relation to hiring, rules of conduct, training, equipping, and monitoring of security forces;
- Residents and visitors to the town of Anapa and the Local Communities will be able to contact the Project at any time and utilize the Grievance Procedure if there are any concerns regarding security arrangements and acts of security personnel;
- As part of the HSSE-IMS, a Security Plan will be developed for each phase of the Project per Good International Industry Practice; and
- If government security personnel are deployed for Project security, South Stream Transport will make every effort to ensure the above training, due diligence, and monitoring are also employed.

Spread of sexually transmitted infections (STIs) due to in-migration of non-local workers

- All workers contracted or sub-contracted for this Project will be required to attend an awareness and educational programme that covers the risks associated with sexually transmitted infections (STIs);
- Specific sexual health testing and clinic facilities will be identified for the Project;
- Condoms will be made available to the workforce; and
- South Stream Transport will have a policy statement regarding sexually transmitted infections (STIs) including HIV/AIDS, and this policy will be communicated internally to staff, and externally to Contractors.

Employment opportunities for the local population

- No further enhancement measures are proposed.

Environmental factors

Construction noise impacts from vehicles, plant and vessels

- In the event that 'Lesnaya Polyana' or 'Club Village Chateau' (Ref. 15.36) become occupied during the construction of the landfall facilities, South Stream Transport will further assess noise levels in respect of legal requirements and determine appropriate mitigation measures.

Road transport impacts, particularly heavy goods vehicles

General mitigation for traffic safety impacts on the community

Measures will be implemented by South Stream Transport prior to construction works commencing, to address transportation related impacts, including:

- Preparation and implementation of a Traffic Management component of the Russian Landfall CMP. The CMP will:
    - Be consistent with, and take into consideration, the construction traffic management procedures that are followed by Gazprom Invest as part of the construction of the Russkaya CS;
    - Be aligned with the Logistics Plan and ensure that access to the pipeline landfall and associated above ground installations will be restricted to the agreed access routes and the construction corridor;
    - Ensure that movement of 'outsize' or 'large/long' vehicles, or convoys, will be timed, where practicable, to avoid busy traffic periods and will be restricted to the agreed access routes and the construction corridor; and
    - Include strict enforcement of speed limits for employees driving company vehicles and adherence to driving and health and safety guidelines during both work and non-work hours.
- The implementation of safe driving protocols. These protocols will include the following measures:
    - Drivers will be briefed to maintain vehicular access to all existing properties and relevant safety measures to be applied along the designated construction access route;
    - Training and enforcement to ensure that all South Stream Transport and Contractor drivers adhere to all Russian driving rules;
    - All drivers will be trained in 'well driven' principles and guidance; and
    - Driving performance will be assessed and monitored with additional training provided if necessary.

Mitigation specific to the community of Rassvet

South Stream Transport will liaise with local authorities regarding the installation of a pedestrian crossing in Rassvet at an appropriate location for the community. The crossing will be of a standard and quality similar to that shown in Figure 15.12 (pedestrian crossing to a bus shelter on the M25 just west of the turning into Rassvet).

South Stream Transport will undertake further traffic assessment at the community of Rassvet to determine:

- The state of road safety infrastructure including the existence of: pavements, cycle lanes, traffic calming measures and pedestrian crossings;
- The need for any additional mitigation measures such as the installation of further pedestrian crossings and other appropriate traffic calming measures;

- The physical state of the road infrastructure and determine measures to be taken to restore the state of the road between the highway, through Rassvet, to the turn-off to the Gai Kodzor bypass; and
- As part of the Traffic Management component of the Russian Landfall CMP, all drivers contracted or sub-contracted for this Project will be required to attend an awareness and training programme that covers road safety and emphasises the vulnerability of cyclists and compliance with pedestrian road crossings in and around Rassvet.

Mobilisation of historic seabed pollutants during trenching and tunnelling

- Protocols similar to those that will be used in the event of marine fuel spills will be prepared and followed to deal with any disturbance of petroleum products in the marine sediment that result in a significant oil film at the surface; and
- The use of bentonite mud for microtunnelling (an inert, heavy and sticky substance which pools on seabed and doesn't disperse) will be carefully planned and monitored to avoid deposits migrating into bathing waters.

Institutional factors

Local health and emergency service resources due to in-migration of non-local workers

- Prior to construction activities commencing, agreement will be reached with local health services as part of the Rapid Health Appraisal (see below) to confirm how the healthcare needs of the construction workforce, including non-Russian workers, will be met. Such consultation will include a solution that avoids any adverse impact to local populations due to resource demands of the Project being greatest at the nearest healthcare facilities;
- With local health services and other authorities on how demand for health and other emergency response services will be met in the event of an unplanned event that affects both Local Communities and the construction workforce;
- The location of hospitals, clinics, doctors' surgeries and pharmacies will be identified to ensure that access to and from them is not restricted by Project activities or that alternative access is in place and has been agreed with the local health authorities; and
- The construction contractor will undertake a Rapid Health Appraisal of the potential socio-economic and health impacts related to the preferred option(s) for workforce accommodation during the Construction and Pre-Commissioning Phase of the Project. The purpose of this appraisal is to avoid significant adverse impacts on the town of Anapa and the Local Communities by identifying potential impacts and appropriate mitigation and management measures prior to the start of construction and to confirm appropriate housing and health provision is in place prior to making accommodation arrangements for the onshore workforce. The appraisal may include consultation with applicable local and regional authorities, including health and social service providers and will include an assessment of local health conditions and services. The assessment will also include a review of the accommodation, conduct, sexual health and general health service resource requirements of the estimated offshore workforce, employed to work aboard Project vessels, during periods of shore based transit to and from their vessels.

15.8.1.4 Residual Impacts

This section presents a summary of the potential Construction and Pre-commissioning Phase residual community health and safety impacts arising from the Project following application of the identified mitigation measures.

Social factors

Conduct of workforce in the community

Subject to the full adoption of the mitigation measures set out in this chapter and elsewhere in the ESIA, the residual significance of potential community/population health impacts arising from the conduct of the workforce, including the offshore workforce, if any, in the town of Anapa and the Local Communities during the Construction and Pre-Commissioning Phase is considered to be **Low**.

Spread of sexually transmitted infections (STIs) due to in-migration of non-local workers (STIs)

Subject to the full adoption of the mitigation measures set out in this chapter and elsewhere in the ESIA Report; and assuming the Rapid Health Appraisal determines that the assumptions made for sexually transmitted diseases due to lack of baseline data are accurate, the residual significance of potential community and population health impacts arising from the spread of sexually transmitted infections (STIs) during the Construction and Pre-Commissioning Phase is considered to be **Low**.

Employment opportunities for the local population

Subject to the full adoption of the enhancement measures set out in the ESIA Report; the residual significance of potential community / population health impacts arising from employment opportunities during the Construction and Pre-Commissioning Phase is considered to be **limited and beneficial**.

Environmental factors

Construction noise impacts from vehicles, plant and vessels

Subject to the full adoption of the mitigation measures set out in this chapter and elsewhere in the ESIA Report; the residual significance of potential community and population health impacts arising from construction noise impacts during the Construction and Pre-Commissioning Phase is considered to be **Low**.

Road transport impacts, particularly heavy goods vehicles

Subject to the full adoption of the mitigation measures set out in this chapter and elsewhere in the ESIA Report; the residual significance of potential community and population health impacts arising from road transport impacts during the Construction and Pre-Commissioning Phase is considered to be **Low / Moderate**.

Table 15.13 Summary of Residual Impacts during Construction and Pre-Commissioning

Activity	Impact	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-mitigation Significance	Mitigation Measures	Residual Impact Significance
Social Factors							
Interactions between the workforce and the local population	Anti-social incidents	Town of Anapa and Local communities	Moderate	Moderate	Moderate	Stakeholder Engagement Plan and Grievance Procedure Workers Code of Conduct Appropriate living, working and recreational conditions for the workforce – Rapid Health Appraisal to identify workforce accommodation	Low

Continued…

Activity	Impact	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-mitigation Significance	Mitigation Measures	Residual Impact Significance
Interactions between the workforce and the local population	Spread of sexually transmitted infections (STIs) due to in-migration of non-local workers	Town of Anapa and Local communities	Moderate	High	High	Workers Code of Conduct including awareness and education programme on STIs and provision of condoms Identification of specific centres for sexual health testing Appropriate living, working and recreational conditions for the workforce – South Stream policy statement on sexually transmitted infections (STIs)	Low
Landfall and nearshore construction activities	Employment opportunities for the local population	Town of Anapa and Local Communities	Not identified	Not identified	Beneficial (limited)	Not applicable	Beneficial (limited)

Continued...

Activity	Impact	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-mitigation Significance	Mitigation Measures	Residual Impact Significance
Environmental Factors							
Traffic flows due to movement of materials and personnel	Noise impacts, daytime	Receptor 4 – dwellings near the Varvarovka bypass	Moderate	Low	Moderate	Further assessments should currently unoccupied planned developments become occupied during the Construction Phase.	Low
Use of the compressor spread	Noise impacts, night time	Varvarovka community receptors					

Continued…

Activity	Impact	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-mitigation Significance	Mitigation Measures	Residual Impact Significance
Traffic flows due to movement of materials and personnel	Impacts on road safety due to construction traffic, particularly heavy goods vehicles	Local Communities and vulnerable groups (children, elderly, pedestrians and cyclists) Community of Rassvet	High	High	High	Logistics Plan to manage and coordinate the transport and logistics, including with the Russkaya CS. Temporary bypass roads around Gai Kodzor and Varvarovka Traffic Management component of the Russian Landfall CMP Implementation of safe driving protocols Liaison with local authorities regarding installation of pedestrian crossing in Rassvet Further assessment of traffic to determine necessity for any additional mitigation measures, including further traffic calming Awareness education for drivers on road safety and compliance with pedestrian crossings.	Low / Moderate

Continued...

Activity	Impact	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-mitigation Significance	Mitigation Measures	Residual Impact Significance
Mobilisation of historic seabed pollutants during trenching and tunnelling	Overall historic seabed pollutant impact (phenol, petroleum products)	Receptor 2 – Shingari and Don Resorts Communities of Sukko and Varvarovka Tourist visitors to the Sukko	High	Low	Low / Moderate	UXO survey Storage of dredged spoil Appropriate dredger to minimise sediment re-suspension (within engineering constraints) Careful planning and monitoring of the use of bentonite mud for microtunnelling	Not significant

Continued…

Activity	Impact	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-mitigation Significance	Mitigation Measures	Residual Impact Significance
Institutional Factors							
In-migration of non-local workers during landfall and nearshore construction activities	Impact on local health facilities and emergency response service resources	Town of Anapa and Local Communities	High	Low	Low / Moderate	Emergency Response Plans First-aid or medical staff and equipment at the construction site Mapping and report on the capacity of local ambulance stations capability- Rapid Health Appraisal to identify appropriate housing and health provision Health Plan with actions and monitoring to address potential health impacts.	Not significant

Complete.

Mobilisation of historic ground contaminants during site clearance and trenching

Subject to the full adoption of the mitigation measures set out in this chapter and elsewhere in the ESIA Report; the residual significance of potential community and population health impacts arising from mobilisation of historic ground contaminants during the Construction and Pre-Commissioning Phase is considered to be **Not Significant**.

Institutional factors

Local health and emergency service resources due to in-migration of non-local workers

At this point in time, and based on the information collected to date through engagement with local health authorities, the expected Project workforce for construction in the landfall section of the Project will not have a significant impact on health care infrastructure of Anapa Resort Town and will not place undue pressure on existing health facilities. Subject to the full adoption of the mitigation measures set out in this chapter and elsewhere in the ESIA Report; and any additional information obtained during the Rapid Health Appraisal and through continuous engagement with local health authorities, the residual significance of potential community and population health impacts arising to local health and emergency service resources during the Construction and Pre-Commissioning Phase is considered to be **Not Significant**.

15.8.1.5 Monitoring

South Stream Transport will develop an Environmental and Social Monitoring Plan for the Project which will detail all monitoring requirements applicable to the Project regardless of associated phase, topic or location. **Chapter 22 Environmental and Social Management** discusses the monitoring programme based on the monitoring requirements across the ESIA Report. This section briefly outlines the key issues, receptors and monitoring activities for community health, safety and security during the Construction and Pre-commissioning Phase of the Project.

Social factors

Conduct of workforce in the community

The monitoring programme will record any issues of poor conduct by the Project's workforce (including contractors and sub-contractors) in the town of Anapa and the Local Communities, and will cover offshore workforce interaction, if any, with the local population (residents and visitors). Additional mitigation measures will be adopted and consultation will be undertaken with local law enforcement and health and social service providers, especially as it pertains to potential impacts to CSW, as necessary and indicated by monitoring results.

This will include monitoring the number of grievances raised by local residents via the Grievance Procedure relating to the workforce and its interaction with the community, including the number of anti-social incidents involving workforce recorded by police, monitoring of health statistics (e.g. of STDs and HIV / AIDs) recorded by local health officials, and recording of any incidents where the worker code of conduct has been violated and whether this has triggered local health / emergency response.

Spread of sexually transmitted infections (STIs) due to presence of workers (STIs)

South Stream Transport will work with local public health and commercial sex worker support organisations to monitor any adverse effects attributable to the Project workforce or Project activities. If significant adverse impacts are indicated then additional mitigation measures will be adopted in collaboration with those organisations.

Employment opportunities for the local population

The monitoring programme will record the number of employment opportunities advertised in local media and taken up by members of the Local Communities.

Environmental factors

Construction noise impacts from vehicles, plant and vessels

Noise impacts to human receptors and monitoring thereof are addressed in **Chapter 10 Noise and Vibration**. With regard to the construction activities monitoring has been specified to occur at the start of the following activities:

- Daytime construction traffic during period of maximum movements (Mid Jun – Nov 2014);
- Daytime trenching, pipe fabrication, pipe laying and landfall facilities construction; and
- Night-time microtunnelling works.

Road transport impacts, particularly heavy goods vehicles

The monitoring programme will record the impact of construction transport on road safety and community severance in Rassvet. Monitoring will include vehicle counts and consultation with residents of Rassvet. If the monitoring indicates that road safety or community severance becomes a significant concern for the local community then further mitigation measures will be investigated.

Monitoring of vehicles based on construction site vehicle entry and exit data will be undertaken and results collated on a regular basis. Perception monitoring in regards to traffic and other potential issues recommended as part of regular stakeholder engagement with communities – including with schools, shop owners, local community leaders. Rassvet and Varvarovka engagement will be held regularly or as otherwise agreed with the relevant municipal / rural district administrations; and with the other communities as warranted or if a grievance is filed.

Mobilisation of historic seabed pollutants during trenching and tunnelling

During dredging, backfilling and trenchless tunnelling activities water quality will be monitored to check that national bathing water quality standards are maintained in surrounding coastal areas, particularly at popular beach locations such as Sukko beach and Shingari Holiday Complex. Monitoring will include engagement with the Shingari and Don holiday complexes. If monitoring indicates that bathing water quality is affected by the Project's activities then further mitigation measures may be required.

Institutional factors

Local health and emergency service resources due to increase of non-local workers

Monitoring of potential changes in the demand and capacity for accommodation, local health and emergency services will be primarily undertaken through direct engagement with local officials, and health and emergency response service providers to discuss whether or not the Project has had increased demands on local health and emergency service resources.

The first such engagement will be undertaken through a face-to-face meeting, and regular engagement will be established (e.g. quarterly or semi-annually) to review the use of health and emergency services related to the Project's workforce and activities. Carrying out engagement with local officials and service providers will also enable South Stream Transport to identify any trends or qualitative changes. South Stream Transport will also monitor their own records (such as Human Resource data, the Grievance Mechanism) for any workplace incidents that may require a response from local officials, health and emergency providers. Open lines of communication will also be established between South Stream Transport, the Contractor, and local service providers.

If monitoring indicates that service demand as a result of the Project is causing resource shortages further mitigation measures will be investigated to ensure that Local Communities are not adversely affected.

15.8.2 Impact Assessment: Operational Phase

15.8.2.1 Introduction

This section identifies the potential impacts and risks to community health, safety and security receptors during the Operational Phase of the Project. For those effects where potentially significant pre-mitigation impacts are assessed in Section 15.8.2.2, potential mitigation measures have been identified in Section 15.8.2.3, followed by a residual impact assessment, the results of which are set out in Section 15.8.2.4.

15.8.2.2 Assessment of Potential Impacts (Pre-mitigation)

Social factors

The following potential impacts resulting from Project activities with community, economic, and financial outcomes were identified as potentially giving rise to community or population level health impacts.

Public anxiety over large volumes of gas close to Local Communities

This issue is relevant to the landfall section.

Perceptions of fear arising from risks of controlled or uncontrolled natural gas releases may give rise to public anxiety.

Stakeholder comments cited safety as a concern, including a fear of potential gas explosion or fire (Ref. 15.34) and the possibility of seismic activity (Ref. 15.34).

The existing mitigation measures in the ESIA Report include:

- Consultation with stakeholders, including the residents of the town of Anapa and the Local Communities has been on-going and will continue, including for disclosure of the ESMPs, as outlined in **Chapter 6 Stakeholder Engagement**; and
- South Stream Transport has developed a Stakeholder Engagement Plan which identifies stakeholders and their interests, describes the consultation undertaken and that planned as part of the Project's ESIA process, and establishes a framework for stakeholder engagement activities to be undertaken as the Project progresses beyond the ESIA phase.

Public anxiety can reasonably be expected to decrease as public understanding develops amongst the local population of the design controls and as the design controls are seen to be effective. For example the air quality assessment notes that the vent stack height has been pre-determined based on safety requirements in the workplace in order to manage air quality and protect workers from the unlikely event that the vented gas might ignite. This level of localised dispersion to safe levels for onsite maintenance personnel, should reassure local residents that there is not expected to be a risk to community receptors, which are far more distant. The continuing success of such alleviation will also depend on good communication between the Project and the local population.

The sensitivity of the local population, including consideration of particular vulnerabilities, is considered to be low. Certain vulnerable sub-populations may be concerned about these processes, e.g. people with existing anxiety type disorders. The magnitude of change caused by the Project that has the potential to affect health outcomes is considered to be moderate. An unknown number of people may experience mental ill health, such as increased anxiety and stress, for more than one month as a result of the proposed works. Applying the scoring of the Significance Matrix the significance of health impacts arising from this activity, without including any additional mitigation or monitoring requirements, is considered to be **Low.**

Benefits to the Russian economy from increased gas sales

This issue is relevant to the landfall, nearshore and offshore sections.

The Project will increase demand for Russian goods and services (gas) and increase government revenues, taxes and royalties. On this basis the socio-economic assessment concludes that there will be a beneficial economic impact nationally from gas sales associated with the Project.

The total current gas pipeline capacity between Russia and Europe is approximately 200 bcm/year, which will increase to 318 bcm/year if the South Stream Pipeline System and other new projects are completed. This could in turn lead to an increase in Russian gas production and sales. In this case, the Project would give rise to increased tax revenues for the Russian government of several billion euros annually. On this basis the socio-economic assessment concludes that there will be a beneficial economic impact nationally from gas sales associated with the Project.

There is the potential for the additional government income generated though gas sales (made possible by this development) to be spent on directly or indirectly improving the health and wellbeing of the Russian people.

The baseline notes that a comparison of socio-economic indicators of well-off and disadvantaged mortality in Krasnodar Krai in 2010 revealed that there is a very high dependency between the levels of investment in the area and the wellbeing of the population. Coverage by physicians, salary, and healthcare expenditures also pay a key role in population wellbeing.

Positive impacts are not scored using the significance matrix; however the following points are noted. The sensitivity of the local population, including consideration of particular vulnerabilities, is considered to be moderate. This reflects the fact that benefits will be diluted across the Russian people. The magnitude of change caused by the Project that has the potential to affect health outcomes is considered to be Beneficial and Limited.

Environmental factors

No potential impacts resulting from Project activities that affect the physical environment were identified as potentially giving rise to community or population level health impacts.

Institutional factors

No potential impacts resulting from project activities that affect institutional factors were identified as potentially giving rise to community or population level health impacts. See the Unplanned Events section (Section 15.10) for issues relating to institutional involvement in the unlikely event of uncontrolled release of gas from the pipeline.

15.8.2.3 Mitigation and Enhancement

The mitigation measures recommended in relation to each of the significant adverse impacts is set out below. Enhancement measures, which have the potential to enhance beneficial outcomes of the Project, are also addressed.

Social factors

Public anxiety over large volumes of gas close to Local Communities

Stakeholder engagement will be continued throughout the life of the Project to ensure that appropriate Project information on operations and safety is communicated.

Benefits to the Russian economy from increased gas sales

This issue is outside the Project's control.

15.8.2.4 Residual Impacts

The below section presents a summary of the potential Construction and Pre-commissioning phase residual community health and wellbeing impacts arising from the Project following application of the identified mitigation measures.

Social factors

Public anxiety over large volumes of gas close to Local Communities

Subject to the full adoption of the mitigation measures set out in this chapter and elsewhere in the ESIA Report; the residual significance of potential community and population health impacts arising from Public anxiety during the Operational Phase are considered to be **Not Significant**.

Benefits to the Russian economy from increased gas sales

Subject to the full adoption of the mitigation measures set out in this chapter and elsewhere in the ESIA Report; the residual significance of potential community and population health impacts arising from benefits to the Russian economy during the Operational Phase are considered to be **Beneficial and Limited**.

Environmental factors

No potential impacts resulting from Project activities that affect the physical environment were identified as potentially giving rise to community or population level health impacts.

Institutional factors

No potential impacts resulting from Project activities that affect institutional factors were identified as potentially giving rise to community or population level health impacts. See the Unplanned Events section (section 15.10) for issues relating to institutional involvement in the unlikely event of uncontrolled release of gas from the Pipeline.

Table 15.14 Summary of Residual Impacts during Operational Phase

Activity	Impact	Receptor	Sensitivity of Receptor	Magnitude of Impact	Pre-mitigation Significance	Mitigation Measures	Residual Impact Significance
Social Factors							
Operation of the pipeline	Public anxiety over large volumes of gas close to local communities during pipe operation.	Local communities	Low	Moderate	Low	Stakeholder Engagement Plan, including on-going consultation with residents of the town of Anapa and Local Communities	Not Significant
Operation of the pipeline	Increased demand for Russian goods and services (gas) and increased government revenues, taxes and royalties.	Russian Oil and Gas industry; National Government and Russian tax payers	Moderate	Not identified	Beneficial (limited)	Not applicable	Beneficial (limited)
Environmental Factors (No impacts)							
Institutional Factors (No impacts)							

15.8.2.5 Monitoring

South Stream Transport will develop an Environmental and Social Monitoring Programme for the Project which will detail all monitoring requirements applicable to the Project regardless of associated phase, topic or location. **Chapter 22 Environmental and Social Management** discusses the monitoring programme based on the monitoring requirements across the ESIA Report. This section briefly outlines the key issues, receptors and monitoring activities for community health, safety and security during the Operational Phase of the Project.

Social factors

Conduct of workers in the community

The monitoring programme will continue to record any issues of poor conduct by the Project's workforce (including contractors and sub-contractors) in the town of Anapa and Local Communities. If a grievance is filed by a member of the Local Community or Local Law Enforcement Providers a meeting will be held with the local Law Enforcement Providers in relation to workforce conduct.

Public anxiety over large volumes of gas close to Local Communities

The monitoring programme will include on-going consultation with residents of Local Communities and the local health authorities.

Benefits to the Russian economy from increased gas sales

This issue is outside the Project's control.

Environmental factors

No monitoring requirement has been identified.

Institutional factors

No monitoring requirement has been identified.

15.8.3 Impact Assessment: Decommissioning

The Project will be decommissioned many years into the future[5] and impacts during the Decommissioning Phase depend on the alternatives chosen at that time – preservation of the pipelines in place or complete or partial removal. If the latter option is chosen and construction activities (e.g. excavation, removal of pipeline, land rehabilitation) are carried out or construction equipment is used, then impacts are expected to be similar to those assessed in

[5] The Project Life (i.e. the duration of the Operational Phase) is estimated to be approximately 50 years. As such, decommissioning would take place sometime in the mid to late 2060s.

Section 15.8.1 in relation to the Construction Phase – i.e., generation of employment (beneficial impacts), increased demand for goods and services (beneficial impacts), and impacts on land users (potentially adverse, depending on whether or not productive land uses such as agriculture were disturbed). However, such impacts are likely to be at lower levels and short-term. Assuming that the restriction on areas governing the type and scale of development that can take place on land within certain circumference of the Pipeline are removed, there may be beneficial impacts for land owners associated with the liberalisation of development rights.

A careful record and archive of construction and operation activities will be maintained in a suitable format for future users of such information. It will include any special mitigation measures that were applied retrospectively, in addition to those identified prospectively in this impact assessment. It will also record all unexpected events that occurred during the Construction and Pre-Commissioning and Operational Phases of the Project.

15.9 Occupational Health and Safety

Occupational Health and Safety is discussed in Appendix 15.1.

15.10 Unplanned Events

Unplanned events are discussed in **Chapter 19 Unplanned Events**, while community perceptions of unplanned events are discussed under the issue of 'Public Anxiety' in Section 15.8.2.

15.11 Cumulative Impacts

The cumulative impacts associated with the Project, and those relating to the Russkaya CS, relating to Community Health, Safety and Security are assessed in **Chapter 20 Cumulative Impact Assessment**.

15.12 Conclusion

This chapter has assessed the potential effects of the Project on Community Health and Safety and set out the Project approach to Community Health and Safety. This assessment has been conducted following the standards and guidelines for financing, as well as national legislation and GIIP.

The Construction Phase of the Project will bring limited direct employment opportunities to Local Communities at the landfall facilities. Procurement of goods and services will also give rise to limited indirect employment across a wider area. This local employment is relatively small in number and while the effects will also be small they will be beneficial.

The infrastructure and logistics requirements of the Project mean that there are inevitably some adverse effects for certain population groups. Large construction sites and busy transport corridors can be disruptive for Local Communities. These may manifest as negative health outcomes. South Stream Transport recognises this risk and will take appropriate measures to reduce disruption through mitigation measures that will govern the movement of transport, noise from Project vehicles and emissions to air. The Project will also maintain communication with Local Communities to ensure that any grievances are addressed promptly.

The Operational Phase of the Project will bring economic benefits to the Russian Federation, which could translate into greater expenditure on infrastructure and initiatives that directly or indirectly improve health across the nation. The Project will also improve energy supply to gas consumers in the EU.

Overall, although this chapter has identified a number of issues that have the potential to give rise to adverse health impacts, mitigation will be included to reduce the residual impact to an acceptable level for both the community and the workforce.

References

Number	Reference
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Ref. 15.2	Health and Safety Scoping Assessment, BCA, October 2013.
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Chapter 16: Cultural Heritage

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16 Cultural Heritage

16.1 Introduction

This chapter presents an assessment of the predicted impacts associated with cultural heritage during the Construction and Pre-commissioning, Operational (includes Commissioning and Full Operational Phases), and Decommissioning Phases of the Project.

Cultural heritage is defined as artefacts, monuments, buildings and sites that have a diversity of values including symbolic, historic, artistic, aesthetic, ethnological or anthropological, religious, scientific and social significance (Ref. 16.1). Cultural heritage is an important component of the cultural identity of communities, groups and individuals, and of social cohesion (Ref. 16.2). Cultural heritage includes:

- Tangible cultural heritage, including:
  - Movable cultural heritage (paintings, sculptures, coins, manuscripts);
  - Immovable cultural heritage (monuments, archaeological sites, etc.); and
  - Underwater cultural heritage (shipwrecks, submerged occupation remains, underwater ruins and settlements);
- Intangible cultural heritage (oral traditions, performing arts, religion etc.); and
- Natural heritage (natural sites with cultural aspects such as cultural landscapes, physical, biological or geological formations).

Cultural heritage thus includes both tangible forms of cultural heritage with archaeological (prehistoric), paleontological, historical, cultural, artistic, and religious values, unique features or objects that embody cultural values, and intangible forms of culture such as cultural knowledge and practices of communities embodying traditional lifestyles (Ref. 16.3). Cultural heritage also includes archaeology, which is the scientific study of the physical evidence of past human societies recovered through artefact collection and analysis, and excavation. Physical archaeology includes portable antiquities, monuments, historic buildings, historic landscapes, cemeteries and burial areas. Archaeological sites are a finite, irreplaceable and non-renewable cultural resource and form an intrinsic part of the cultural heritage of the people of the Russian Federation (Refs. 16.4 and 16.5). Throughout this chapter, the term cultural heritage is used to refer to all cultural heritage (tangible and intangible), including archaeology.

Cultural heritage is protected under regional and federal legislation, and by international agreements adhered to by the Russian Federation (Refs. 16.1 to 16.27, and 16.28) (Section 16.6.1). Cultural heritage (including archaeology) is regarded as important due to, but not limited to, the following factors:

- *"Archaeological heritage is a fragile and non-renewable cultural resource. Land use is therefore controlled in order to minimise the destruction of the archaeological heritage"* (Ref. 16.28);
- Archaeology and cultural heritage are important to civilization and cultural life, therefore they are protected and potentially damaging activities are subject to regulation (Refs. 16.4 and 16.5); and

- Cultural heritage can be important to national, regional and community identity and economic activities (e.g. tourism, crafts, and agricultural practices) (Ref. 16.29).

This chapter aims to identify any known or potential cultural heritage within the Project Area (terrestrial and marine), and to assess potential Project impacts upon this cultural heritage[1]. In accordance with International Finance Corporation (IFC) and Organisation for Economic Co-operation and Development (OECD) guidance, this ESIA also considers natural, palaeontological and intangible cultural heritage (Ref. 16.3; Ref. 16.30; Ref. 16.31).

The Project has been designed to avoid impacts on cultural heritage where feasible, while balancing cultural heritage considerations with other environmental and engineering requirements. Where significant cultural heritage impacts remain, this chapter also presents suitable mitigation measures which aim to minimise predicted impacts. A Grievance Mechanism and on-going stakeholder engagement will be implemented as part of mitigation and monitoring measures.

The data and interpretations presented in this chapter are linked to other chapters, including **Chapter 6 Stakeholder Engagement**; **Chapter 7 Physical and Geophysical Environment**; **Chapter 8 Soils, Groundwater and Surface Water**; **Chapter 13 Landscape and Visual**; **Chapter 14 Socio-Economics** and **Chapter 17 Ecosystem Services**.

16.2 Scoping

The scope of the cultural heritage impact assessment for the Project was defined through a scoping process which identified cultural heritage receptors and potentially significant impacts related to the Project. Baseline information which informed the scoping process largely drew on information gathered from studies undertaken for the South Stream Offshore Pipeline, including feasibility, engineering and environmental surveys carried out between 2009 and 2013 (see Section 16.4). Key steps in the scoping process for cultural heritage comprised the following:

- The Projects' Front End Engineering and Design (FEED) was reviewed to identify activities with the potential to significantly affect cultural heritage objects or receptors;
- Cultural heritage receptors within the Project Area (see **Chapter 1 Introduction** for definition) were identified through a process of secondary data review and surveys undertaken for the Project (as described in Section 16.4) and professional expertise; and
- A review of relevant national and international legislative requirements and lender requirements to ensure legislative and policy compliance.

[1] This chapter was prepared by qualified and registered cultural heritage professionals. The assessment has been undertaken according to the UK Institute for Archaeologists (IfA) Code of Conduct (Ref. 16.32) and adheres to the high professional standards required of Registered Archaeological Organisations of the IfA. Research, fieldwork and reporting has been undertaken following relevant and locally-applicable elements of the IfA Standard and Guidance for Historic Environment Desk-based Assessment (Ref. 16.33) and IfA Standard and Guidance for Archaeological Field Evaluation (field scanning) (Ref. 16.34).

The Project Area (as described in Section 16.3) contains a range of terrestrial and marine cultural heritage receptors and such features are therefore an important consideration in the ESIA process. Potential impacts upon marine and terrestrial cultural heritage were identified through the Project's stakeholder engagement activities as being of high importance to the Project (**Chapter 6 Stakeholder Engagement**).

Terrestrial cultural heritage receptors include archaeological sites from the Bronze Age, burial mounds (*kurgan*), areas of Antique/Hellenistic, early medieval/Byzantine, medieval and modern occupation, cemeteries, monuments and memorials. The Project Area also has the archaeological potential of other periods, such as early prehistoric tool scatters, hunting and occupation debris and evidence of settlement, farming, land divisions and burials, as well as the potential for historic landscape and woodland features, built heritage (including historic domestic, religious and agricultural buildings, and remains associated with 20th century conflict, including unmarked graves).

In terms of marine cultural heritage, the north-eastern Black Sea region is rich in marine cultural heritage objects or receptors (CHOs) which are fragile and irreplaceable resources and include submerged settlements, shipwrecks and associated nautical material, other anthropogenic structures of historical or archaeological significance, and remains associated with 19th and 20th century conflict. The underlying geological sedimentary deposits of the Project Area have the potential to contain Mesozoic, Miocene and Pliocene marine fossils. Above these fossiliferous deposits is a mantle of Quaternary deposits, soils and coastal marine sediments. There is little potential for the presence of Pliocene hominin and faunal remains, or Pleistocene fossils, due to the absence of refuges such as caves. Marine sediment sequences may provide evidence for past climatic and environmental conditions.

The Project Area does not contain any World Heritage Sites or known tangible or intangible archaeological or cultural heritage features of international significance (nearest World Heritage property is the Western Caucasus natural heritage site (WHS 900), located more than 50 km to the southeast). No intangible cultural heritage (such as specific notable or listed cultural traditions) related to the Project Area, and that could be exploited for commercial purposes, has been identified.

The cultural heritage receptors within the Project Area are identified in this chapter and discussed in terms of their importance and the potential impact that the Project may have on them. Cultural heritage experts met with Project engineers in April 2013 to discuss marine cultural heritage as well as proposed impact avoidance and mitigation strategies.

With reference to the IFC Performance Standards 2012, the Project is not assessed as having any impact on indigenous peoples (Ref. 16.35); further details on the relevance of indigenous people and the Project can be found in **Chapter 14 Socio-Economics**.

16.3 Spatial and Temporal Boundaries

The Project Area is defined in **Chapter 1 Introduction** and traverses three defined sections: landfall, nearshore and offshore:

- The landfall section is located in a rural landscape approximately 10 km south of the town of Anapa. The eastern part of the route is characterised by vineyards and overgrown former vineyards on hillsides; the western coastal corridor comprises dense mature woodland and vegetation. The coastal segment comprises a cliff edge and scree slope where pipelines will be installed inside microtunnels;
- The nearshore section begins at the exit point of the pipeline microtunnels south of Anapa, approximately 400 m from the coast at a depth of approximately 23 m below sea level, and extends outward to the southwest to a depth 30 m below sea level (Ref. 16.36); and
- The offshore section extends from the end of the nearshore section passing through approximately 225 km of Russian EEZ waters, of which 50 km lie within Russian territorial waters. Within the offshore section are three distinct oceanographic regions that are classified by water depth: the continental shelf (35 m to approximately 150 m), the continental slope (150 m to 1,900 m), and the abyssal plain (1,900 m to 2,200 m) (Ref. 16.37).

The terrestrial and marine cultural heritage Study Areas were determined in accordance with Russian Federation legislation of June 25, 2002 No. 73-FZ ('On Cultural Heritage Sites') and Design Documentation State Survey Areas as set out in Agreement No. 240/10 dated 10 January 2010 between Peter Gaz and JSC Giprospetsgaz. This constitutes internationally recognised practice in site survey (Ref. 16.3, para 6; Ref. 16.30, GN12) and was established based on the Project design and consideration of topography and setting (Ref. 16.30, GN3; Ref. 16.38, para 7).

16.3.1 Terrestrial Cultural Heritage Study and Survey Areas

Terrestrial Study and Survey Areas details are presented below:

- **Area of Potential Cultural Sensitivity:** Cultural heritage objects or receptors such as memorials and religious sites have been identified in a wider area, up to 5 km from the centreline of the originally proposed pipeline route, as these may experience traffic and setting[2] impacts during the Construction Phase;
- **General Study Area:** Extends approximately 1 km either side of the originally proposed pipeline route centreline (Ref. 16.39) and was determined in accordance with Russian Federation legislation of 25 June 2002 No. 73-FZ 'On Cultural Heritage Sites';
- **Survey Area:** Archaeological and cultural heritage field surveys have been undertaken on a corridor covering 1 km on either side of the originally proposed pipeline route centreline. This included a walkover survey across the Study Area (Ref. 16.40), followed by systematic fieldwalking (artefact collection) and sample test pit investigation of three sites at Varvarovka (ibid; RU-TCH-03; RU-TCH-04; RU-TCH-05); and

[2] Setting (cultural heritage) is defined in the Terms to Know and Glossary.

- **Zone of Potential Influence:** Defined as terrestrial areas within 2 km of the originally proposed pipeline route centreline, and ancillary terrestrial aspects including access roads, borrow and disposal areas, construction camps, and unplanned developments induced by the Project including areas impacted by increased traffic movement.

These areas are set out in Table 16.1 and are illustrated in Figure 16.1 Figure 16.2 and Figure 16.5.

16.3.2 Marine Cultural Heritage Study and Survey Areas

Marine Study and Survey Areas details are presented below:

- **Area of Potential Cultural Sensitivity:** Cultural heritage objects or receptors such as war graves have been identified up to 2 km from the pipeline route;
- **General Study Area:** This area covered an extensive area including the Black Sea and the surrounding land areas. The General Study Area provided information on the maritime cultures, shipping evolution, shipbuilding trends, and navigation patterns. This information facilitates the interpretation of survey data, which is collected from a narrower Survey Area, centred on the pipeline route;
- **Survey Area:** This area extends over a 2 km wide area centred on the centreline of the originally proposed pipeline route. This area was widened in the proximity of geohazards or other features that were not deemed to be optimal for pipe laying and required a broader corridor to be assessed. The whole survey area, including the sections where it was widened, was subject to geophysical investigations as well as detailed geotechnical and environmental field surveys (Figure 16.7 to Figure 16.9);
- **Zone of Potential Influence:** This zone was defined as the seabed within 150 m either side of the proposed centreline of an individual pipeline. This is based on the avoidance buffer distance chosen by the Project as a design control measure to ensure the avoidance of impacts to cultural heritage objects. The Zone is one of Potential Influence as it is not the case that the entire 150 m wide area could be impacted by Project activities – rather, this area is used to ensure the avoidance of impacts by routing the pipeline away from objects. This avoidance buffer distance was chosen after careful consideration of engineering and design constraints and after a review of commonly-used avoidance buffer intervals for similar marine construction projects. This area is the same for the Construction and Pre-Commissioning Phase, and for the Operational Phase. Specific investigations related to individual sonar anomalies were undertaken in this area; and
- **Anchoring Spread Area**: This area was defined based on the risk of adverse impacts to positively identified and potential CHOs as a result of Project activities involving anchored vessels in the nearshore section of the Project. This was not defined except by depth, and therefore there was no assessment of CHO, nor of impacts or effects.

These areas are described in Table 16.1 and are illustrated in Figure 16.1 and 16.2, where applicable.[3]

Table 16.1 Summary of Spatial Boundaries – Terrestrial and Marine

<table>
<tr><th>Area</th><th>Terrestrial</th><th>Marine</th></tr>
<tr><td rowspan="2">Area of Potential Cultural Sensitivity
(sacred, spiritual and intangible heritage, including war graves)</td><td colspan="2">Documentary research, site visit, consultation</td></tr>
<tr><td>Up to 5 km either side of the centreline of the proposed pipeline route</td><td>Up to 2 km either side of the centreline of the proposed pipeline route</td></tr>
<tr><td rowspan="2">General Study Area
(prehistoric, historic, sacred, spiritual and intangible heritage, including war graves)</td><td colspan="2">Documentary and inventory research</td></tr>
<tr><td>1 km either side of the centreline of the originally proposed pipeline route</td><td>Russian waters of the Black Sea</td></tr>
<tr><td rowspan="2">Survey Area</td><td>Field walkover survey</td><td>Marine surveys for geo-environmental, geotechnical & engineering purposes
Marine surveys for archaeological purposes
Review of survey data for archaeological information</td></tr>
<tr><td>1 km either side of the centreline of the originally proposed pipeline route</td><td>Minimum 2 km wide area centred on the original proposed pipeline route centreline</td></tr>
<tr><td>Zone of Potential Influence</td><td>Zone within 2 km of the pipeline centre-line
Area within 2 km of facilities including access roads, borrow and disposal areas and construction camps</td><td>Zone within 150 m either side of the proposed centreline of an individual pipeline</td></tr>
</table>

Continued...

[3] Some of the field surveys covered a broader area but still encompassed the Survey Area as defined in this Chapter.

Area	Terrestrial	Marine
Anchoring Spread Area (note areas not defined except by depth, and therefore there was no assessment of CHO, nor of impacts or effects)	n/a	Less than 350 to 380 m water depth

Complete.

16.4 Baseline Data

16.4.1 Methodology and Data

Cultural heritage objects or receptors of relevance to the impact assessment have been defined through a combination of secondary data sources and cultural heritage surveys carried out across the Study Areas.

16.4.2 Secondary Data

16.4.2.1 Desk-based Research

Secondary data sources as follows were consulted as part of this cultural heritage assessment:

- Archaeological studies undertaken by Russian archaeological experts of the Support Foundation for Archaeological Monuments Protection, Moscow and JSC Kuban Heritage, Krasnodar in 2011. The desk-based assessment of primary and secondary archaeological data, including the results of previous archaeological surveys, involved searching source databases, and the study of documentary and archive sources including: the Archaeological Institute of the Russian Academy of Sciences (RAS, Moscow); the Krasnodar State Historic-Archaeological Museum named Felitsin (KSHAM, Anapa); the Department on the Protection, Restoration and Exploitation of Historical Cultural Values (Heritage) of Krasnodar Krai (Anapa); and the State List of Monuments and List of Defined Facilities of Historical Cultural Heritage located in the territory of the resort city of Anapa (Ref. 16.39; Ref. 16.40; Ref. 16.41);
- Secondary data gathering included consultation of the UNESCO World Heritage List (Ref. 16.42), Intangible Heritage Lists (Ref. 16.43) and Database of National Cultural Heritage Laws (Ref. 16.44) for both terrestrial and marine cultural heritage. Analysis of the wider historical, cultural and archaeological context involved consultation of information in relevant digital databases of the Ministry of Culture (Ref. 16.45) and the Office for the Protection, Restoration and Maintenance of Historical and Cultural Values (Heritage) of Krasnodar Region (Ref. 16.46); national and regional databases (Ref. 16.47), bathymetric and shipwreck data (Ref. 16.48); and information from relevant archaeological institutions and museums including KSHAM;
- In order to complement the extensive research of Russian-language secondary sources undertaken during desk-based assessment (Ref. 16.39), relevant international academic

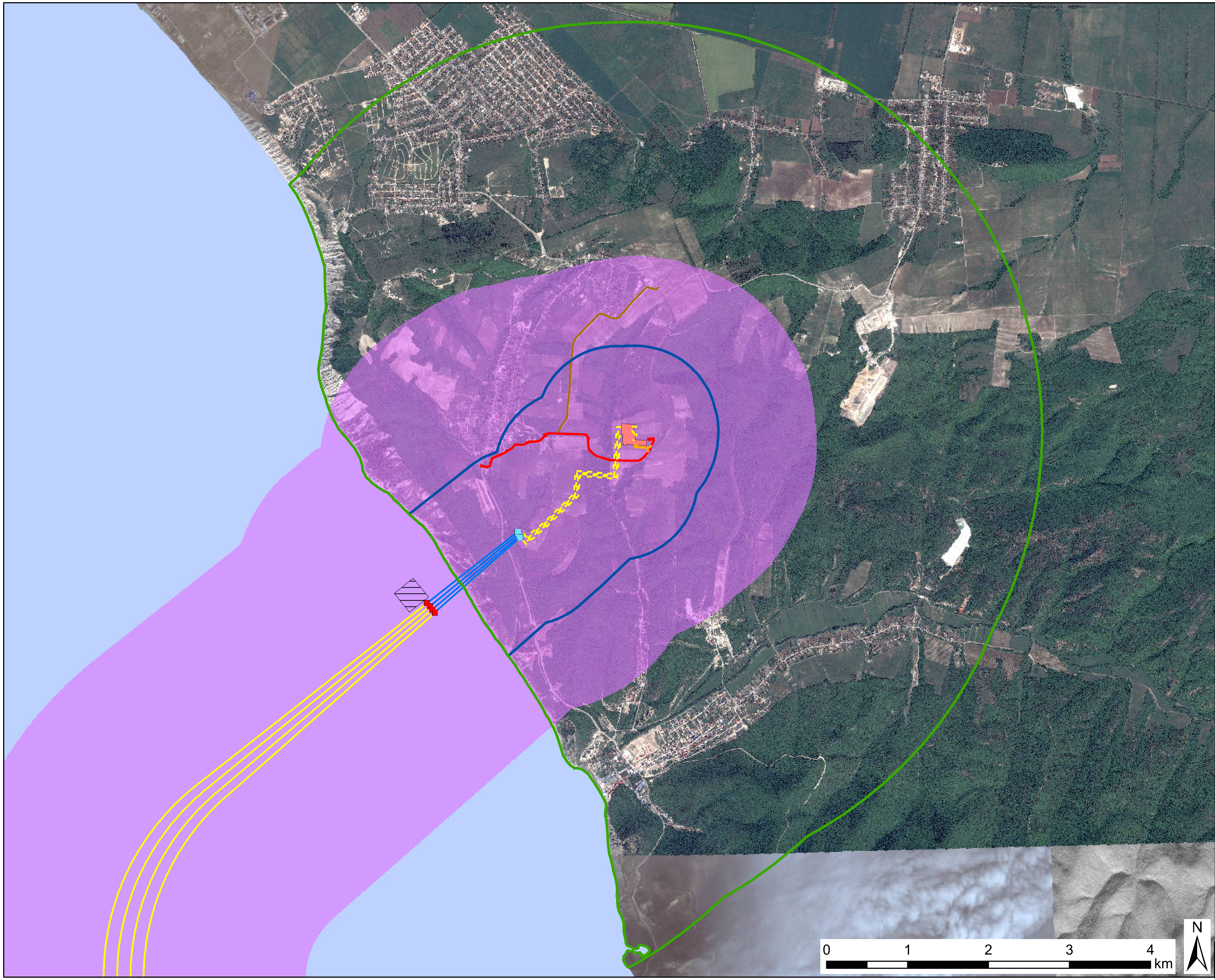
research papers were reviewed in a number of university libraries in Canada, the USA and the UK for both terrestrial and marine archaeology. Journals included *Antiquity, World Archaeology, Europe-Asia Studies, Historic Environment, American Journal of Archaeology, European Journal of Archaeology, Journal of Indo-European Studies, Black Sea Studies, Hellenic Studies, Greek Roman and Byzantine Studies, Journal of Mediterranean Archaeology, Journal of Nationalism and Ethnicity, Paléorient, Journal of World Prehistory, Proceedings of the Prehistoric Society, Préhistoire Européenne, Journal of Field Archaeology, Journal of Archaeological Sciences, Science, Expedition, Archaeological Oceanography, Marine Geology, International Journal of Nautical Archaeology and the Journal of Maritime Archaeology* (Refs. 16.49 to 16.57);

- Consultation of databases on the national and regional framework of Russian archaeology and cultural heritage, including the Council of Europe Compendium of Cultural Policies and Trends in Europe (Ref. 16.58) and the European Heritage Network National Heritage Policies Database (Ref. 16.59);
- Analysis of the wider historical, cultural, archaeological and administrative context involved considering national and regional cultural policies and registers (Ref. 16.45; Ref. 16.46; Ref. 16.47), information on regional art and cultural policy (Ref. 16.60), regional material culture and crafts (Ref. 16.61; Ref. 16.62), and cultural festivals (Ref. 16.63; Ref. 16.64; Ref. 16.65);
- The history and location of land, naval and aerial combat sites in the vicinity of the pipeline corridor were assessed based on key local sources, memorials and international databases, including – Kriegsmarine Service Records (WASt), Lloyd's Register of Ships/Casualty Returns and Lloyd's List (Ref. 16.66);
- This study considered the academic context of past and on-going Black Sea archaeological research projects, including wider Black Sea research projects including the Black Sea Trade Project (Ref. 16.67), various projects of the Danish National Research Foundation Centre for Black Sea Studies (Ref. 16.68) and the French Research Institute in Oceanography's ASSEMBLAGE Project (Ref. 16.69); and
- National mapping was consulted to inform terrestrial field visits and understanding of the wider geographical and topographical context. Satellite imagery (Worldview-2/Ikonos Natural & False Colour Imagery, Oct/July 2011) was assessed for evidence of archaeological features and used in planning site visits. However, substantial portions of the route are under woodland cover or vineyard cultivation, which masks archaeological features from identification through satellite imagery.

16.4.2.2 Reporting Methodology

Arbitrary site identification numbers are used for terrestrial cultural heritage, e.g. RU-TCH-01 (Russia, Terrestrial Cultural Heritage, site no. 1). The referencing of marine cultural heritage follows an arbitrary numbering system for cultural heritage objects and also uses sequences of target naming systems established during earlier survey stages. Distances reported in the text in this chapter are measured from the nearest edge of a cultural heritage object to the nearest edge of a Project component or pipeline centreline (terrestrial) or from the nearest edge of a cultural heritage object to the nearest pipeline centreline (marine).

Plot Date: 16 Apr 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 16 Cultural Heritage\Figure 16.1 Terrestrial Cultural Heritage Study Area.mxd



LEGEND

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Landfall facilities
- Proposed microtunnels
- Proposed offshore pipelines
- Microtunnel entry shaft
- Microtunnel exit pit
- Permanent access road to be constructed by SSTTBV
- Varvarovka bypass road (used by Project during construction only)
- Potential storage area for dredged material
- General study area and survey area
- Area of potential cultural sensitivity
- Zone of potential influence

United Gas Supply System

- Permanent access road to be constructed by Gazprom Invest

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue

For Information

Client

South Stream
Offshore Pipeline
ENERGISING EUROPE

Project Title

SOUTH STREAM
OFFSHORE PIPELINE

Drawing Title

TERRESTRIAL CULTURAL
HERITAGE
STUDY AREAS

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Figure 16.1

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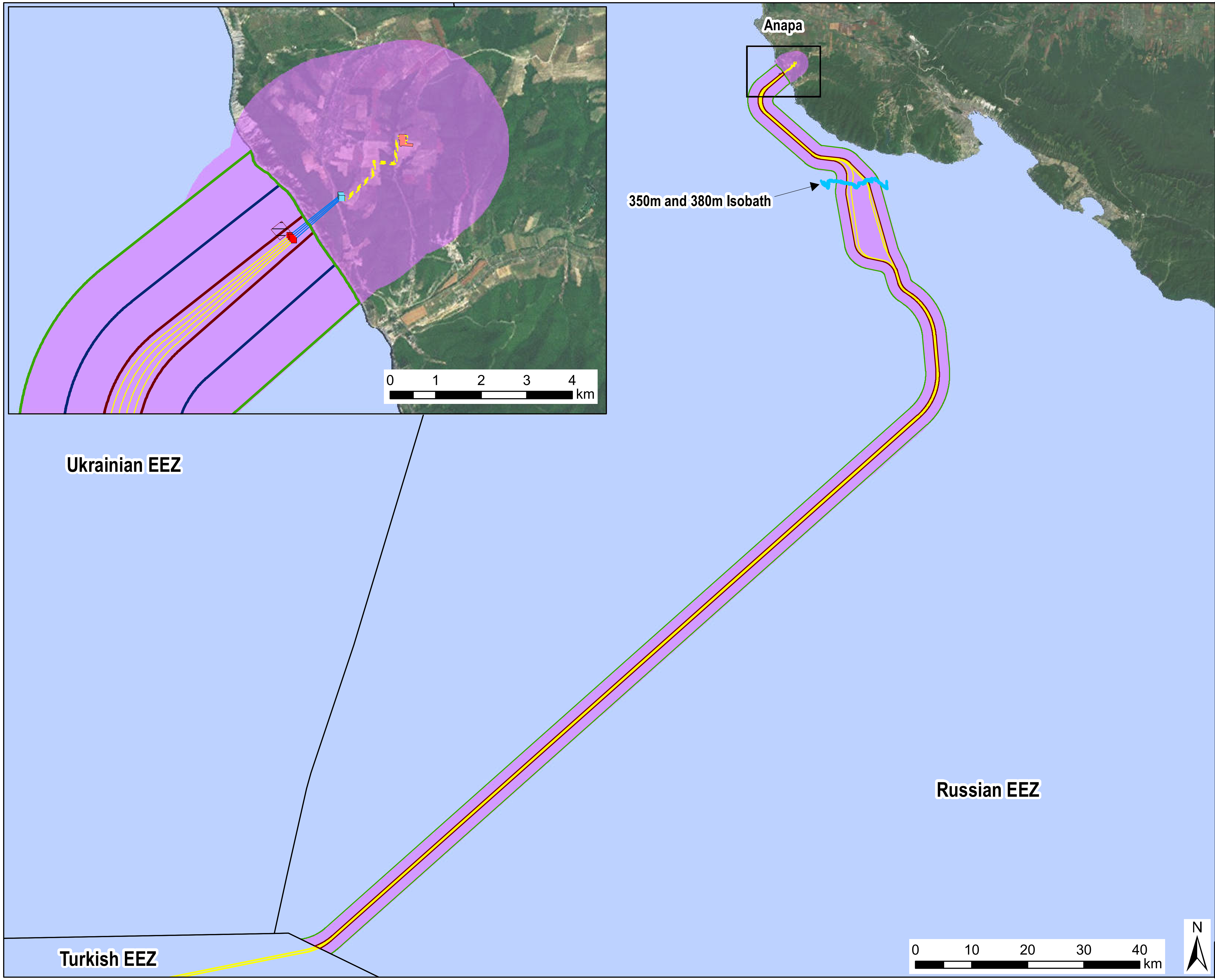

LEGEND

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Landfall facilities
- Proposed microtunnels
- Proposed offshore pipelines
- Microtunnel entry shaft
- Microtunnel exit pit
- Area of influence
- Potential storage area for dredged material
- Area of potential cultural sensitivity
- Zone of potential influence
- Exclusive economic zones boundaries
- Limit of anchoring spread area

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Project Title

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File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 16 Cultural Heritage\Figure 16.2 Marine Cultural Heritage Study Area.mxd

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16.4.2.3 Stakeholder Engagement

Meetings have been held with stakeholders including the Ministry of the Environment, regional, local and rural district administrations, government authorities, community service and infrastructure organisations, landowners, land users, residents of local communities (Gai Kodzor, Sukko, Supsekh, Varvarovka, Rassvet) and tourists, businesses and business associations, marine area users, inter-governmental organisations including the Black Sea Commission, a number of NGOs including international, national, local and community-based organisations (such as Ekurs, KD Group Political Consulting), academic and research organisations (Institute of Archaeology, Russian Academy of Sciences in Moscow).

These are further detailed in **Chapter 6 Stakeholder Engagement**. For cultural heritage, consultation was undertaken with the Department for Conservation, Restoration and Use of Historical and Cultural Treasures (Heritage) of the Krasnodar Region, the Institute of Archaeology of the Russian Academy of Sciences (IA-RAS) and the Krasnodar State Historic-Archaeological Museum named Felitsin (KSHAM).

The State Archaeological Expert Evaluation noted that the Commission of Experts considered it reasonable and possible to carry out works on the preservation of cultural heritage sites (terrestrial and marine) located in the area of the planned construction (positive conclusion) and recommended the research and design documentation for approval by the state agency for cultural heritage protection (Ref. 16.70; Appendix 16.8). The Project development has been approved by the Department for State Protection of the Cultural Heritage of Krasnodar Krai subject to the implementation of mitigation measures (Appendices 16.9 and 16.10).

Details of stakeholder engagement are set out below.

Terrestrial Cultural Heritage Stakeholder Engagement

Specific cultural heritage stakeholder engagement activities undertaken during the preparation of this assessment include the following:

- The Department for Conservation, Restoration and Use of Historical and Cultural Treasures (Heritage) of the Krasnodar Region was consulted by letter regarding terrestrial and marine cultural heritage in the Study Area (13.02.2011; Ref. 16.71; Appendix 16.3). Their initial response provided information on cultural heritage and zones of protection within the Study Area. It noted that test pit investigations should be carried out as part of a comprehensive baseline investigation of the terrestrial alignment. Depending on the results of investigations, in accordance with Article 36.3 of Federal Law No. 73-FZ (2002), it will be necessary to develop a Cultural Heritage CMP, monument protection measures, fieldwork plan and a mitigation works costing updating that in Proekt documentation (Ref. 16.72; Appendix 16.4);
- Archaeological test pit investigations undertaken in 2011 revealed unstratified archaeological material (ceramics, bone and building materials) at sites Varvarovka 1, Varvarovka 2 and Varvarovka 3. The Krasnodar Krai Heritage Department ('the Department') considered that these sites were not liable to mandatory preservation due to the absence of archaeological stratification and features, and were not eligible for inclusion

on the Unified State Register of the Objects of Cultural Heritage (Monuments of History and Culture) of the Peoples of the Russian Federation. The Department noted that due to the presence of cultural material in the topsoil, and the potential for buried archaeological deposits beneath the soil horizon disturbed by ploughing, Construction Phase groundworks should be subject to an archaeological watching brief in accordance with the current Handbook of Instructions of the Ministry of Culture (Ref. 16.73);

- Krasnodar Krai Heritage Department was consulted with regard to mitigation requirements at the kurgan site (RU-TCH-02) National Monument No 363 (Appendices 16.3 & 16.4). The Department has approved the Project development subject to the implementation of mitigation measures, including the archaeological supervision (watching brief) of excavation and construction work and informing monument protection authorities prior to the start of groundworks (Appendix 16.9);
- The Krasnodar State Historic-Archaeological Museum named Felitsin (KSHAM, Anapa) was consulted by letter regarding terrestrial and marine cultural heritage in the Study Area (13.02.2011; Ref. 16.74; Appendix 16.5);
- The Krasnodar Krai Heritage Department was consulted regarding archaeological surveys for the Varvarovka bypass road area resulting in a terrestrial walkover survey in June 2014 (see Table 16.2). Upon completion of the survey, the Department noted that due to the partial location of the site within the archaeological protection zone of the Varvorovka settlement (medieval, 6th to 13th centuries AD), excavation and construction work should be subject to archaeological supervision (watching brief) in accordance with the current Handbook of Instructions of the Ministry of Culture (Ref. 16.73) and informing monument protection authorities prior to the start of groundworks (Appendix 16.11); and
- During the community public hearing held at the Arin Berd Armenian cultural centre on 12 December 2012, a priest in Gai Kodzor was concerned that noise and vibration from the Russkaya Compressor Station (CS) would have an impact on his church and services. See Appendix 20.1 (Environmental Impacts of Associated Facilities: Russkaya CS) for further information. Further details regarding stakeholder consultation are contained in **Chapter 6 Stakeholder Engagement**.

Marine Cultural Heritage Stakeholder Engagement

Potential impacts upon marine cultural heritage were identified through the Project's stakeholder engagement activities as being of high importance to the Project (**Chapter 6 Stakeholder Engagement**) and meetings were undertaken with the Institute of Archaeology of the Russian Academy of Sciences (IA-RAS) and the Krasnodar State Historic-Archaeological Museum named Felitsin (KSHAM) to determine the scale and scope of the impact assessment, its parameters and the surveys undertaken. The Project held meetings with both organisations inJuly 2013 to:

- Provide information on the proposed mitigation strategy for marine cultural heritage (i.e. avoidance by a buffer of 150 m);
- Request comments and feedback on the proposed strategy, including any alternative suggestions; and

- For cultural heritage objects that fall within the 150 m buffer and the pipeline route cannot be optimized, discuss proposed mitigation plans (i.e. relocation and/or recovery).

Both IA-MAS and KSHAM agreed with 150 m as being an acceptable distance for avoidance. It was agreed that:

- The two aircraft wings (RU-MCH-001 [B5_S0006] & RU-MCH-002 [RS_651]) receive additional visual survey via remotely operated vehicle (ROV) to identify the type of aircraft and search for any additional remains, as these sites could represent military vessels and possibly war graves. The results of these surveys should then be checked against military records to potentially identify the aircraft and determine its crew and, if warranted, consult with the Russian Association of War Memorials (Ассоциация "Военные Мемориалы"). Recovery of wing RU-MCH-001[4] was not recommended due to logistical complications (e.g. who will raise the object and where will it be housed), but it could be relocated away from the pipeline construction corridor if it is considered to be at risk from pipe-lay operations;
- The amphora (RU-MCH-003) would be recovered under the supervision of a licensed Russian archaeologist, using a ROV; and
- The wooden shipwreck (RU-MCH-004), would be extremely difficult and costly to recover and conserve and it is best left in place; it was noted that sufficient precautions must be taken to avoid any possibility of anchor damage.

Krasnodar Krai Heritage Department has approved the Project development subject to the implementation of mitigation measures, including the recovery of the amphora (RU-MCH-003) (Appendix 16.10).

16.4.3 Data Gaps

Based upon the review of the data presented in Section 16.4.2 a gap analysis was undertaken between March and May 2012 in order to identify cultural heritage surveys needed to adequately define baseline conditions. The gap analysis noted that:

- The available reporting did not consider results of, or interfaces with, other environmental topics, e.g. soils, geotechnical studies, coastal erosion, bathymetric and geophysical data in an integrated manner;
- Existing data concentrated on known sites, rather than archaeological potential;
- Terrestrial data contained limited and unconfirmed information on current land use, and the reliability of data on the location, date, significance and character of archaeological and cultural heritage sites needed to be verified on the ground;

[4] Wing RU-MCH-002 lies in deep water on the continental slope at a depth of approximately 1578 m, is located over 162 m from the nearest pipeline.

- No terrestrial geophysical survey or intrusive archaeological investigation beyond test pit investigation had been carried out, due to the lack of a defined route and terrain constraints (woodland and active vineyards);
- The available reporting did not consider social topics, such as culture and tourism;
- The available reporting made no reference to intangible, natural or palaeontological heritage;
- Limited information on marine non-intrusive geophysical survey or ROV investigation was available at the time of the data gap analysis;
- A survey of the Anchor Corridor had not been undertaken as the area covered by this could not be calculated prior to the selection of the construction contractor and confirmation from the contractor of the area to be used by anchors for the pipe-laying vessel; and
- The reliability of marine survey data was not known. The gap analysis indicated that following the review of the geophysical methods applied and all available reports, further marine archaeological surveys may be required.

Actions arising from the gap analysis included obtaining and translating the full suite of reports prepared in 2011 (Refs. 16.39 to 16.41; Refs. 16.75 to 16.83) and 2012 (Ref. 16.84) for onshore and offshore cultural heritage, including correspondence, raw marine survey data, relevant marine survey methods and subsea imagery (Refs. 16.39 to 16.41; Refs. 16.75 to 16.83; Ref. 16.84); obtaining topographic mapping and information on military or restricted sites at appropriately detailed scales; contacting relevant authorities to establish their requirements; undertaking local consultation; and undertaking a site visit to establish archaeological potential and inform the scope of further survey, design and mitigation works.

After the gap analysis had been completed, further marine surveys using ROV were carried out between June and October of 2012 (see Table 16.3) and a terrestrial walk-over survey was carried out in August 2012. Following these further surveys, the implementation of the gap analysis actions, and the application of the Project design controls and mitigation measures (see Section 16.7), it was confirmed that no further terrestrial archaeological surveys were required. A further marine survey of the Anchor Corridor Area in the nearshore section of the Project would be required but would be undertaken prior to construction by the Project contractor once vessel type and anchor corridor area were known (see Sections 16.4.5 and 16.7).

16.4.4 Primary Data/Baseline Surveys

Surveys undertaken for the Project are detailed in Table 16.2 (terrestrial) and Table 16.3 and Table 16.4 (marine). The results of field surveys are summarised in Table 16.6 (terrestrial and marine) and Table 16.7 (marine). The location of archaeology and cultural heritage sites are marked on the constraints maps, Figure 16.5 (terrestrial) and Figure 16.7, Figure 16.8 and Figure 16.9 (marine). Inventories of cultural heritage sites are contained in Appendices 16.1 and 16.2 (Ref. 16.39; Ref. 16.40; Ref. 16.41).

Georeferencing is sensitive information which is omitted in order to protect sites from illegal looting. In order to protect terrestrial sites from looting, and shipwreck sites from unauthorised diving, the Project has adopted a policy of site confidentiality. This means that the general locations of sites are mapped, but their exact locations (i.e. coordinates) are not publicly disclosed in this ESIA Report.

16.4.4.1 Terrestrial Surveys

A systematic visual walkover survey of the terrestrial portion of the construction corridor was undertaken up to approximately 1 km either side of the originally proposed pipeline centreline, with a linear separation of 20 to 30 m between archaeologists, noting areas of high topographic potential and observing areas of existing ground disturbance. Field survey was inevitably constrained in areas of dense woodland and steep hillsides. Systematic fieldwalking and artefact collection was undertaken in three vineyards southeast of Varvarovka where the walkover survey had identified artefact scatters (RU-TCH-03; RU-TCH-04; RU-TCH-05). Based on the results of the fieldwalking survey, nine test pits (2 m x 2 m) were excavated in areas of high potential in order to assess the character and integrity of deposits. This work was undertaken according to Russian Federation Permit N1149 for archaeological excavations and surveys (dated 10.11.2010) and Krasnodar region license N56 (dated 16.11.2010) (Ref. 16.40; Ref. 16.41).

A non-intrusive terrestrial walkover survey was undertaken in August 2012. This involved walking the proposed route of the construction corridor and assessing the potential for previously unrecorded archaeological sites or monuments on or adjacent to the Survey Area; visiting designated national monuments to assess their condition and vulnerability; and visiting cultural heritage sites located in within the terrestrial Area of Potential Cultural Sensitivity, noting churches, cemeteries and war memorials. An additional non-intrusive terrestrial walkover survey supplemented by the excavation of test pits was undertaken in June 2014 to fully cover the area of the Varvarovka bypass road.

Terrestrial cultural heritage field studies undertaken are detailed in Table 16.2.

Table 16.2 Terrestrial Cultural Heritage Studies

Name of Survey	Month, Year	Contractor	Limits of Study	Type of Study
Archaeological desk-based study	September – December 2011	Support Foundation for Archaeological Monuments Protection & JSC Kuban Heritage	Approximately 2.5 km either side of the originally proposed onshore pipeline route centreline.	Desk-based assessment of archives and cultural heritage databases (fund materials)
Terrestrial field survey	October – November 2011	Support Foundation for Archaeological Monuments Protection & JSC Kuban Heritage	Approximately 1 km either side of the originally proposed onshore pipeline route centreline.	Terrestrial archaeological field survey (visual walkover survey, systematic fieldwalking and test pit excavation)

Continued…

Name of Survey	Month, Year	Contractor	Limits of Study	Type of Study
Terrestrial archaeological site walkover survey (non-intrusive).	August 2012	On-Site Archaeology, UK	Approximately 1 km either side of the originally proposed onshore pipeline route centreline. Communities within the terrestrial Area of Potential Cultural Sensitivity.	Verification of survey data. Visual survey for the presence of visible archaeological features. Assessment of current condition of known archaeological sites and designated monuments. Identification of tangible, intangible and critical cultural heritage in accordance with IFC PS8 requirements.
Terrestrial archaeological site walkover survey (non-intrusive) supplemented by the excavation of test pits.	June 2014	JSC Kuban Heritage	Plotted route of the northern section of the Varvarovka bypass road	Investigation for the presence of visible archaeological features. Assessment of current condition of known archaeological sites and designated monuments.

Complete.

16.4.4.2 Marine Surveys and Analysis

Three steps were employed in the identification of marine cultural heritage:

- The geophysical and environmental marine surveys conducted to collect primary data;
- The geophysical and environmental marine survey data interpretation; and
- Geographic Information System (GIS) analysis integration.

The marine surveys were carried out by third-party contractors, while data post-processing and analysis were completed by both the third-party survey contractors and contracted cultural heritage professionals. A description of marine survey methods is set out in Appendix 16.7 (Marine Geophysical, Environmental and Archaeological Survey Methods).

Information on marine CHOs draws on data gathered from previous studies carried out for the Project, including extensive feasibility and engineering surveys performed since 2008. Those studies, which primarily focused on gathering information for geoenvironmental, geotechnical, environmental and engineering purposes, are detailed in Table 16.3. The surveys utilised the following equipment to image and investigate the seafloor: side-scan sonar; multibeam echo sounder; sub-bottom profiler; and magnetometer (limited use in shallow waters only). During investigations, objects that exhibited anthropogenic features were located and briefly analysed to determine if further investigations were required.

In addition, marine cultural heritage surveys in 2012 contributed information to this cultural heritage assessment. Fieldwork included a visual inspection of potential CHO targets in the nearshore and offshore sections using a Remotely Operated Vehicle (ROV) equipped with an underwater video camera. These surveys are also noted in Table 16.3.

Table 16.3 Marine Surveys

Name of Survey	Month, Year	Surveyor	Location of Study	Type of Survey
Offshore Seismic Survey	December 2010	Peter Gaz	Russian Territorial and EEZ Waters	2D high resolution
Nearshore Geophysical Surveys	April 2011	Peter Gaz	Russian Territorial Waters	Multi-beam echosounder, sub-bottom profiler, side-scan sonar
Offshore Geophysical Survey	April – May 2011	Peter Gaz	Russian Territorial and EEZ Waters	Multi-beam echosounder, sub-bottom profiler, side-scan sonar, magnetometer
Offshore Geophysical Survey	May – July 2011	Peter Gaz	Russian Territorial and EEZ Waters	Multi-beam echosounder, sub-bottom profiler
Nearshore Geophysical Surveys	August 2011	Peter Gaz	Russian Territorial Waters (near Anapa, Krasnodar Krai)	Geomorphology surveys
Offshore Geophysical Survey	October 2011	Peter Gaz	Russian Territorial and EEZ Waters	Multi-beam echosounder, sub-bottom profiler, side-scan sonar
Offshore cultural heritage surveys	June 2012	Peter Gaz	Russian Territorial and EEZ Waters	ROV (e.g. visual) analysis of cultural heritage)
Offshore cultural heritage surveys	June 2012	Peter Gaz	Russian Territorial and EEZ Waters	ROV (e.g. visual) analysis of cultural heritage)

Continued...

Name of Survey	Month, Year	Surveyor	Location of Study	Type of Survey
Offshore cultural heritage surveys	September – October 2012	Peter Gaz (MV "Akademik Golitsyn")	Russian Territorial and EEZ Waters	ROV (e.g. visual) analysis of cultural heritage)

Complete.

Desk-based analysis of marine geophysical survey data (ROV and video data) was undertaken by the Support Foundation for Archaeological Monuments Protection and JSC Kuban Heritage in 2011. Further cultural heritage analysis was carried out in 2012 and 2013 to verify the survey data acquired for other purposes, analyse new survey data, and to assess the baseline conditions for marine archaeology CHOs within the Survey Area[5]. Table 16.4 provides details of the analysis carried out and methods used to achieve the required objectives.

Table 16.4 Marine Cultural Heritage Data Analysis

Survey method	Survey extent	Objective	Surveyor	Date
Desk-based analysis of marine geophysical data	Approximately 2 km centred on the original proposed pipeline route centreline	Desk-based analysis of marine geophysical survey data	Support Foundation for Archaeological Monuments Protection & JSC Kuban Heritage	Sep – Dec 2011
Desk-based analysis of marine geophysical survey data (ROV & video data)	Approximately 2 km centred on the original proposed pipeline route centreline	Verification of survey data Visual identification, interpretation and assessment of visible archaeological features Assessment of character and current condition of marine archaeology	URS	2012 and 2013

16.4.5 Data Assumptions and Limitations

Potential cultural heritage occurring outside the defined Study and Survey Areas detailed herein has not been considered within this impact assessment.

[5] The analysis of CHO was based on pipeline route definition #300512 (dated 30 May 2012).

Cultural heritage data only represents known sites. Additional, presently unknown buried terrestrial or marine archaeological sites may exist that have not been identified through the ESIA investigations.

During the terrestrial surveys, areas of exposed topsoil, subsoil and natural geology were examined for the presence of artefacts or traces of human occupation. These areas include the edges of vineyards, roadside ditches, the sides of dry gullies, eroding cliff faces, upcast spoil from animal burrows and storm-pulled tree root boles. Fields may have subsequently been ploughed, ditches and gullies may have been subject to natural scouring or deliberate clearing, further erosion may have occurred and further trees may have been uprooted. To obtain a fuller coverage, it would be necessary to monitor the Study Area over a number of years.

The woodland in the Study Area is extensive and heavily overgrown in places, which may obscure archaeological sites. Many of the sites that might exist here may only be discovered by chance (hence mitigation measures include archaeological watching brief and chance finds procedure, see Section 16.7).

No detailed analysis of primary medieval and post-medieval historical sources related to the Study Area has been undertaken although place-name evidence has been reviewed.

No research has been undertaken into oral sources, as it was considered that this would be unlikely to reveal any substantial amount of relevant data relating to the Study Area, which contains no settlements within it and has relatively recent vineyard cultivation. The route corridor population is seasonal and transient, mainly using the area for leisure or fishing.

Since the Scoping Report was issued, the community of Rassvet has been identified as a potentially affected Local Community due to confirmation that construction traffic will travel through Rassvet. Therefore, commitments to mitigate potential impacts on Rassvet's cultural heritage have been considered in this chapter.

In the nearshore section of the Project, low sedimentation rates and shallow bedrock offer little to no depositional protection from the existing high energy environment (see Section 16.5.4.2) so any buried remains are likely to be small and scattered. Due the very slow rate of sedimentation on the abyssal plain (see **Chapter 7 Physical and Geophysical Environment**) in the offshore section of the Project, it is unlikely that previously unknown objects would be identified in that area.

The Anchoring Spread Area in the nearshore section of the Project had not been surveyed at the time of writing and is therefore not included in the assessments and conclusions of this Chapter. An Anchor Corridor Survey will be undertaken by the construction contractor when the area to be used for anchoring vessels has been calculated and confirmed based on identified vessels and the pipelaying method (see **Chapter 5 Project Description**).

16.5 Baseline Characteristics

16.5.1 Overview

The Black Sea and the Krasnodar Krai are rich in both terrestrial and marine cultural heritage including the archaeological remains of prehistoric *kurgan* burial mounds, ancient towns and settlements, archaeological remains of shipwrecks and associated nautical material. Within the Project Area there is known terrestrial cultural heritage and known and potential marine cultural heritage, including the remains of submerged vessels.

The baseline section of this Chapter presents the historical and cultural context followed by information on the terrestrial and marine known and potential cultural heritage objects identified within the Study Areas as defined in Section 16.3.

The Black Sea has been navigated for thousands of years and served as a nexus for human activity and migration. The subject of scholarly research for the past 50 years, it is unknown when humans first traversed these waters, as archaeological examples of early watercraft have yet to be encountered. Early vessels developed during the Mesolithic to Early Bronze Age (c. 10,000 BC) were relatively simple by today's standards and possibly consisted of dugout canoes, skin boats, and/or rafts. These types of watercrafts are intended for use in localized coastal waters and were probably used to transport a limited number of people for exploration and resource procurement purposes. Remains of such dugout boats have been discovered along the Bulgarian coast that date to the Early Bronze Age (c. 3,200 BC) and represent some of the earliest watercraft to be discovered in the Black Sea.

It was during the Bronze Age that vessels began to increase in size and complexity. Simple canoes gave way to larger, plank-built vessels that were capable of carrying great quantities of goods and merchandise farther along the coast, as trade at this time likely existed between coastal settlements. A boom in maritime activities occurred with the arrival of Greek explorers during Antiquity (c. 700 BC to AD 395). Subsequent colonisation efforts allowed for major trade and production centres began to develop at settlements along every coast of the Black Sea. With the Greeks came their knowledge of seafaring and nautical traditions, which included sail-driven merchant ships and rowed military vessels, traditions eventually utilized by the Romans when they came into power. Maritime trade networks significantly expanded, especially during the medieval and post-medieval periods (395 to 1422), when Mediterranean and other European ships made their way into the Black Sea.

Shipbuilding underwent a profound change at this time; the concept of naval architecture was born and foreign construction conventions and ideas spread through the region. Speed, manoeuvrability, and carrying capacity were traits that shipwrights yearned to perfect, and gradually ships continued to grow in terms of size, grandeur, and intricacy. Seafaring soon became a global enterprise and the Black Sea became a highly attractive region both economically and militarily. Changes to shipbuilding continued, as steam-power and metal-hulled ships began to replace more traditional watercraft beginning in the 19th century. Large scale naval warfare during this time and through the 20th century also contributed to the development of ship design and construction.

A timeline of the north-eastern Black Sea Region is presented in Table 16.5, summarising the regional chronology in order to assist in understanding the area's historical and cultural context. It is important to note that there is a degree of overlap between some cultural periods, and that local chronological models continue to be developed through the application of scientific dating methods.

Table 16.5 Timeline of the North-eastern Black Sea Region

Epoch	Period	Description
Pleistocene Era	Lower Palaeolithic circa (c.) 2,000,000 – 200,000 Before Present (BP)	Homo erectus (1.9 Ma - 200,000 BP) European Neanderthal Homo sapiens (350,000 - 30,000 BP)
	Middle Palaeolithic c.200,000 – 43,000 BP	European Neanderthal Homo sapiens (350,000 - 30,000 BP)
	Upper Palaeolithic c.43,000 – 12,000 BP	European Neanderthal Homo sapiens (350,000 - 30,000 BP) European Early Modern Humans (43,000 BP+) Intermittent glaciations, hunting and gathering, portable and cave art, mammoth bone houses
Holocene Era	Mesolithic c.10,000 – 6,800 Before Christ (BC)	Hunting and gathering in extensive temperate forests and on coastlines
	Neolithic c.6,800 – 3,200 BC	Animal husbandry and agricultural cultivation, hunting wild animals, fishing and gathering wild foods. Horses domesticated
	Eneolithic/Chalcolithic c.5,000 – 3,200 BC	Development of copper metalworking alongside Neolithic developments
	Bronze Age c.3,300 – 700 BC	Early Bronze Age c. 3,700 – 2,500 BC, Maikop Culture Middle Bronze Age c. 3,300/2,900 – 1900 BC, Catacomb Culture Middle Bronze Age c. 3,000 – 1,700 BC, Kabardino-Pyatigorsk/North Caucasus Middle Bronze Age c. 2700 – 1,400 BC, Circassian Dolmen Culture Late Bronze Age c. 1,900 – 1,200 BC, Srubna/Timber Grave Culture

Continued…

Epoch	Period		Description
Holocene Era	Bronze Age c.3,300 – 700 BC		Late Bronze Age c. 1,300 – 700 BC, Scythian and Sarmatian nomads
	Iron Age c.900 BC – Anno Domini (AD) 200		Scytho-Meotian, Sindian and Sarmatian semi-nomads
	Antiquity c.800 BC – AD 370	Archaic c.800 – 480 BC	6th century BC, Early Greek Pontic colonies
		Classical c.480 – 323 BC	Kingdom of the Cimmerian Bosporus
		Hellenistic 323 – 146 BC	Hellenistic Kingdom of the Cimmerian Bosporus
		Roman 63 BC – AD 370	Roman Kingdom of the Cimmerian Bosporan
	Medieval AD 370 –1475	Barbarian invasions	Goths, European Huns, Turkic tribes, Bulgars
		Khazar AD 618– 1048	Khazar Khanate, Tmutarakan Principality
		Kievan Rus	10th and 11th centuries, Kievan Rus polity
		Byzantine	13th century
		Tatar-Mongolian invasions	13th century, invasions of Golden Horde khans
		Genoese	13th to 15th century, colony of Mapa (Anapa)
	Post-medieval	1475 – 1829	Ottoman Empire
	Modern	1829 – present	1829 Treaty of Adrianople, Anapa annexed to Russia 1853 to 1856 Crimean War 1917 Russian Revolution 1941 – 1945 Great Patriotic War & 1942 – 1943 Axis occupation

Complete.

16.5.2 Archaeological and Historical Context – Terrestrial and Marine

The following archaeological and historical context sets out the background setting of the Project, covering both terrestrial and marine areas. Cultural heritage receptors identified within the Study and Survey Areas are summarised in Table 16.6 and an illustrated inventory is contained in Appendices 16.1 (Inventory of Terrestrial Cultural Heritage Finds) and 16.2 (Inventory of Marine Cultural Heritage Finds).

16.5.2.1 Lower Palaeolithic (c.2,000,000 to 200,000 BP)

During the Lower Palaeolithic, pre-modern humans (Homo erectus) lived in small groups, hunting and gathering from a home base often near a river or cave. Remains include stone tools and fossil bone. Evidence for Lower Palaeolithic activity is very rare, but of great scientific importance. The earliest known hominin site in the region is at Dmanisi, Georgia (located c.680 km southeast of the Project shore crossing), where researchers have found faunal remains dating to the Pliocene (c.5.332 to 2.588 million years before present (Ma)) or earliest Pleistocene Era (c.2.588 to 0.781 Ma), fossilised Homo erectus hominin bones, and Oldowan (c.1.8 Ma) and Acheulean (c.1.4 Ma) stone tools (Ref. 16.85; Ref. 16.86).

Desk based literature review has not identified any terrestrial Lower Palaeolithic sites within the General Study Area. Lower Palaeolithic sites are thus not considered further within this impact assessment.

16.5.2.2 Middle Palaeolithic (c.200,000 to 43,000 BP)

During much of this period, Kuban was a peri-glacial environment, located south of the ice sheets and west of the glaciers of the Caucasus Mountains. The Ice Age glaciations did not reach the eastern shores of the Black Sea, but the colder climate was reflected in the animal species present.

Acheulian material (c.700,000 to 120,000 BP) frequently comprises flint, slate and sandstone tools recovered from river-rolled gravels and eroded river terraces that are not in their original location. Later Acheulian tools, such as scrapers, choppers and chisels have been recovered from inland sites in Krasnodar such as Belorechensk (Belaya River, approximately 200 km east of the Project shore crossing) and Labinsk (Bolshaya Laba River, 268 km to the east), the valley of the River Kuban (approximately 60 km to the northeast), and coastal sites such as Kadoshy Cape, near Tuapse (approximately 155 km to the southeast) (Ref. 16.87; Ref. 16.88).

During the Mousterian (120,000 to 30,000 BP), Neanderthals and early humans lived in caves, open-air settlements and temporary hunting camps, in structures built from the bones of mammoths and other large animals. Mousterian tools have been recovered from Ust'-Labinsk, approximately 190 km inland, east of the Project shore crossing in eastern Krasnodar Krai, and archaeological layers have been investigated at the cave sites of Barakaevskaya Monasheskaya and Gubskaya (265 km inland). Tools and the bones of hunted animals including bison, aurochs (extinct cattle), megaloceros (extinct elk), mammoth, wild horse, red deer, wolf and cave bear were recovered from the Ilskaya I and II caves (approximately 95 km east of the Project; Ref. 16.89).

Desk based literature review has not identified any terrestrial Middle Palaeolithic sites within the General Study Area. Middle Palaeolithic sites are thus not considered further within this impact assessment.

16.5.2.3 Upper Palaeolithic (c.43,000 to 12,000 BP)

During the Upper Palaeolithic, anatomically modern humans arrived in Europe and south-west Asia. Tools became increasingly complex and varied, with distinctive regional styles, perhaps indicating the emergence of territorial groups. During intermittent cold periods, the Kuban region lay south of the ice sheets. Mammoth bone was used extensively in constructing huts and tents, and caves and rock shelters were occupied. Large mammals such as reindeer, bison and woolly rhinoceros were hunted using spears.

The earliest evidence for human activity in the vicinity of the landfall section of the Project comprises Upper Palaeolithic stone tools found in the vicinity of the village of Supsekh (located approximately 5 km north of the landfall section of the Project) (Ref. 16.90). Given the distance between defined Upper Palaeolithic receptors and the Project, these are not considered further within this impact assessment.

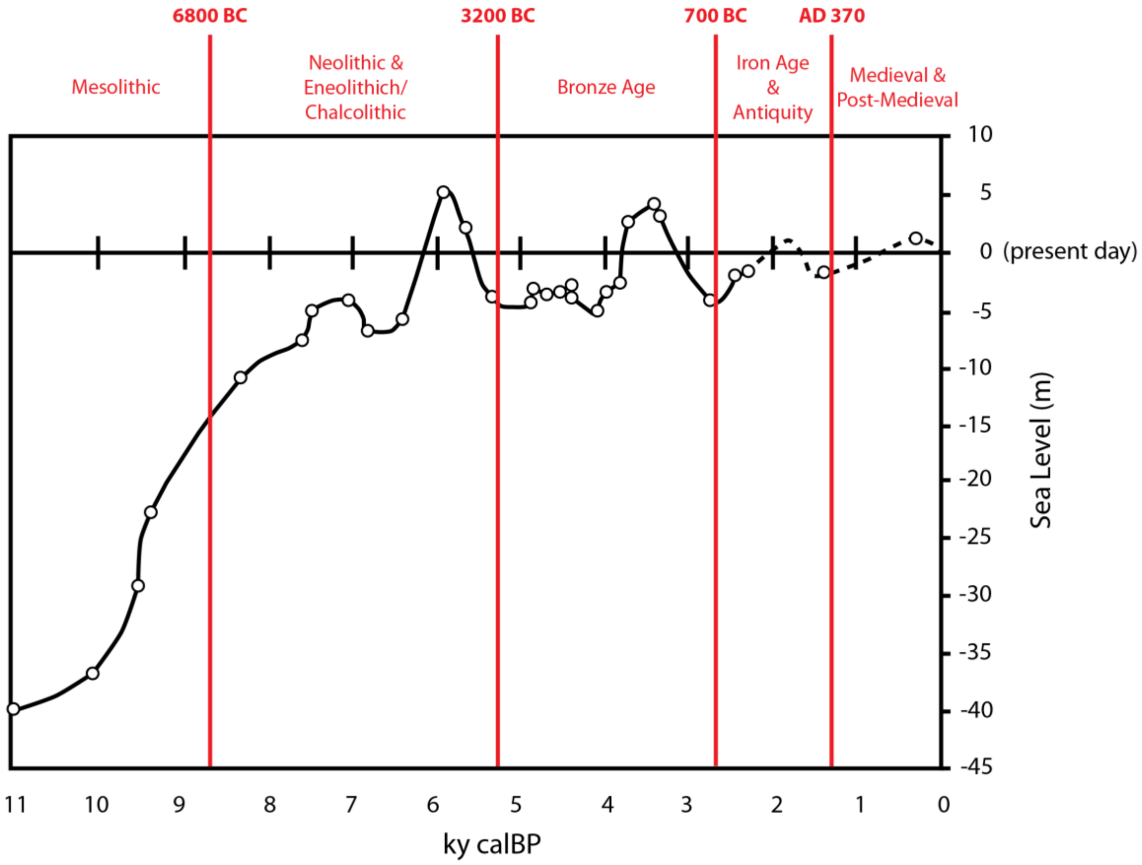
16.5.2.4 Mesolithic (c.10,000 to 6800 BC)

The retreat of the ice sheets of the Würm glaciation marked the end of the Pleistocene epoch and the start of the Holocene (Ref. 16.86). The climate became more temperate, resulting in the expansion of forest and steppe, and opening up a wider range of food and other natural resources. Mesolithic populations subsisted by semi-nomadic, seasonal hunting and gathering. Bows and arrows, slingshots and composite tools made from small microliths were developed. Grinding stones were used to process plants. Harpoons and net-sinkers have been found, indicating a greater role of fish in the diet than in previous periods.

Stratigraphic and palaeogeographic data indicates that the level of the Black Sea has undergone a range of significant rises and falls, resulting in a changing coastline and the submersion of Pleistocene and early Holocene landscapes (Ref. 16.91). Ancient coastlines have left permanent traces in the form of coastal terraces, relict seafloor features and offshore deposits. During this period the sea levels of the Black Sea were significantly lower than the sea levels of today. Analysis of submerged topography indicates that during the late Pleistocene, sea levels along the eastern and southern shorelines of the Black Sea were, at maximum, approximately 100 m to 155 m below present-day sea levels (Ref. 16.92). Lower sea levels meant greater exposure to the continental shelf for potential human activities, as there was likely to have been extensive exploitation of coastal receptors at this time. Sea levels at the end of the Mesolithic are estimated between 13 m and 15 m below present day levels (Figure 16.3; Ref. 16.93). The rise in sea level up to those of the present day may have slowed agricultural development, forced the migration of affected coastal populations, and extended the period of nomadic ephemeral land use. The drastic rise in sea level is primarily due to regional tectonic faulting and uplifts coupled with the relatively unstable climate oscillations from warm and moist to cold and dry. Archaeological sites from this period were inundated following an increase in sea level. Additionally, many terrestrial Mesolithic sites have been lost due to changes in river courses as a result of a rise in sea level. The potential for inundated Mesolithic sites to exist within the shallow-water marine environment of the Project Area is classified as low due to high wave-based energy coupled with diminished sedimentation rates and shallow bedrock.

Desk based literature review has not identified any terrestrial Mesolithic sites within the General Study Area. Mesolithic sites are thus not considered further within this impact assessment. No marine Mesolithic sites have been identified within the marine Survey Area.

Figure 16.3 Sea Level Curve of the Black Sea



Note: Figure after Filipova-Marinova, M. 2007 "Archaeological and paleontological evidence of climate dynamics, sea-level change and coastline migration in the Bulgarian sector of the Circum-Pontic Region," figure 2, p. 460. In V. Yanko-Hombach, A.S. Gilbert, N. Panin & P.M. Doukhanov (eds) The Black Sea Flood Question: Changes in Coastline, Climate, and Human Settlement. Springer, Dordrecht, pp. 453-481.

16.5.2.5 Neolithic and Eneolithic/Chalcolithic (c. 6,800 to 3,200 BC)

During the early Neolithic period, there was a shift towards the domestication of animals and plants. Pottery, textiles and a range of new stone agricultural tools were developed. Neolithic houses, made of mud and wood, were built in small villages. These were often located in river valleys. During the Eneolithic/Chalcolithic period (c. 5,000 to 3,200 BC), copper and gold metalworking was developed.

An overall increase to sea level continued into the Neolithic and Eneolithic/Chalcolithic periods. According to some researchers, the level of the Black Sea rose suddenly around 5,600 BC, increasing from 80 m below sea level, at maximum, to present-day levels, resulting in a catastrophic flood which submerged coastal sites, harbours, and river deltas (Ref. 16.94; Ref. 16.95). However, recent research suggests that if the flood occurred at all, water may have risen much less (Ref. 16.96), and that it was not a sudden event (Ref. 16.97). Analysis of sea level curves indicates that several transgression/regression episodes occurred during these periods. During the final Eneolithic through to the Early Bronze Age (c. 4,400 to 3,200 BC), several submerged marine beach facies and estuarine peat layers were found in the Kerch Strait region, connecting the Sea of Azov with the Black Sea (approximately 60 km northwest of Anapa), at depths that ranged from 6.5 m to 5 m below present day sea levels (Refs. 16.98 to 16.105). The Kerch Straits begin approximately 80 km northwest of the Project shore crossing. Sea level oscillations continued throughout this period resulting from global climate changes brought about by planetary orbital shifts, increased volcanism, and regional plate tectonics. Russian sea level curves place the most likely occupied areas during this time along a submerged shoreline between 6 m and 5 m below sea level. The potential for inundated Neolithic and Eneolithic/Chalcolithic sites to exist within the shallow-water marine environment of the Project Area is classified as low due to high wave-based energy coupled with diminished sedimentation rates and shallow bedrock.

Desk based literature review has not identified any terrestrial Neolithic and Eneolithic/Chalcolithic sites within the General Study Area. Neolithic and Eneolithic/Chalcolithic sites are thus not considered further within this impact assessment. No Eneolithic/Chalcolithic sites have been identified within the marine Survey Area.

16.5.2.6 Bronze Age (c. 3300 to 700 BC)

It is not until the late Chalcolithic to Early Bronze Age (c. 3,800 to 3,200 BC) that the sea levels stabilised across the Black Sea and large-scale re-settlement of earlier flooded landforms occurred. By this time sea levels had reached between 8 m to 5 m below present day sea levels at Anapa and the Kerch Strait region (Refs. 16.93, 16.100, 16.105). Sea levels rose up to 5 m above present day levels during the second millennium BC, a total increase of 10 m, before regressing back to approximately 4 m below present day levels c. 700 BC (Ref. 16.93). The potential for inundated Bronze Age sites to exist within the shallow-water marine environment of the Project Area is classified as low due to high wave-based energy coupled with diminished sedimentation rates and shallow bedrock.

During the Bronze Age, farming and technology continued to develop and societies became more complex as social hierarchies emerged. Bronze metalworking and land and sea trade developed. The Bronze Age in Kuban is characterised by the construction of a range of elaborate tombs or kurgan burial mounds.

A series of culture-historical terms have been ascribed to the sequence of Bronze Age activity in the region. These are named after geographical type sites or key characteristics, and include the Maikop Culture, the Catacomb Culture, the Kabardino-Pyatigorsk/North Caucasus Culture, the Circassian Dolmen Culture and the Srubna/Timber Grave Culture. However, the dating of these periods, continuity and change between 'cultures' and the development of characteristic monuments and material typologies is still unclear and subject to academic debate, as relatively few modern excavations or scientific dating programmes have been undertaken.

There are Early Bronze Age Maikop Culture settlements (c. 3,000 BC) in the vicinity of Anapskaya (approximately 8.4 km north of the Project construction corridor) and Supsekh (approximately 4.4 km northwest of the construction corridor), with pottery sherds, stone tools and quern stones. Maikop Culture burials with circular stone coverings were identified near Rassvet in 1962-1963, accompanied by grave goods of pottery, musical instruments and bronze weapons (Ref. 16.41, p17). A ritual offering stone from a Maikop sanctuary was found near Anapa (Ref. 16.90, p20-21). No Dolmen Culture settlements (c. 2,500 BC) have been identified in the Anapa area, although dolmens (megalithic monuments) were noted near Natukhaevskaya (approximately 20 km northeast of the Project shore crossing) and in the Sukko valley (approximately 3 km southeast of the Project construction corridor) in the late 19th century (Ref. 16.106). The Catacomb Culture (c. 2000 BC) is represented by a number of kurgan burial mounds in the Anapa area. The North Caucasus Culture is represented by several burials in the Anapa area and by Kabardino-Pyatigorsk type stone axes.

The Late Bronze Age (c. 1,400 to 700 BC) is represented by tools, jewellery and weapons found in the Anapa area, and material from the Sukko valley, Vestnik, Gostagaevskaya and Chekon. A Late Bronze Age settlement has been identified in the vicinity of Supsekh. A number of Late Bronze Age Koban Culture kurgan burial mounds have been investigated. Their construction methods and grave goods may indicate origins in, or contact with, the Central Caucasus.

Evidence of maritime activity begins to appear during the Bronze Age. Archaeological remains of at least five dugout canoes have been found in western Russia that date to this period (Ref. 16.107). These discoveries all come from nearby inland river systems and no dugouts have yet been found near Anapa. Detailed listings of associated artefacts are scarce, but include pottery fragments and stone tools such as grooved chisels and axes. These vessels are likely to have transported resources and trade goods from production centres to settlement sites. Remains of similar watercraft have been found along the western Black Sea coast of Bulgaria; making it possible that canoes were once used all around the Black Sea shores (Ref. 16.108, Ref. 16.109).

No shipwreck remains have yet been discovered in Russia of sea-going vessels of this period, but the Uluburun shipwreck, located off Kas in Turkey (Antalya), can serve as an appropriate comparative example, as it has the most complete hull remains of any Late Bronze Age shipwreck and dates between 1316 and 1305 BC (Ref. 16.110). Notable is the Uluburun's method of construction, which is known as shell-first, as the hull planks are joined together using pegged mortise-and-tenons. Mortise-and-tenon joinery was a common shipbuilding practice all throughout the Mediterranean from the Bronze Age through to the medieval period (Ref. 16.111).

No Early Bronze Age material has been found within the terrestrial General Study Area.

The remains of Bronze Age to medieval period settlements have been identified during archaeological fieldwalking and test pit investigations at Varvarovka-2 (RU-TCH-04; unstratified site; northern pipeline centreline lies 357 m east of the south-eastern receptor boundary and the core of the site lies 477 m west of the northern pipeline centreline) and Varvarovka-3 (RU-TCH-05; unstratified site; located 557 m northwest of the northern pipeline centreline; the core of the site lies 651 m northwest of the northern pipeline centreline) (Ref. 16.39; Ref. 16.40; Ref. 16.41; Ref. 16.112). There are dolmens located in the Sukko valley, approximately 3 km *south of the landfall section, and four Bronze Age kurgans or kurgan groups are located on high points between the villages of Varvarovka and Supsekh, located more than 4.5 km north of the landfall section.*

No evidence of Bronze Age maritime activity has been found within the marine Survey Area.

16.5.2.7 Iron Age (c. 900 BC to AD 200)

The sea levels of the Black Sea experienced minimal change during the Iron Age. The sea level was approximately 4 m below present day levels at the beginning of this period and rose approximately 5 m before dipping again to 2 m below present day levels (Ref. 16.93). This oscillation is attributed to ocean-atmosphere reorganisation associated with the Phanagorian Regression. The potential for inundated Iron Age sites to exist within the shallow-water marine environment of the Project Area is classified as low due to high wave-based energy coupled with diminished sedimentation rates and shallow bedrock.

Agricultural improvements in the Iron Age may have resulted in a shift from nomadic to more sedentary herding, and regional trading groups began to emerge. The ancient historians Herodotus (Ref. 16.113) and Strabo (Ref. 16.114) wrote that the Anapa region was populated by semi-nomadic Scythian tribes known as Maeotians and Sindians, in the 7th to 6th century BC. The nomadic Sarmatians were also recorded in the area in the 6th century BC, and Scytho-Maeotians may have fortified their settlements in response to this threat. The Kuban region was a significant contact and trading zone for agricultural and nomadic peoples, and held an important position in trade between Greeks and Barbarians. The Scytho-Maeotian tribes were gradually Hellenised, importing wine from western Turkey, northern Greece and the northern Aegean islands.

Maritime activities continued to expand in the Iron Age as a result of exploration and trade. The Scythian tribes were primarily horse-breeders and herders and maintained a semi-nomadic way of life up through the 3rd century BC (Ref. 16.115). Little is known of their maritime endeavours or vernacular watercraft, but dugout canoes are likely to have been used for inland water-based travel. Fishing was a popular activity in the northern Black Sea region during the early Iron Age, as evidenced by decorative fish motifs and tools used in fish procurement (such as hooks, line/net weights) (Ref. 16.116). After the arrival of the Greeks in the 6th century BC, it is possible that the Scythians adopted Greek shipbuilding techniques and developed sea-going watercraft, as ancient authors noted the flow of cultural influences between the two groups (Ref. 16.117). The Greeks also brought with them an increased demand for fish, which resulted in a shift from domestic to commercial fishing between the 4th and 2nd centuries BC (Ref. 16.116).

The remains of Bronze Age to medieval period settlements, which may include Iron Age material, have been identified during archaeological fieldwalking and test pit investigations at Varvarovka-2 (RU-TCH-04; unstratified site; northern pipeline centreline lies 357 m east of the south-eastern receptor boundary) and Varvarovka-3 (RU-TCH-05; unstratified site; northern pipeline centreline lies 557 m southeast of the southern boundary of the receptor and 651 m south east of the core of the receptor) (Ref. 16.39; Ref. 16.40; Ref. 16.41; Ref. 16.112).

No other evidence for terrestrial Iron Age activity has been found within the General Study Area, and no evidence for Iron Age activity has been identified within the marine Survey Area.

16.5.2.8 Antiquity (c. 800 BC to AD 370)

The Black Sea in Antiquity follows the same sea level curve as seen in the Iron Age. The sea level was approximately 4 m below present day levels at the beginning of this period and rose approximately 5 m before dipping again to 2 m below present day levels (Ref. 16.93). The potential for inundated Antique period sites to exist within the shallow-water marine environment of the Project Area is classified as low due to high wave-based energy coupled with diminished sedimentation rates and shallow bedrock.

Greek colonists settled on the shores of the Bay of Anapa in the late 6th century BC (Ref. 16.89; Ref. 16.118; Ref. 16.119), developing a town on the earlier settlements of Sindos or Limenas Sindikos. Their most significant settlement grew into the polis or city-state of Gorgippia, located on the site of modern Anapa, on the coast approximately 10 km northwest of the Project.

During the Classical period (480 to 323 BC), the city of Gorgippia was located in a key strategic position within the southern limits of the Cimmeran Bosporan Kingdom (Figure 16.4).

Figure 16.4 Greek Cities of the Black Sea

This Ancient Greek kingdom was first settled by Milesians in the 6th century BC, and its capital was at Panticapaeum (now Kerch in Crimea, Ukraine). The port of Gorgippia exported grain, fish and slaves to Athens, the Aegean and the Mediterranean, and imported wine. Trading partners changed over the 4th century; initially, wine was imported principally from Thrace (Mende), then from the Mediterranean, and later from the Aegean island of Kos and Knidos in south-western Turkey. The fertile hinterland (chora) of Gorgippia was characterised by planned, small satellite villages and farmsteads. Some were fortified, such as the farm of Dzhemet, Rassvet which was excavated in the 1960s and 1970s (Ref. 16.41). The area seems to have been rather thinly populated in comparison with the other chora of the Taman peninsula. South of Gorgippia, villages developed at Supsekh and Sukko.

A number of Gorgippia's necropolises have been investigated. Grave goods in the more central cemeteries demonstrate extensive Greek and Mediterranean culture and imported goods. However, some graves in Gorgippia's central cemeteries also contain local Scythian weapons and Maeotian ceramics. Rural necropolises are different, with distinctive stone structures and grave goods similar to those of the earlier Kobanskaya Culture, and Maeotian pottery. These rural necropolises are found within a radius of 20 km of Anapa, and have been noted at Anapskaya (approximately 8.1 km north of the construction corridor), Rassvet (3.5 km to the north), Usatova Balka (7.5 km to the north), Voskresenskiy (16 km to the north northwest), between Krasnyi and Krasnaya Skala (18.2 km to the north) and also at Tuapse (158 km to the southeast). There are similarities between the moulded pottery and jewellery deposited in the Kobanskaya Culture kurgans in the 8th to 6th century BC and in Antique rural necropolises of the 6th to 4th century BC. This seems to indicate a degree of cultural continuity in inland areas beyond the Greek Pontic shores.

In 310/309 BC, united Sarmatian nomadic tribes conquered the steppes on the right bank of the Kuban. The Maeotians' fortifications were dismantled, and their tradition of kurgan burial mounds richly furnished with weaponry ceased. Burial customs changed, and grave goods in kurgans increasingly included amphorae; some are accompanied by opulent Graeco-Sarmatian gold work, imported pottery and textiles.

The Bosporan Kingdom of Pontus became a client kingdom of the Roman Empire in 63 BC, and was briefly incorporated into the Roman province of Moesia Inferior (AD 63 to 68). The Roman kingdom was threatened by local Scythian and Sarmatian tribes, particularly in the 3rd to 4th century AD, when they were displaced by the westward migration of Goths. The city of Gorgippia was destroyed by fire c. AD 238/240, perhaps at the hands of Gothic tribes from the east, or Alans from the west. The Goths and Sarmatian Borani seized Bosporan shipping in AD 255. Gorgippia declined, and was finally abandoned following the Hun invasions of the 370s.

Analysis of submerged beach terraces from this area of the Black Sea reveals that sea levels during this period were between 4.5 m and 2.5 m below present-day levels (Ref. 16.93, Ref. 16.100, Refs. 16.102 to 16.105). In the Kerch Strait submerged Antiquity period wells, amphora, and other structures have been recorded at these depths, indicating possible port settlements. Submerged settlement sites on the Russian Black Sea coast have been identified in nearshore areas off Patrey (Garkuscha, Taman Bay, 70 km north of the Project); Kepy (65 km north-northwest of Anapa), Phanagoria (61 km north), Hermonassa, Taman Peninsula (72 km north), Korokondama, Cape Tuzla (74 km northwest), and Anapa (10 km north) (Ref. 16.120, Ref. 16.121).

When the Greeks reached the Pontic shores, they brought with them an extensive knowledge of sea-based navigation and shipbuilding technology. The warship and merchant ship were the two main types of Greek vessels that existed during this period, but it is the latter that likely made it to the eastern Black Sea region. Merchant ships were deep, broad wooden vessels that used sails as the primary mode of propulsion (Ref. 16.122). This ship type is depicted in decorative motifs from the period and even exists in an archaeological example from the eastern Mediterranean, the Kyrenia shipwreck. Warships, by contrast, were long, narrow wooden vessels with raised platforms and curved posts at both ends (Ref. 16.122). Another primary difference is that warships utilised solely oars for propulsion or a combination of both oars and sails. While characteristically different, it is believed that warships and merchant ships were built in the same fashion; that is, they were built in the shell-first style using an elaborate system of mortise and tenons to secure planking strakes, followed by the insertion of transverse frames as a secondary means of hull strengthening. The Greeks built their vessels using this method throughout Antiquity, while eventually increasing the size of both ship types.

The Romans, by contrast, were not a seafaring people and probably relied on Greek nautical traditions to design and build their vessels. Whilst not much is known about their warships, extensive research has been conducted on the Roman merchant fleet. These vessels were double-ended wooden sailing ships usually with two masts with a cargo capacity ranging from 3,000 to 10,000 amphorae (Ref. 16.122). They were rigged with one large, square mainsail and a smaller, triangular topsail and were fitted with large quarter rudders (i.e. steering oars) at the stern. The same shell-first, mortise-and-tenon construction method used during the Hellenistic period was employed by the Romans.

Regarding trade destinations and goods, the Greeks were more far-reaching than the Romans in their nautical endeavours. From 600 to 323 BC, Greeks sailors made their way from the Sea of Marmara all around the coast of the Black Sea, even reaching the Crimean Peninsula and the Sea of Azov (Ref. 16.123). Hellenistic settlements and city-states developed at eastern sites such as Gorgippia (Anapa, Russia), Phasis (Poti, Georgia) and Dioscurias/Sebastopolis (Sukhumi, Russia) until they came under Roman rule in the 2nd century BC (Figure 16.4). The Romans largely ignored the eastern Black Sea coast, as they instead concentrated efforts to develop settlements on the southern and western coasts. Principal Black Sea exports during this period included grain, salt, fish, and metals, while imports from the Mediterranean included oil, wine, and finished products such as ceramics, metal goods and glassware (Ref. 16.124).

Maritime archaeological finds have been found along the Russian Black Sea coast that date to the Antiquity period. At the Yevpatoria sea port, Lake Donuzlav, Crimea, Ukraine (345 km to the west of the shore crossing and approximately 255 km north of the offshore section), the remains of a ship and its cargo of Heraclean amphora were discovered dating from the 4th to 3rd centuries BC (Ref. 16.120). Vessels from this period have also been found along the Turkish coast, thereby increasing the potential for archaeological finds in the region (Ref. 16.49).

A group of rural villas and farmsteads dating to the Antique period have been identified approximately 1.6 km northwest of Varvarovka (Ref. 16.39; Ref. 16.41). A burial dated to the 6th to 4th century BC is recorded between the villages of Varvarovka and Supsekh, located more than 4 km north of the landfall section of the Project (Ref. 16.39; Ref. 16.41).

There is a designated kurgan located approximately 50 m northwest of the pipeline microtunnel section (RU-TCH-02, National Monument No. 363) (Ref. 16.39; Ref. 16.40; Ref. 16.41). It is dated to the Antique to medieval period. The remains of three farming settlements have been identified located north of the proposed construction corridor during archaeological fieldwalking and test pit investigations. These comprise the sites of Varvarovka-1 (RU-TCH-03; unstratified site; receptor boundary lies 853 m east of the microtunnel exit and the core of the receptor lies 937 m west of the northern pipeline centreline), Varvarovka-2 (RU-TCH-04; unstratified site; northern pipeline centreline lies 357 m east of the south-eastern receptor boundary) and Varvarovka-3 (RU-TCH-05; unstratified site; edge of receptor area located 557 m northwest of the northern pipeline centreline; core of the receptor lies 651 m northwest of the northern pipeline centreline) (Ref. 16.39; Ref. 16.40; Ref. 16.41; Ref. 16.112).

No evidence of Antique period maritime activity has been identified within the marine Survey Area.

16.5.2.9 Medieval (AD 370 to 1475) and Post-medieval Periods (AD 1475 to 1829)

Very minor sea level fluctuations occurred in the Black Sea during the medieval and post-medieval periods. Sea levels were approximately 1 m above present day levels and regressed to modern levels by the 19th century. The potential for inundated medieval and post-medieval sites to exist within the shallow-water marine environment of the Project Area is classified as low due to elevated sea levels during this period, high wave-based energy, diminished sedimentation rates, and shallow bedrock.

During the early medieval period, the region formed part of the Khazar Khanate. It was a major commercial contact zone between northern Europe and Asia (Ref. 16.115). Genoese traders built the fortress of Mapa at Anapa in the 13th century. Raw metals, gold, pearls, amber, textiles and spices were imported, while agricultural products from the Adygei hinterland were exported. These include cereals, cheese, oil and honey, as well as furs and slaves.

Mapa was captured by the Ottoman Empire in 1475. Trade continued and the city was fortified, becoming a strategically important centre of Ottoman culture in the late 17th century. Russia attacked the city and the Ottoman fleet six times between 1788 and 1828 during the Russian-Turkish wars. Anapa was annexed by Russia following the Treaty of Adrianople in 1829.

Minor sea level oscillations continued to occur during these periods, with the last notable regression taking place during the 'Little Ice Age' (c. 1350 to 1850) (Ref. 16.93, Ref. 16.100, Refs. 16.102 to 16.105). Sea levels regressed to 3 m to 2 m below present-day sea levels. Peat layers located at these depths in the Sukhumi Bay region attest to the regression along the north-eastern margin of the Black Sea.

Maritime activity continued to increase along the north-eastern coast of the Black Sea given its strategic location between Europe and Asia. The Khazars maintained control from the Caspian Sea to the Crimean Peninsula to trade salt, wax, fur, leather, and slaves (Ref. 16.115, p74). While watercraft were probably used in river- and sea-based transport of these goods, details on the type or design are lacking. Anchors with stone, lead, and iron stocks dating from the 5th to 7th centuries have been found around the Straits of Kerch, but cultural affiliation has not yet been determined (Ref. 16.120). Dugout canoes that plied the rivers and coastal areas continued to be used during this time up through the 18th century (Ref. 16.120). The 4th and 7th century shipwrecks discovered at Yassıada Island (Bodrum, Turkey) can provide possible parallels for the types of sea-going watercraft used in the Black Sea (Ref. 16.122). These vessels were Byzantine merchantmen and featured construction techniques that could be traced back to the Graeco-Roman tradition of shipbuilding: a shell-first, mortise-and-tenon joined hull. These wrecks also show a gradual departure from this type of construction to one that relied more heavily on the strength of the skeletal framework within the hull, which is known as frame-first construction.

During the late medieval and post-medieval periods, ships in the Black Sea continued to increase in size as interactions with nations outside of the region became more frequent. Recognising the commercial success and growing prosperity of the region, Scandinavian merchant-mercenaries redirected their trade through the Black Sea (Ref. 16.124). Archaeological evidence exists that shows Scandinavian shipbuilding techniques were incorporated into local western Russian vessels during this time, such as clinker joinery and bottom-based construction (Ref. 16.125). There was also extensive military activity throughout the region between the Byzantine, Arabic, and Rus' forces. The Rus' were a Varangian (Viking) group active between late 9th and mid-13th century; Khazar Tmutarakan came under Rus' control in the 10th and 11th centuries.

Italian ships carried Genoese and Venetian traders into the Black Sea starting in the 13th century. The Italians were known for their formidable naval fleet, which included long, rowed galleys, frigates, and smaller warships (Ref. 16.122). Rounder, sail-driven merchantmen with tall sides and bulging prows continued to carry oil, wine, and other goods into the region.

Shipwreck material from this period has been discovered along the Russian coast. A well-preserved Byzantine merchantman was found near the Russian Black Sea resort of Sochi (approximately 230 km southeast of the shore crossing) (Ref. 16.126). Maritime-related artefacts found in the region include anchors, anchor arms, navigation instruments, ship decorations, and ceramics (Ref. 16.120).

Terrestrial cultural heritage comprises two medieval cemeteries located in arable fields on north-facing hillsides east of Supsekh, located more than 4 km north of the landfall section of the Project (Ref. 16.39).

Marine cultural heritage comprises a single ceramic amphora that dates approximately to the medieval period (RU-MCH-003) and an undesignated wooden shipwreck that probably dates from the medieval to post-medieval periods (RU-MCH-004). Both are located within the marine Zone of Potential Influence.

16.5.2.10 Modern Period (1829 to Present)

During the 19th century, the hinterland of Anapa was populated by a cosmopolitan mix of Russians, Ukrainians, Greeks, Germans, Tatars and Armenians. The village of Varvarovka was one of a series of agricultural settlements established by Czech immigrants from Austria-Hungary in the 1870s, at the initiative of agronomist Franz Hejduk. The village of Supsekh was established in the late 19th century. A village called Galkina Shel was established in 1908, and

Armenian refugees from Trabzon settled here in 1915 to 1916. This village was renamed Gai Kodzor in 1925, meaning 'Armenian Gorge' (Ref. 16.127).

Anapa's modern vineyards were first established in the mid- to late 19th century. Following the construction of the railway to Novorossiysk in 1892, coastal resorts, sanatoria and summer tourism developed. After the 1917 revolution, the area became a focus for health treatments and children's holiday camps.

During the Great Patriotic War (1941 to 1945), the Kuban peninsula was occupied by German and Romanian Axis troops between August 1942 and September 1943.

With regard to the marine environment, shipbuilding changed drastically in the modern period. In the early to mid-19th century, metal started to be used more regularly for structural elements and eventually the hull; by the end of the century the majority of ships were being built completely out of iron and steel. Another revolutionary change came with the advent of marine steam engines, and later combustion engines, which had a decisive effect on how ships were built, manned, and operated.

Naval warfare was directly affected by these changes. As vessels became more robust and resilient as a result of their metal hulls, weaponry and ordnance were also redesigned to be more effective. Torpedoes, sea mines, and submarines were used quite extensively in naval combat starting at the end of the 19th century. In the 20th century, aircraft were introduced into military campaigns. During the Great Patriotic War, the nearshore area experienced active marine battles between German and Russian forces, and the Kuban was occupied by Axis troops between 1942 and 1943.

DS Kalinin, Hero of the Soviet Union and commander of the Second Reconnaissance Detachment Staff of the Black Sea Fleet (1910 to 1943), was killed in action with marines leading a seaborne assault south of the village of Supsekh in May 1943. This event is commemorated with a major memorial erected close to the Anapa-Sukko road, approximately 750 m southeast of the pipeline route centreline (RU-TCH-01, National Monument No. 383). War memorials in the village of Gai Kodzor commemorate Soviet soldiers killed during the Great Patriotic War, and villagers executed at Gai Kodzor in August and December 1942 (RU-TCH-11, National Monuments No. 390 & 391), approximately 5.1 km northeast of the nearest pipeline centreline and connection with the Russian gas network. At Varvarovka, there are monuments to the Soviet marines killed and villagers executed by the invaders in 1942 to 1943, and to countrymen who died in the Great Patriotic War (RU-TCH-09, National Monuments No. 381 & 382), approximately 1.2 km northwest of the northern pipeline centreline. Varvarovka village cemetery (Armenian and Russian cemetery) includes the common grave of Soviet soldiers and civilians killed in 1942 to 1943 (RU-TCH-06, National Monument No. 380), approximately 398 m northwest of the northern pipeline centreline. An MI-6 heavy transport helicopter crashed in 1992 in woodland northeast of Varvarovka, located more than 2.7 km north of the northern proposed pipeline centreline; the site is marked by two memorials (Ref. 16.128).

There are a number of cemeteries associated with the villages to the north of the Project. These comprise Varvarovka village cemetery, a mixed Armenian and Russian cemetery (RU-TCH-06), approximately 398 m north of the northern pipeline centreline and close to the Gazprom Invest Road (permanent access road) and 100 m west of the Project temporary access *road to the microtunnel site; Varvarovka Armenian cemetery (RU-TCH-07), approximately 2.1 km northwest of the nearest pipeline centreline; and Gai Kodzor Armenian cemetery and church (RU-TCH-10), approximately 5.6 km northeast of nearest pipeline centreline.*

A new Russian Orthodox church is under construction at Varvarovka (RU-TCH-08), approximately 1.8 km northwest of the northern pipeline centre-line. The Armenian Apostolic Church of St. Sarkis (St. Sergius) at Gai Kodzor was built in 1997 (RU-TCH-12), approximately 4 km northeast of the nearest pipeline centreline, and a new Armenian church of St Gevorg (St. George) has been under construction on an adjacent plot since 2007/8. In the square adjacent to these in Gai Kodzor is a modern Armenian khachkar cross-stone (RU-TCH-13; see Section 16.4.3 Intangible Cultural Heritage for further details).

Two marine sites were identified within the marine Survey Area. These are:

- *An aircraft wing with integrated fuel reservoir that dates to the modern period (RU-MCH-001); and*
- *A metal component belonging to either a marine vessel or aircraft (possibly a wing) that also dates to the modern period (RU-MCH-002).*

Desk-based archival research undertaken by Peter Gaz in 2011 and 2012 identified three previously known shipwreck sites: sanitary vessel Dnepr, freight vessel Fabritsius, and the steam scow Gordipiya (Ref. 16.75). The Gordipya is used for recreational diving. In addition, three non-self-propelled bolinder barges, two chaser motor boats, and a number of auxiliary vessels were lost or destroyed in the Anapa region. These objects are located more than 150 m from the nearshore section of the Project.

16.5.2.11 Uncertain Date

Located on the coast west of Supsekh, approximately 3.3 km northwest of the shore crossing, at the base of a cliff, is a series of mortared sandstone walls of uncertain date and function called the 'Walls of the Sea'. There is speculation that it may be associated with submerged settlement remains (masonry structures) found by divers off the Anapa coast, although they are similar in fabric and construction method to elements of Anapa's fortifications associated with the Russo-Turkish wars of the late 18th and early 19th centuries (Ref. 16.129; RU-TCH-17).

Marine sites of uncertain date include nineteen potential CHOs originally within the marine Zone of Potential Influence, which will be avoided by 150 m via pipeline re-routing (see Section 16.7).

There is the potential for currently unknown or unregistered CHOs to exist in the nearshore and offshore sections of the Project that lack archaeological context (isolated/chance finds). These may include nautical items that were lost while sailing (e.g. anchors, trade goods), heavy objects jettisoned during inclement weather or conflict, disarticulated ship remains, remains of 19th and 20th century conflict, intentionally scuttled or abandoned material, and un-associated debris or garbage.

16.5.3 Intangible Cultural Heritage

Intangible cultural heritage refers to cultural resources, knowledge, innovations and/or practices of local communities embodying traditional lifestyles (Ref. 16.43). With reference to IFC PS8 paragraph 3 (iii) (Ref. 16.3), the Project does not propose to use any intangible forms of culture for commercial purposes.

The UNESCO Representative List of the Intangible Cultural Heritage of Humanity supports the 2003 Convention for the Safeguarding of the Intangible Cultural Heritage. There is no Russian listed intangible cultural heritage closer than 5,000 km to the Project. 2010 census data indicates that Krasnodar region's multi-ethnic indigenous population includes Russians (88.3%), Armenians (5.5%), Ukrainians (1.6%), Tatars (0.5%), Greeks (0.4%) and other nationalities including Yezidy[6] (3.7%) (Ref. 16.61). Krasnodar's national-cultural autonomy organisations reported in 2012 include German, Jewish, Kurdish, Korean, Tatar, Adyghe (Circassian), Assyrian, Russian Roma, Greek and Belarusian groups (Ref. 16.61). In additional to significant state-supported cultural institutions (Ref. 16.60), the area has a number of amateur associations and clubs such as folk dancing, choirs and orchestral groups, including Russian, Cossack, Greek and Armenian groups (Ref. 16.130). The villages of Varvarovka and Gai Kodzor both have cultural centres.

Traditional Kuban Cossack culture and local folk arts and crafts are being revived with State support, and include weaving, traditional embroidery, pottery, woodworking, basketry, leather manufacture, wool felting and blacksmithing (Ref. 16.62); masters of these arts are honoured with the title 'Master of arts and crafts of Kuban'. Other distinctive local cultural elements include traditional Cossack costume, which dates back to the late 19th century (Ref. 16.61). Gastronomic specialities include local wine (Gai Kodzor Vineyards), as well as Kuban produce including pickles, boiled pork, lard, blinis (pancakes) and pastries (Ref. 16.63).

Socially significant religious and secular events celebrated on the territory of Gai Kodzor, Sukko and Supsekh include national and international festivals, profession day, village days and commemorations of military and historical people and events that have made a significant contribution to the development of Russia and Kuban (Ref. 16.64; Ref. 16.65).

Non-working holidays in the Krasnodar region comprise New Year holidays (1 – 5 January), Christmas/Nativity (7 January), Defender of the Motherland Day (23 February), International Women's Day (8 March), Spring and Labour Day (1 May), Victory Day (9 May), Russia Day (12 June) and National Unity Day (4 November). Other festivals include Theophany/ Epiphany (19 January), Maslenitsa (Pancake Week prior to Great Lent), Easter, International Day for Protection of Children (1 June), Family Day (Saints Peter and Fevronia of Murom, 8 July), Day of Liberation from German-fascist Invaders (Anapa and Anapa region, 21 September), Kuban Family Day (third Sunday in September), the Day of Elderly People (1 October) and Mother's Day (last Sunday in November).

In addition to these holidays and festivals are civic and arts festivals, including 'From Masters of Arts to the Toilers of the Village' national heritage revival festival, the 'Address of Childhood is

[6] A Kurdish ethno-religious group with Indo-Iranian roots.

Kuban' festival of children's artistic creativity, and the 'For the Glory of Kuban - for the Benefit of Russia' festival of amateur artistic creativity.

On Victory Day (9 May) and Anapa and Anapa region Liberation Day (21 September) there are rallies, vigils, and wreath- and flower-laying ceremonies at monuments and war memorials. Intangible cultural heritage includes festivals and commemorations associated with war memorials (RU-TCH-06; RU-TCH-09; RU-TCH-11), cemeteries (RU-TCH-06; RU-TCH-07; RU-TCH-10) and churches (RU-TCH-08; RU-TCH-10; RU-TCH-12).

There is extensive tourist interest in Krasnodar's Bronze Age dolmens, some of which are subject to tourist pilgrimages and offerings (Ref. 16.131). No such activities have been observed to be associated with *kurgan* site (RU-TCH-02) or any archaeological remains located in the terrestrial Study Area.

There is a spring in northern Varvarovka, St. Barbara's Source (RU-TCH-14; Figure 16.5) where a resident had a vision of a girl in a red dress stretching out her hands to the spring, and held that this was a vision of the village's patron saint, Saint Barbara (feast day December 17). It is believed that the water from this spring has healing powers. Before the recent construction of Varvarovka Russian Orthodox church, believers met near the spring. An annual procession to the well takes place on the Feast of Theophany (Epiphany/Feast of Lights/Feast of the Manifestation, 19 January), and the water is blessed. Attendees include local parishioners and pilgrims from further afield (Ref. 16.132; Ref. 16.133). St. Barbara's Source is located approximately 1.9 km northwest of the northern pipeline centreline. There are springs in the villages of Raevskaya/Rajewski (15.4 km east of the shore crossing) and Semigorye (21 km to the northeast).

The village of Gai Kodzor has an annual festival in May at the modern khachkar cross-stone next to the Armenian Apostolic Church of St. Sarkis (St. Sergius) (RU-TCH-12) and the adjacent Armenian church of St. Gevorg (St. George) under construction since 2007/8 (Ref. 16.130, Ref. 16.134). The *khachkar* (RU-TCH-13) was carved by Armenian sculptor and stonemason Sergei Danilyan, brought from Armenia and erected in 1992. It depicts two phoenix birds, symbolizing the friendship between the Armenian and Russian peoples. A festival is held at the *khachkar* in the last week of every May, involving representatives from all communities in the Anapa area. *Khachkars* or Armenian cross-stones are carved outdoor stone stelae which act as a focal point for worship, as memorial stones and as relics facilitating communication between the secular and divine. *Khachkars* reach 1.5 m in height, and have an ornamentally carved cross in the middle, resting on the symbol of a sun or wheel of eternity, accompanied by vegetative-geometric motifs, carvings of saints and animals. They constitute a distinctive symbol of the identity of Armenian communities at home and abroad. The symbolism and craftsmanship of *khachkars* was inscribed on the UNESCO Representative List of the Intangible Cultural Heritage of Humanity in 2010 (Ref. 16.135).

There is a large modern concrete cross on a hill overlooking Supsekh, which was erected in 2005 to commemorate the 60th anniversary of the end of the Great Patriotic War. The area is used as a place of prayer, and the adjacent sign board indicates that it is the property of the Russian Orthodox Church (RU-TCH-15). The site is located approximately 4.5 km north of the Project construction corridor.

A sacred tree was noted west of the road between Sukko and Anapa, north of Varvarovka and distant from the Project (RU-TCH-16). Prayer ribbons and cloth rags are suspended from the branches of a blackthorn tree (*Prunus spinoza*). Sacred trees and groves occur in many cultures across the world (Ref. 16.136). In the Kuban region, the custom may date back to Circassian/Adyghe traditions, which in turn overlie earlier practices (Refs. 16.137 to 16.140).

16.5.4 Baseline Summary

The previous section has described the wider archaeological, historical and cultural context. This section focuses on receptors located within the Project Study and Survey Areas (Figure 16.1 and Figure 16.2). Table 16.6 presents an overall summary of terrestrial and marine cultural heritage receptors and the distances to the nearest Project component (terrestrial) or pipeline centreline (marine). Sites in bold italic type are those that are considered to be vulnerable to Project impacts and are carried forward to the impact assessment (Section 16.6.4.2).

Table 16.6 Terrestrial and Marine Cultural Heritage Receptors in the Project Area

Date	Terrestrial	Distance from nearest Project component	Marine	Distance from nearest pipeline centreline
Lower Palaeolithic	No sites identified within 5 km of the Project		No sites identified within the marine Survey Area	
Middle Palaeolithic	No sites identified within 5 km of the Project		No sites identified within the marine Survey Area	
Upper Palaeolithic	Upper Palaeolithic stone tools found near Supsekh	5 km	No sites identified within the marine Survey Area	
Mesolithic	No sites identified within 5 km of the Project		No sites identified within the marine Survey Area	
Eneolithic/ Neolithic	No sites identified within 5 km of the Project		No sites identified within the marine Survey Area	
Bronze Age	Varvarovka-2 (RU-TCH-04) unstratified site	357 m	No sites identified within the marine Survey Area	
	Varvarovka-3 (RU-TCH-05) unstratified site	557 m		
	Dolmens in the Sukko valley	3 km		

Continued...

Date	Terrestrial	Distance from nearest Project component	Marine	Distance from nearest pipeline centreline
Bronze Age	Bronze Age kurgans/kurgan groups between Varvarovka and Supsekh	4.5 km	No sites identified within the marine Survey Area	
Iron Age	Varvarovka-2 (RU-TCH-04)	357 m	No sites identified within the marine Survey Area	
	Varvarovka-3 (RU-TCH-05)	557 m		
Antiquity	*Kurgan (RU-TCH-02, National Monument No. 363)*	50 m	No sites identified within the marine Survey Area	
	Varvarovka-1 (RU-TCH-03) unstratified site	853 m		
	Varvarovka-2 (RU-TCH-04)	357 m		
	Varvarovka-3 (RU-TCH-05)	557 m		
	Antique rural villas and farmsteads, Varvarovka	1.6 km		
	Burial recorded between Varvarovka and Supsekh	4 km		
Medieval **Post-medieval**	Two medieval cemeteries east of Supsekh	4 km	***Single medieval ceramic amphora (RU-MCH-003)***	Within 150 m
			Wooden shipwreck (RU-MCH-004)	

Continued...

Date	Terrestrial	Distance from nearest Project component	Marine	Distance from nearest pipeline centreline
Medieval **Post-medieval**	Varvarovka medieval settlement (RU-TCH-018).	150m		
Modern period	DS Kalinin Memorial (RU-TCH-01, National Monument No. 383)	750 m	***Modern aircraft wing (RU-MCH-001)***	Within 150 m
Modern period	Gai Kodzor war memorials (RU-TCH-11, National Monuments No. 390 & 391)	5.1 km	*Modern metal component (RU-MCH-002)*	Over 150 m
	Varvarovka war memorials (RU-TCH-09, National Monuments No. 381 & 382)	1.2 km	Shipwreck of sanitary vessel *Dnepr*	Over 150 m
	Varvarovka village cemetery (Armenian and Russian): common grave of Soviet soldiers and civilians (RU-TCH-06, National Monument No. 380)	398 m	Freight vessel *Fabritsius* Steam scow *Gordipiya*	Over 150 m
	Varvarovka memorials to crashed military helicopter	2.7 km	Three bolinder barges	
	Varvarovka, village cemetery, Armenian and Russian cemetery (RU-TCH-06)	398 m	Two chaser motor boats	

Continued...

Date	Terrestrial	Distance from nearest Project component	Marine	Distance from nearest pipeline centreline
Modern period	Varvarovka Armenian cemetery (RU-TCH-07)	2.1 km	Auxiliary vessels	Over 150 m
	Gai Kodzor Armenian cemetery and church (RU-TCH-10)	5.6 km		
	New Russian Orthodox church, Varvarovka (RU-TCH-08)	1.8 km		
	Armenian Apostolic Church & khachkar, Gai Kodzor, (RU-TCH-12 & RU-TCH-13)	4 km		
Uncertain date	Supsekh, sea walls	3.3 km	Nineteen potential CHO	Over 150 m
Intangible cultural heritage	St. Barbara's Source (RU-TCH-14)	1.9 km	No marine receptors identified	
	Supsekh cross (RU-TCH-15)	4.5 km		
	Sacred tree (RU-TCH-16)	> 5 km		

Complete.

16.5.4.1 Baseline Conditions – Terrestrial

As can be seen from Table 16.6, the Project has a moderate to high potential to encounter buried terrestrial cultural heritage remains of settlement and burials dating to the Bronze Age, Iron Age, Antique and medieval periods. The southern part of the 125 m statutory protective perimeter of the kurgan burial mound (RU-TCH-02; National Monument No 363) is crossed by the microtunnels. This mound may be an outlier of a wider group of Bronze Age *kurgans* located to the north, on high ground between the villages of Varvarovka and Supsekh, which are not within the terrestrial Study Area or impacted by the Project.

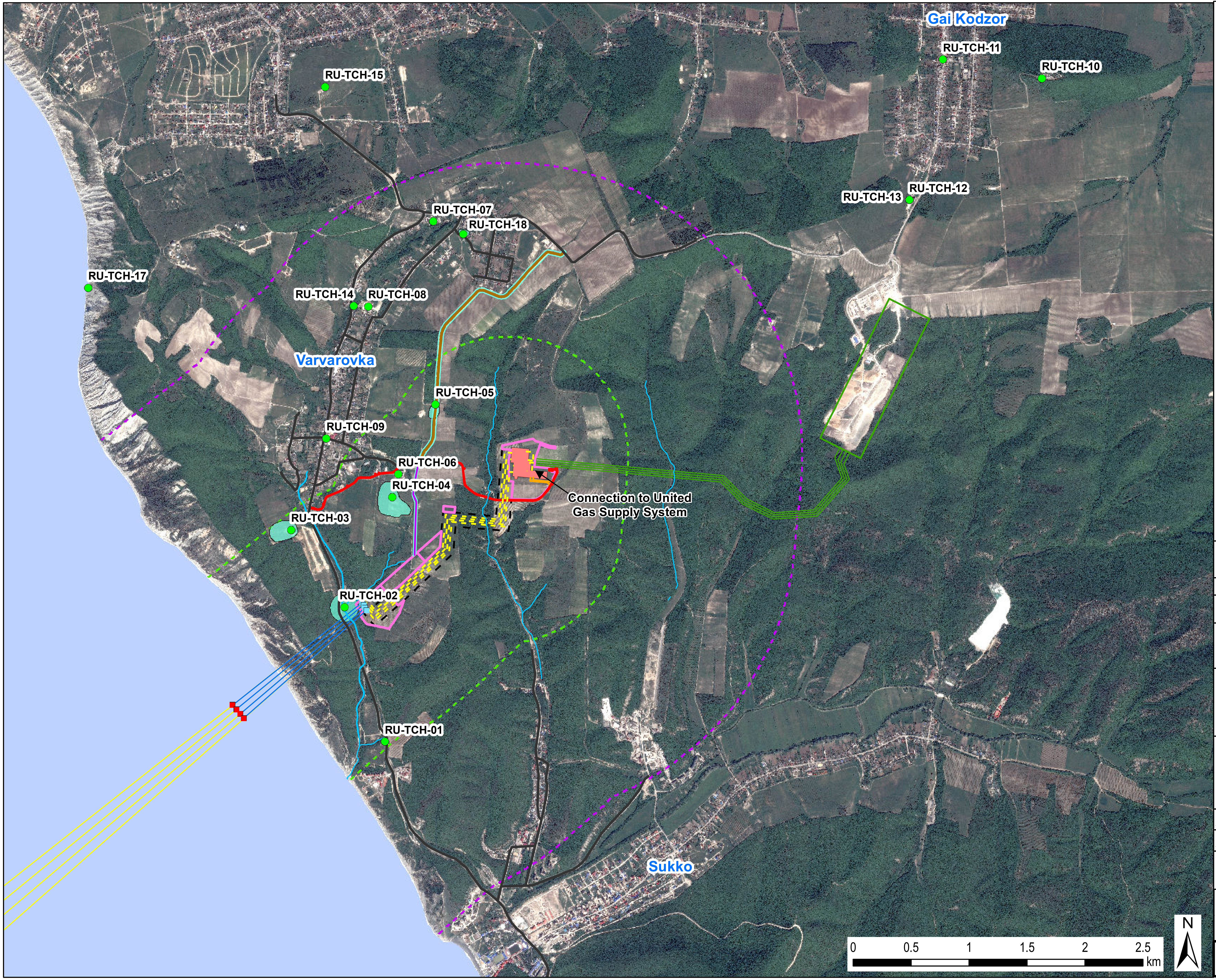
Fieldwalking and test pit investigation has identified the remains of three settlements of prehistoric, Antique and early medieval date, northwest of the Project (RU-TCH-03, RU-TCH-04, RU-TCH-05; unstratified sites) (Figure 16.5). The status of these sites has been reviewed by the Department of the Protection, Restoration and Operation of Historical and Cultural Values (Heritage) of Krasnodar Region. They were found not to warrant the classification of Cultural Heritage Object or National Monument due to their unstratified character (Ref. 16.112; Appendix 16.8.2). The Project is located beyond the mapped southern extent of these rural settlements, but may encounter peripheral remains. However, the Temporary Access Road runs immediately east of RU-TCH-04 and the Varvarovka bypass road (used by Project during construction only) runs through site RU-TCH-05 and through the protection zone of site RU-TCH-18. An archaeological watching brief will be maintained on all intrusive groundworks, including groundworks in these areas. These sites are not discussed further within this Chapter.

The preservation potential of archaeological remains in the Project landfall section is considered to be low to moderate. Any archaeological deposits along the top edge of the cliff will have undergone coastal erosion processes. Woodland cover east of the microtunnel area is liable to have caused moderate damage to any archaeological deposits due to root growth and root boles left after trees are felled or uprooted. Test pit investigations of the three settlements (RU-TCH-03, RU-TCH-04, RU-TCH-05) noted that occupation strata have been largely removed by vineyard ploughing, and survive only where cut into bedrock. The *kurgan* burial mound (RU-TCH-02) has been subject to robbing in the past, and it is likely that deposits in the uppermost, central part of the mound are no longer stratigraphically intact.

16.5.4.2 Baseline Conditions – Marine

As shown in Table 16.6, the marine environment has a high potential to feature the following cultural heritage remains: shipwrecks; maritime structures and objects; and remains associated with 19th and 20th century conflict. As a result of the anoxic conditions in the Black Sea, which inhibit corrosion and microbial degradation, the preservation potential for any CHO is greatly enhanced below a water depth of 120 m to 200 m.

Prehistoric and historic occupation areas – such as campsites, resource extraction sites, or settlements – that became submerged as a result of inundation by the Black Sea are not expected in the shallow-water marine environment in the nearshore section of the Project. The low potential for archaeological sites is due to high wave-based energy in these areas that can scatter and destroy submerged cultural material.



LEGEND

- Desk-based study area
- Archaeology and cultural heritage field surveys
- Terrestrial cultural heritage and archaeology
- Terrestrial cultural heritage and archaeology areas
- Rivers (mapped within a 1km radius of Project)
- Main roads

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Landfall facilities
- Proposed microtunnels
- Proposed offshore pipelines
- Construction corridor
- Temporary construction area for road construction
- Construction sites
- Microtunnel entry shaft
- Microtunnel exit pit
- Permanent access road to be constructed by SSTTBV
- Temporary access road constructed by SSTTBV
- Varvarovka bypass road (used by Project during construction only)

United Gas Supply System

- Russkaya compressor station
- United Gas Supply System pipelines
- Permanent access road to be constructed by Gazprom Invest

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check / Date	Suffix

Purpose of Issue

For Information

Client

South Stream Transport AG — ENERGISING EUROPE

Project Title

SOUTH STREAM OFFSHORE PIPELINE PROJECT

Drawing Title

TERRESTRIAL CULTURAL HERITAGE RECEPTORS AND STUDY AREAS

Drawn	Checked	Approved	Date
AH	CP	AD	30/06/2014

URS Internal Project No.	Scale @ A3
46369084	1:30,000

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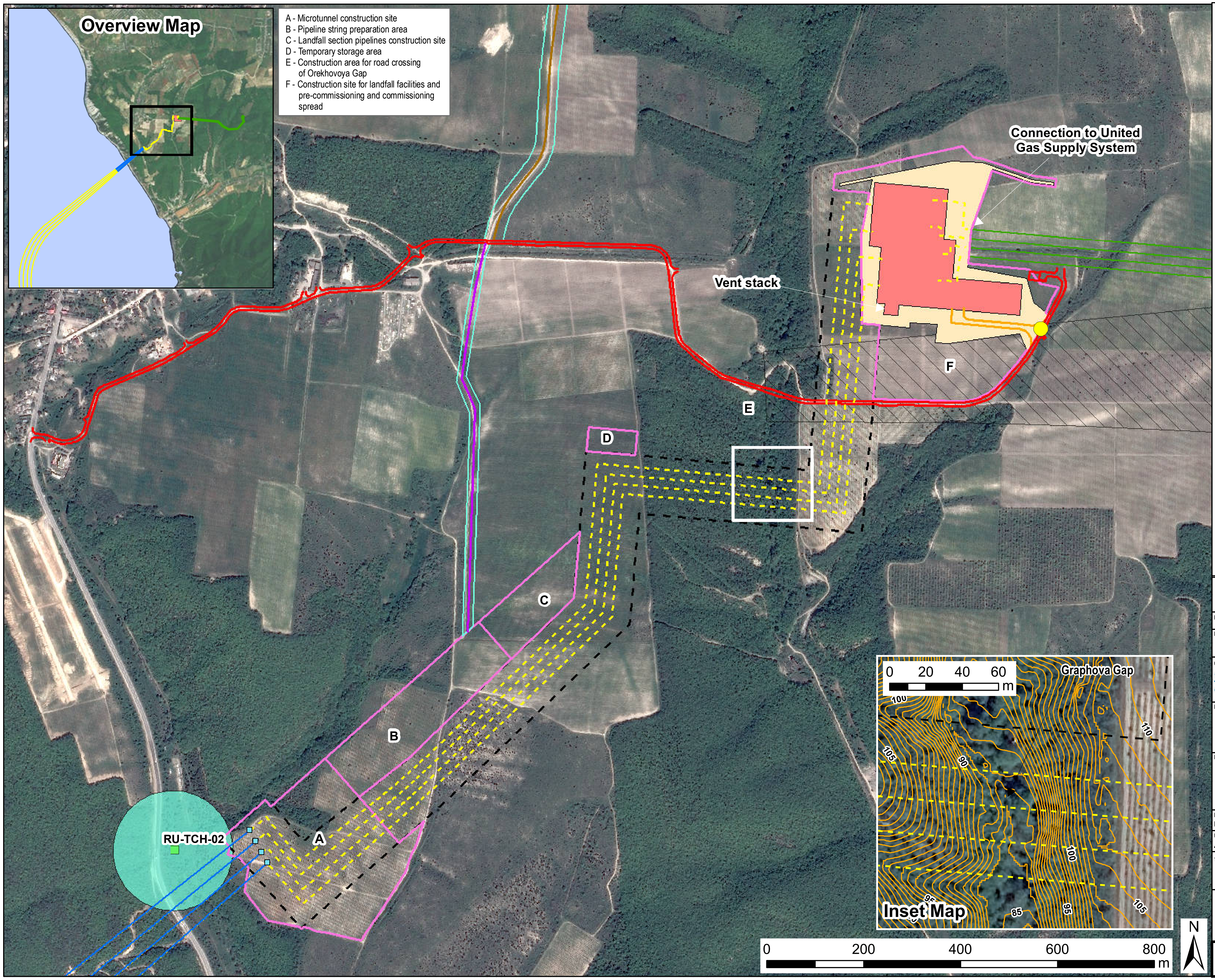
Drawing Number	Rev
Figure 16.5	

Plot Date: 30/06/2014
File Name: I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 16 Cultural Heritage\Figure 16.5 Terrestrial Cultural Heritage Receptors and Study Areas.mxd



LEGEND

Terrestrial cultural heritage and archaeology areas

Terrestrial cultural heritage and archaeology

Marfovsky fault (indicative location)

Russian Sector of South Stream Offshore Pipeline

Proposed landfall section pipelines

Landfall facilities

Anode bed for cathodic protection of landfall section pipelines

Proposed microtunnels

Proposed offshore pipelines

Microtunnel entry shaft

Construction corridor

Cut and fill side slopes

Temporary construction area for road construction

Construction sites

Permanent access road to be constructed by SSTTBV

Temporary access road constructed by SSTTBV

Varvarovka bypass road (used by Project during construction only)

United Gas Supply System

United Gas Supply System pipelines

Permanent access road to be constructed by Gazprom Invest

Projection: Lambert Conformal Conic

Revision Details	By Check	Check Date	Suffix

Purpose of Issue: For Information

Client: South Stream Offshore Pipeline — Stream ENERGISING EUROPE

Project Title: SOUTH STREAM OFFSHORE PIPELINE

Drawing Title: RELATIONSHIP BETWEEN KURGAN (RU-TCH-02), ITS 125M PROTECTIVE BUFFER, AND THE LOCATION OF MICROTUNNELS

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46369082	1:7,500

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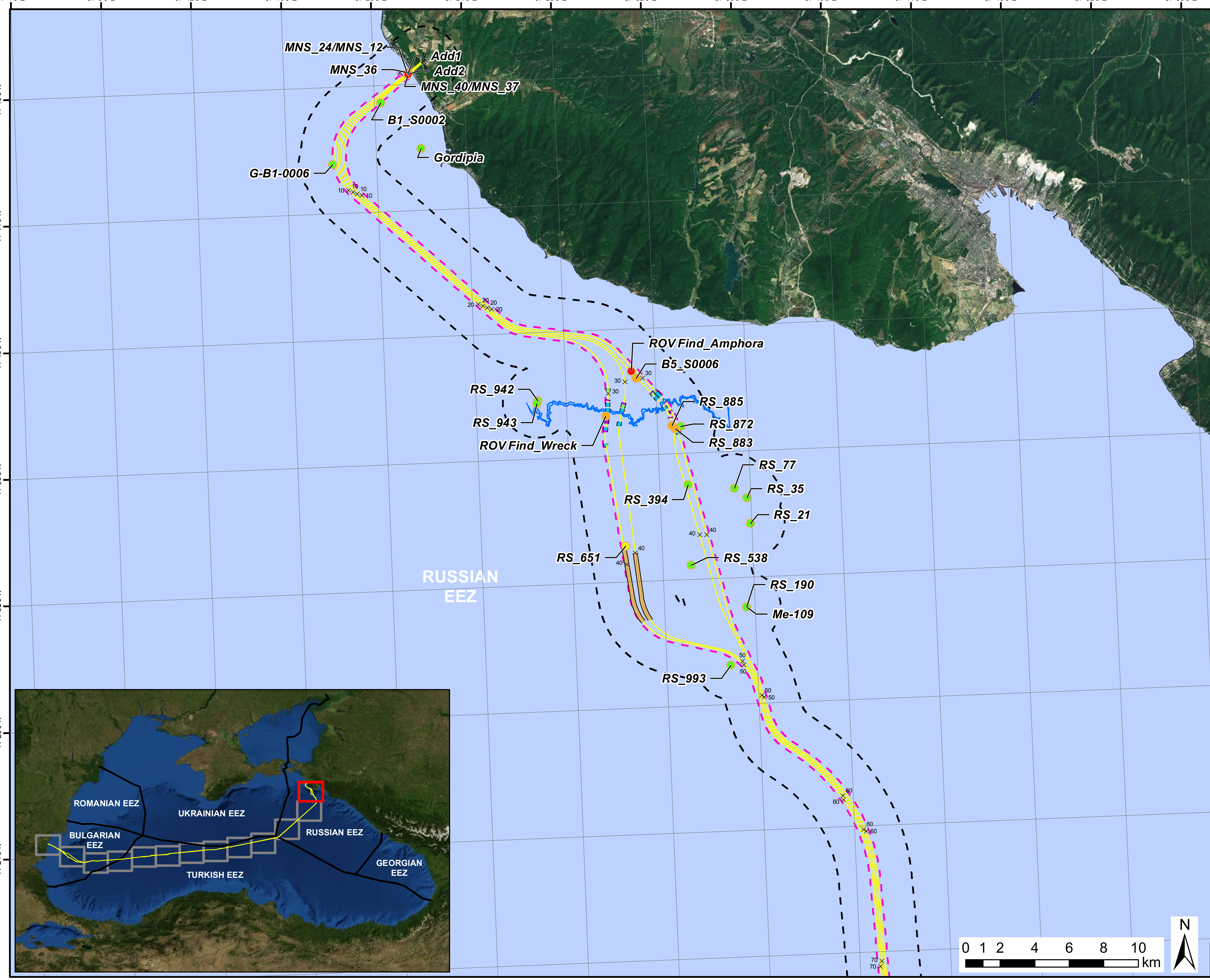
Drawing Number: Figure 16.6

Rev

Plot Date: 04 Mar 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 16 Cultural Heritage\Figure 16.6 Relationship between Kurgan (RU-TCH-02), its 125m Protective Buffer, and the Location of Microtunnels.mxd



LEGEND

Russian Sector of South Stream Offshore Pipeline

- Proposed offshore pipelines
- × 10km markers

Marine Targets

Distance from pipeline

- < 50m
- 50 - 100m
- 100 - 150m
- > 150m

Seabed Intervention

- Crossings
- Free spans (dynamic)
- Free spans (static)
- Rockfall protection
- Turbidity current
- Limit of anchoring spread area
- Temporary storage area for dredged material
- Zone of potential influence
- Survey area
- Exclusive Economic Zone boundary

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue
For Information

Client
South Stream Offshore Pipeline ENERGISING EUROPE

Project Title
SOUTH STREAM OFFSHORE PIPELINE

Drawing Title
MARINE TARGETS ON PROPOSED PIPELINE ROUTE (RUSSIA: NORTH-EASTERN SECTION)

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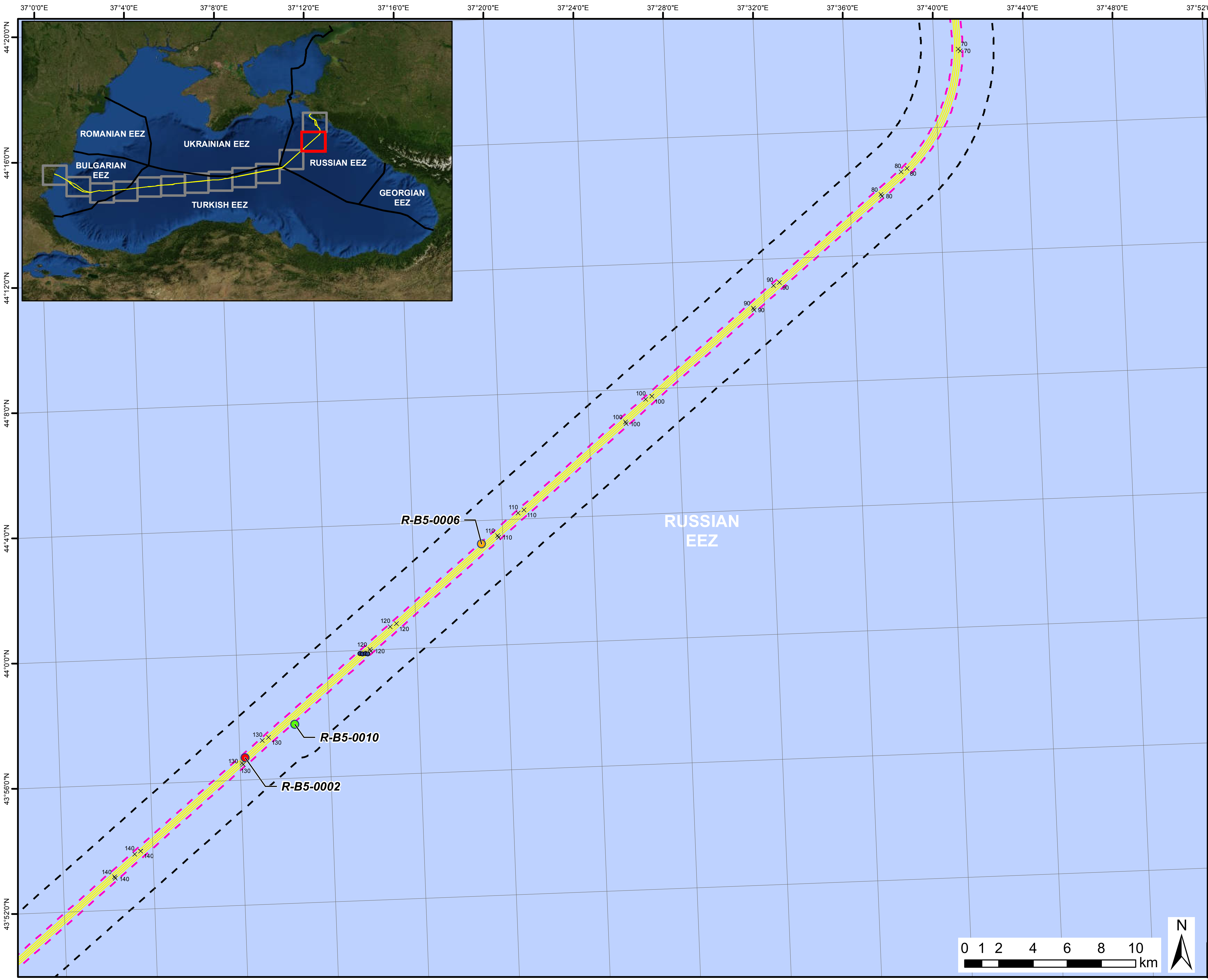
Drawing Number
Figure 16.7

Rev

Plot Date: 16 Apr 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 16 Cultural Heritage\Figure 16.7 Marine Targets on Proposed Pipeline Route (Russia North-eastern Section).mxd



LEGEND

Russian Sector of South Stream Offshore Pipeline

Proposed offshore pipelines

10km markers

Marine Targets

Distance from pipeline

< 50m

50 - 100m

100 - 150m

> 150m

Seabed Intervention

Crossings

Free spans (dynamic)

Free spans (static)

Rockfall protection

Turbidity current

Limit of anchoring spread area

Temporary storage area for dredged material

Zone of potential influence

Survey area

Exclusive Economic Zone boundary

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue

For Information

Client

South Stream Offshore Pipeline ENERGISING EUROPE

Project Title

SOUTH STREAM OFFSHORE PIPELINE

Drawing Title

MARINE TARGETS ON PROPOSED PIPELINE ROUTE (RUSSIA: CENTRAL SECTION)

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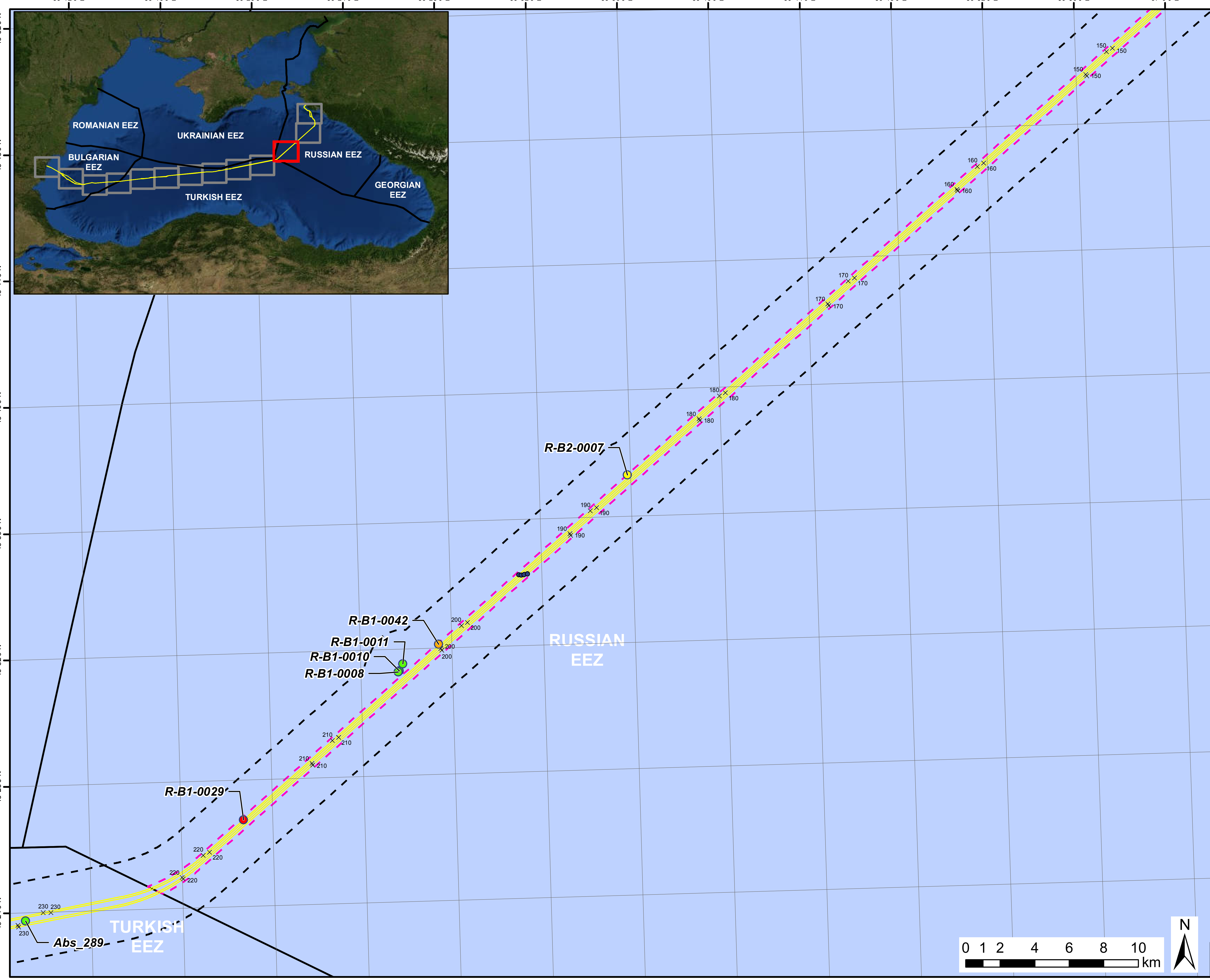
Drawing Number

Figure 16.8

Rev

Plot Date: 16 Apr 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 16 Cultural Heritage\Figure 16.8 Marine Targets on Proposed Pipeline Route (Russia Central Section).mxd



LEGEND

Russian Sector of South Stream Offshore Pipeline

- Proposed offshore pipelines
- 10km markers

Marine Targets

Distance from pipeline

- < 50m
- 50 - 100m
- 100 - 150m
- > 150m

Seabed Intervention

- Crossings
- Free spans (dynamic)
- Free spans (static)
- Rockfall protection
- Turbidity current
- Limit of anchoring spread area
- Survey area
- Temporary storage area for dredged material
- Zone of potential influence
- Exclusive Economic Zone boundary

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue

For Information

Client

South Stream Offshore Pipeline ENERGISING EUROPE

Project Title

SOUTH STREAM OFFSHORE PIPELINE

Drawing Title

MARINE TARGETS ON PROPOSED PIPELINE ROUTE (RUSSIA: SOUTH-WESTERN SECTION)

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Drawing Number: Figure 16.9 | Rev

Plot Date: 16 Apr 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 16 Cultural Heritage\Figure 16.9 Marine Targets on Proposed Pipeline Route (Russia South-western Section).mxd

Compounding this issue are low sedimentation rates and shallow bedrock, conditions that offer little to no depositional protection from these high energy environments. While there is a possibility for archaeological remains to exist, it is unlikely that intact, undisturbed archaeological deposits will be encountered during Project activities in the shallow-water marine environment.

Geophysical and cultural heritage field surveys conducted in 2011 and 2012 discovered a total of 26 CHOs and potential CHOs within the marine Survey Area of the offshore and nearshore sections in Russian territorial waters and EEZ (Table 16.4; Refs. 16.75 to 16.83), three of which were within the marine Zone of Potential Influence. Table 16.7 below and Figure 16.7, Figure 16.8 and Figure 16.9 show the geographical distribution of these targets. The locations of the continental shelf, continental slope and abyssal plain are discussed in **Chapter 7 Physical and Geophysical Environment**.

Table 16.7 Marine CHOs and Potential Marine CHOs within the Marine Survey Area

Oceanographic Region	Number of CHOs and Potential CHOs within the marine Survey Area	Number of CHOs and Potential CHOs within the marine Zone of Potential Influence*
Nearshore	0	0
Continental shelf	4	2
Continental slope	12	1
Abyssal plain	9	0
TOTAL	**25**	**3**

*This area is defined as within 150 m of the nearest pipeline centreline.

16.5.4.3 Objects within the Zone of Potential Influence - Marine

There are a total of three CHOs located within the marine Zone of Potential Influence i.e. within 150 m of the centreline of any of the four pipelines. These targets (RU-MCH-001 [original designation B5_S0006], RU-MCH-003 [ROV Find_Amphora], and RU-MCH-004 [ROV Find_Wreck]) are positively identified CHOs that range in date potentially from the medieval period to the modern period. The locations of these objects are shown on Figure 16.7 to Figure 16.9, whilst an illustrated inventory is presented in Appendix 16.2. These objects are discussed below.

Object RU-MCH-001 (recorded during original surveys as target B5_S0006) is an aircraft wing with an integrated fuel reservoir that lies at a depth of 78 m on the continental shelf. The object measures 6 m long by 2 m wide, and appears to be primarily constructed of metal. A determination on the identification of the exact aircraft type could not be made from the available data. This object is not an archaeological monument, but is a CHO in accordance with

Federal Law No.73-FZ of June 25, 2002. It is located approximately 56.7 m to the west of the originally proposed centreline of pipeline route # 3.

Object RU-MCH-003 (originally recorded as ROV Find_Amphora & RS_Cab Ph) is a single ceramic amphora that lies at a depth of 72 m on the continental shelf. This appears to be an isolated find, as there are no other associated objects or materials in the immediate vicinity of the amphora. A determination on the exact cultural affiliation could not be made from the available data, but preliminary analysis suggests it could potentially date to the medieval period. This object is not an archaeological monument, but is a CHO in accordance with Federal Law No.73-FZ dated 25 June 2012. It is located 23.9 m east of the originally proposed centreline of pipeline route #3.

Object RU-MCH-004 (recorded during original surveys as ROV Find_Wreck) is a wooden shipwreck that lies at a depth of 442.8 m on the continental slope. The wreck is mostly buried and only one end of the vessel protrudes from the seabed. A determination on the exact cultural affiliation or date could not be made from the available data. This object is not an archaeological monument, but is a CHO in accordance with Federal Law No.73-FZ dated 25 June 2012. It is located 69.7 m west of the originally proposed centreline of pipeline route #1.

The remaining nineteen potential CHO targets within the marine Survey Area. (targets R-B1-0029, R-B1-0042, R-B2-0007, R-B5-0006) are potential CHOs that will be avoided by pipeline re-routing (see Section 16.7).

In addition, seven anthropogenic targets that are not CHOs have been identified within 150 m of individual pipelines. Two acoustic targets (Add1 and Add2) in the nearshore section were determined to be modern-period metal structures, likely to be disarticulated marine cranes, in 12 m to 16 m of water. Three magnetic targets (MNS_24/MNS_12, MNS_36, and MNS_40/MNS_37) were identified in the nearshore section as metal anchors and anchor components in 10 m to 12 m of water that date to the modern period. Finally, two acoustic targets (RS_883 and RS_885) on the continental slope were identified as modern-period debris. Target RS_883 is an anchor chain at a depth of 762 m, and target RS_885 is a wooden rod at a depth of 712 m. Although these objects are not CHOs, they are noted so as not to impact Project activities.

16.5.4.4 Objects outside the Zone of Potential Influence but within the Survey Area – Marine

Twenty-two objects are located outside the Zone of Potential Influence and the Anchoring Spread Area, but within the marine Survey Area. Of these, two are aircraft wrecks/remains, one is a shipwreck, and 19 have been identified as potential CHO. This assessment is based on their size (greater than 5 m long), shape, height off the bottom, and acoustic reflectivity in the side-scan sonar images. These are detailed in Appendix 16.2 and illustrated on Figure 16.7 to Figure 16.9.

16.5.5 Critical Cultural Heritage

The Project has the potential to impact critical cultural heritage as defined in IFC PS8 (Ref. 16.3) given the presence of one formally designated site, a burial mound (*kurgan*) (RU-TCH-02, National Monument No. 363) located approximately 50 m northwest of the pipeline microtunnel section (Section 16.6.5.1).

The Project also has the potential to impact peripheral elements of Bronze Age, Antique and medieval occupation at Varvarovka-1 (RU-TCH-03), Varvarovka-2 (RU-TCH-04) and Varvarovka-3 (RU-TCH-05). As outlined in Section 16.5.4.1 the Department of the Protection, Restoration and Operation of Historical and Cultural Values (Heritage) of Krasnodar Region considers that these features do not warrant classification as Cultural Heritage Objects or National Monuments due to their unstratified character (Ref. 16.112; Appendix 16.4). These sites therefore do not constitute critical cultural heritage as defined in IFC PS8 (Cultural Heritage) (Ref. 16.3).

The nearest World Heritage property is the Western Caucasus natural heritage site (WHS 900), located more than 50 km to the southeast of the landfall section of the Project. The World Heritage Tentative List archaeological site of the Hellenistic city of Tanais (Ref. 5422) is located approximately 270 km to the northeast of the landfall section of the Project, in the Rostov on Don Region (Ref. 16.42).

16.5.6 Palaeontological Heritage

The underlying geology of the area comprises a system of ridges of the Black Sea Caucasus, folded Palaeozoic Era structures (c.541 to 252.2 Ma) and Jurassic (c.201 to 152 Ma) and Cretaceous (c.145 to 72 Ma) period strata (Ref. 16.141; periods defined by the International Commission on Stratigraphy v2013/01, Ref. 16.86). For further details on geology and soils, see **Chapter 7 Physical and Geophysical Environment**.

The Black Sea region was submerged beneath an ocean during the Mesozoic Era (c.252 to 66 Ma), and it is rich in marine fossils of the Miocene (c.23 to 5 Ma) and Pliocene (c.5 to 2.5 Ma) series, including molluscs, gastropods and bivalves; the fossilised bones of sea turtles and cetaceans have also been found. These deposits are frequently revealed in cliff faces and eroded river and stream channels. Above these fossiliferous deposits is a mantle of Quaternary Period (c.2.6 Ma to present) deposits comprising soils and coastal marine sediments. Sediments may contain climatic and environmental indicators such as diatoms, ostracods and formanifera (Ref. 16.142). Other fossil bearing deposits are as follows:

- The Palaeozoic basement may contain remains of Carboniferous (c.358 to 323 Ma) marine fossils (conodonts, brachiopods, corals, echinoderms, mollusca, benthonic formanifera; plant microflora, branches, leaves) and Permian (c.300 to 252 Ma) plant microflora;
- Jurassic strata (c.208 to 146 Ma) may contain fossils of ichthyosaurs and plesiosaurs, fish, bivalves, belemnites, brachiopods, echinoids, starfish, sponges and ammonites; and
- Cretaceous strata (c.146 to 65 Ma) may contain fossil remains of sharks, rays, fish, ichthyosaurs, plesiosaurs, mosasaurs, baculites, marine diatoms (Ref. 16.143; Ref. 16.144).

The Cenozoic Era (c.65 Ma to present) saw the development of mammals, birds, protozoa and flowering plants. Cenozoic fossils from limestone areas include marine fauna such as shells, sea urchins, sharks, marine reptiles, whilst terrestrial fauna included reptiles, birds and mammals.

Pliocene fossil remains of hominin and faunal remains have been found at Dmanisi, Georgia (Section 16.5.2.1). During the Quaternary Period (2.6 Ma to present), a series of repeated glaciations during the Pleistocene Epoch (1.8 Ma to 11,700 BP) saw the extinction of large mammals. The remains of bison, mammoth, megaloceros, aurochs and cave bears have been recovered from the inland Ilskaya I and II caves (Ref. 16.89). During the Upper Palaeolithic cold periods, mammoth bone was used to construct huts and reindeer, bison and woolly rhinoceros were hunted.

The Project Area does not contain any refuges such as caves, so has little potential for harbouring fossils of Quaternary Period megafauna. However, Quaternary sediments, in particular marine sediment sequences, have the potential to contain evidence for past climatic and environmental conditions, including evidence of sea level changes. Such sediments are present across the entire Black Sea marine region, and are subject to on-going targeted research programmes; deposits in the vicinity of the proposed pipeline route do not present any specific interests or research targets.

16.6 Impact Assessment

16.6.1 Impact Assessment Methodology

The impact assessment methodology specific to cultural heritage, presented in this section, builds upon the general assessment methodology summarised in **Chapter 3 Impact Assessment Methodology**. The methodology is then developed specifically in relation cultural heritage receptors in relation to impacts arising from the construction, operation and decommissioning of the Project, as is further outlined below.

16.6.1.1 Federal and Regional Legislation

As detailed in **Chapter 2 Policy, Regulatory and Administrative Framework**, this cultural heritage assessment has taken into consideration national legislation, including the Constitution of the Russian Federation (Ref. 16.4), the Civil Code of the Russian Federation (Ref. 16.7), Foundations of Russian Federation Legislation on Culture No. 3612-1 (Ref. 16.5) and Federal Law of June 25, 2002 No. 73-FZ "On Objects of Cultural Heritage (Historical and Cultural Monuments) of the Russian Federation" (Ref. 16.8).

The Constitution of the Russian Federation establishes the right of every person to have access to cultural values (Clause 44, P. 3) and the responsibility of every person to preserve historical and cultural heritage, to protect monuments of history and culture (Clause 44, P. 3), and to preserve nature and environment, treating natural receptors with care (Clause 58). Federal law states that the cultural heritage (monuments of history and culture) of the Russian Federation is a unique value for the multinational people of the Russian Federation and forms an integral part of the world cultural heritage, and notes that State protection of cultural heritage (monuments of history and culture) is one of the priorities of the authorities of the Russian Federation, the state authorities of the Russian Federation and local self-government (Ref. 16.4).

Penalties for damage to heritage are set out in the Civil Code of the Russian Federation (Ref. 16.7). The objectives of the Foundations of Russian Federation Legislation on Culture No. 3612-1 (Ref. 16.5) are the maintenance and protection of the constitutional rights of citizens of the Russian Federation for cultural activities, the establishment of legal guarantees for free cultural activities of associations of citizens, peoples and other ethnic communities of the Russian Federation, the definition of the principles and rules of law related to subjects cultural activity and the definition of the principles of state cultural policy, legal rules for state support for culture and guarantees of non-interference in the creative process.

According to Federal Law No. 73-FZ (Ref. 16.8), all cultural receptors and objects of cultural heritage are considered to be the exclusive property of the State, and are protected by the State. Archaeological sites, both formally registered and newly identified, are considered to be objects of cultural heritage of a federal value. According to Article 46 of the Law, individuals and legal entities engaged in business and other activities in the territory of the CHOs are obliged to observe the procedure of use of this territory as established in the Federal Law and Land Laws of the Russian Federation. The broad objective of these regulations is to avoid harm to cultural objects. Article 61 sets out criminal, administrative and other legal liability in the event of violation of the Law.

Other applicable cultural heritage legislation includes:

- Land Code of the Russian Federation (Articles 3, 27, 56, 99) (Ref. 16.9);
- Law of the Russian Federation "On the Subsurface Resources" (Ref. 16.10);
- Urban Planning Code of the Russian Federation (Ref. 16.11);
- Criminal Code of the Russian Federation (Ref. 16.12, Article 164, Article 243);
- Federal Law of 14 January 1993 No. 4292-1 "On the Perpetuation of the Memory of those who Died in Defence of the Fatherland" (Ref. 16.13);
- Federal Law of 12 January 1996 No. 8-FZ "On Burial and Funeral" (Ref. 16.14); and
- Other normative legal acts of the Russian Federation on the protection and use of cultural heritage.

This cultural heritage assessment takes account of Krasnodar regional legislation, including Krasnodar Regional Laws:

- "On Culture" (No. 325, 2000) (Ref. 16.15);
- "On the Objective Composition of Local Immovable Historical and Cultural Monuments Located in the Territory of the Krasnodar Region" (2000) (Ref. 16.16);
- "On Cultural Heritage (historical and cultural) of the Russian Federation located in the Krasnodar Territory" (and subsequent amendments, No. 558-KZ, 06.02.2003) (Ref. 16.17);
- "On Immovable Monuments of History and Culture of Regional Importance", Situated in Krasnodar Krai (2009) (Ref. 16.18);

- "On the Designated Areas and Protection Zones of Immovable Cultural Heritage (Historical And Cultural Monuments) of Regional and Local Value Located in the Krasnodar Region" (No. 2316-KZ, 19.07.2011) (Ref. 16.19);
- "On Burial and Funeral Business in the Krasnodar Territory" (No. 666-KZ, 04.02.2004) (Ref. 16.20); and
- The Krasnodar Governor's Resolution "On Amendments to the decree of the Head of Administration of Krasnodar Region of 09.09.2011 No. 975. On the control of the protection, restoration, use and cultural values (Heritage) of the Krasnodar region" (No. 455, 2007) (Ref. 16.21).

16.6.1.2 International Agreements

The Russian Federation has ratified a number of international conventions regarding cultural heritage including various conventions of the Council of Europe (CoE), International Commission on Monuments and Sites (ICOMOS) and the United Nations Educational, Scientific and Cultural Organization (UNESCO), which are set out in Table 16.8.

Table 16.8 Summary of Relevant International Agreements

Agreement and Objective	Objective	Date of Ratification
UNESCO 1970 Convention on the Means of Prohibiting and Preventing the Illicit Import, Export and Transfer of Ownership of Cultural Property (Convention on Cultural Property)	Prohibits and prevents the illicit import, export and transfer of ownership of cultural property and aims to discourage the pillage of archaeological sites and cultural heritage by controlling international trade in looted antiquities through import controls and other measures.	28 April 1988
UNESCO 1972 Convention concerning the Protection of the World Cultural and Natural Heritage (World Heritage Convention)	To ensure that effective and active measures are taken for the protection, conservation and presentation of the "cultural and natural heritage" on its territories.	12 October 1988
UNESCO 2001 Convention on the Protection of the Underwater Cultural Heritage	The Convention sets out basic principles for the protection of underwater cultural heritage; provides a detailed State cooperation system; and provides widely recognised practical rules for the treatment and research of underwater cultural heritage.	Not ratified by Russian Federation, but is internationally accepted as Good International Industry Practice (GIIP) and is cited in IFC GN8 (Ref. 16.30)

Continued...

Agreement and Objective	Objective	Date of Ratification
UNESCO 2003 Convention for the Safeguarding of the Intangible Cultural Heritage	To safeguard and ensure respect for the world's Intangible Cultural Heritage, including raising awareness of the importance of intangible heritage and encouraging international cooperation and assistance.	Ratification process not yet completed
UNESCO 2005 Convention on the Protection and Promotion of the Diversity of Cultural Expressions	Recognises the rights of states to protect and promote the diversity of cultural expressions, encompassing cultural and natural heritage, movable cultural property, intangible cultural heritage and contemporary creativity.	Ratification process not yet completed
CoE 1954 European Cultural Convention	To develop mutual understanding among the peoples of Europe and reciprocal appreciation of their cultural diversity, to safeguard European culture, to promote national contributions to Europe's common cultural heritage respecting the same fundamental values.	21 February 1991
CoE 1995 European Convention on the Protection of the Archaeological Heritage (revised) (Valetta Convention)	Notes that cultural heritage comprises "all remains and objects and any other traces of mankind from past epochs… The archaeological heritage shall include structures, constructions, groups of buildings, developed sites, moveable objects, monuments of other kinds as well as their context, whether situated on land or under water". Makes the conservation and enhancement of the archaeological heritage one of the goals of urban and regional planning policies. Sets guidelines for the funding of excavation and research work and publication of research findings.	12 October 2011
CoE 1985 Convention for the Protection of the Architectural Heritage of Europe (Granada Convention)	Reinforces and promotes policies for conserving and enhancing Europe's heritage. Affirms the need for European solidarity with regard to heritage conservation and fosters practical co-operation among the Parties.	13 November 1990

Continued…

Agreement and Objective	Objective	Date of Ratification
UNCLOS 1982 United Nations Convention on the Law of the Sea	Comprehensive regime of law and order in the world's oceans and seas establishing rules governing all uses of the oceans and their resources. Article 303 notes that "States have the duty to protect objects of an archaeological and historical nature found at sea and shall co-operate for this purpose". This article also gives coastal states limited rights to protect cultural heritage within the contiguous zone. Article 149 states that "all objects of an archaeological and historical nature found [on the seabed underneath the high seas] shall be preserved or disposed of for the benefit of mankind as a whole, particular regard being paid to the preferential rights of the State or country of origin, or the State of cultural origin, or the State of historical and archaeological origin".	12 March 1997
UNESCO 1956 Recommendation on International Principles Applicable to Archaeological Excavations (New Delhi)	To ensure the protection of its archaeological heritage, the provision of archaeological services, the control over accidental discoveries and the upkeep of excavation sites and monuments, the establishment of museums and public education, and the repression of clandestine excavations and of the illicit export of archaeological finds.	5 December 1956
ICOMOS 1990 Charter for the Protection and Management of the Archaeological Heritage (Lausanne Charter)	Notes that archaeological heritage is a fragile and non-renewable cultural resource, and that policies for the protection of the archaeological heritage should be integrated into land use, development, planning, cultural, environmental and educational policies. Sets out principles of survey, investigation, maintenance, protection, presentation, information, reconstruction, training, international cooperation.	11 October 1990

Complete.

16.6.1.3 Standards and Guidelines for Financing

IFC Performance Standard and Guidance on Cultural Heritage (Ref. 16.3 and Ref. 16.30) aims to protect cultural heritage from the adverse impacts of Project activities and supports its preservation, in accordance with the World Heritage Convention (Ref. 16.1). Its scope includes:

- Tangible cultural heritage with archaeological, palaeontological, historical, cultural, artistic, and religious values;
- Unique natural features or tangible objects that embody cultural values, such as sacred groves, sacred trees, rocks, lakes, and waterfalls;
- Intangible forms of culture proposed to be used for commercial purposes, such as cultural knowledge, innovations, and practices of communities embodying traditional lifestyles; and
- Critical Cultural Heritage - internationally recognised or legally protected cultural heritage areas, including proposed World Heritage Sites. Heritage of communities who use, or have used within living memory, the cultural heritage for long-standing cultural purposes.

In addition, this cultural heritage assessment has been developed with reference to the OECD Common Approaches (Ref. 16.31).

Where further detailed guidance was needed and was not covered by the IFC PS or OECD Common Approaches, the Project has referred to UNESCO and ICOMOS guidance as appropriate.

16.6.2 Impact Assessment Criteria

The criteria used to assess the potential impacts upon cultural heritage sites follow the current international standard for cultural heritage impact assessment, issued by the International Council on Monuments and Sites (Ref. 16.145). It is acknowledged that this current international standard contains much reference to World Heritage, but the assessment tools contained within its appendices are applicable to all cultural heritage. It has been adapted for Russia by applying tiered national standards based on the designation level of known monuments. Cultural monuments are classified according to national standards by type and their significance to Russian culture and history.

16.6.2.1 Receptor Sensitivity

Identified cultural heritage features have been evaluated for their sensitivity in accordance with Table 16.9 which presents a description of receptor sensitivity, (using the categories High, Moderate, Low and Negligible) and highlights relevant applicable legal standards. The terms High, Moderate, Low and Negligible are terms which correlate to the impact assessment matrix which applies to the whole ESIA (**Chapter 3 Impact Assessment Methodology**)[7]. Legal standards are detailed in **Chapter 2 Policy, Regulatory and Administrative Framework** and in Section 16.6.2 Applicable Standards.

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[7] This is comparable to the categorisations adopted by national standards; the terms High and Major are deemed equivalent. The overall matrix for this ESIA has no 'Very High' category, and for this reason the 'High' category conflates sites of national and international sensitivity. No World Heritage Sites or proposed World Heritage Sites will be impacted by the Project.

The sensitivity of terrestrial and marine cultural heritage receptors also reflects how vulnerable or robust a site, monument, artefact, assemblage or complex is to damage or destruction by a number of factors, including:

- Natural conditions, such as erosion, flooding, wave movement and chemical deterioration;
- Environmental conditions, such as faunal and floral impacts;
- Human conditions, such as vandalism or interference, recreational use, e.g. vehicle damage, anchor strike; and
- Project-related conditions, including construction and operational impacts.

Table 16.9 Cultural Heritage Receptor Sensitivity

Sensitivity and Value	Description, based on ICOMOS 2011 Guidance on Heritage Impact Assessments for Cultural World Heritage Properties (appendices 3A and 3B)	Applicable Legal Standards*
High (D)	Sites of acknowledged international importance inscribed as World Heritage Sites. Individual attributes that convey Outstanding Universal Value. Nationally-designated archaeological monuments, sites, buildings or historic landscapes protected by national laws. Undesignated sites, structures or historic landscapes of demonstrable national value. Assets that can contribute significantly to acknowledged national or international research objectives, whether designated or not. Well or extremely well preserved historic landscapes or seascapes with considerable or exceptional coherence, time-depth, or other critical factors. Intangible Cultural Heritage inscribed on national registers, or associated with movements or individuals of national or global significance.	International: UNESCO World Heritage Sites UNESCO Representative List of the Intangible Cultural Heritage of Humanity IUCN Marine Protected Areas (Category III Natural monuments or features, including shipwrecks & and cultural sites) UNESCO Geoparks (with cultural heritage and/or palaeontology linkage) UNESCO MAB Biosphere Reserves (with cultural heritage linkage) Ramsar Convention on Wetlands of International Importance sites (with cultural heritage linkage) Russia: National Cultural Heritage Register of Russia & State Code of Particularly Valuable Objects of Cultural Heritage of the Peoples of the Russian Federation

Continued…

Sensitivity and Value	Description, based on ICOMOS 2011 Guidance on Heritage Impact Assessments for Cultural World Heritage Properties (appendices 3A and 3B)	Applicable Legal Standards*
Moderate (C)	Designated or undesignated sites, landscapes or seascapes that can contribute significantly to regional research objectives. Designated or historic (unlisted) buildings that have exceptional qualities or historical associations, with important historic integrity and contributing significantly to historic character. Designated or undesignated historic landscapes or seascapes of regional value, which would warrant designation. Intangible cultural heritage areas in local registers, or associated with movements or individuals of local importance.	Russia: National Cultural Heritage Register of Russia & State Code of Particularly Valuable Objects of Cultural Heritage of the Peoples of the Russian Federation
Low (B)	Designated or undesignated assets of local importance. Assets compromised by poor preservation and/or poor survival of contextual associations, or with little or no surviving archaeological interest. Assets with potential to contribute to local research objectives. Historic (unlisted) buildings of modest quality in their fabric or historical associations, or buildings or urban landscapes of no architectural or historical merit; buildings of an intrusive character. Undesignated historic landscapes or seascapes with importance to local interest groups, whose value is limited by poor preservation and/or poor survival of contextual associations. Landscapes or seascapes of little or no significant historical interest. Intangible cultural heritage activities of local significance, or associated with individuals of local importance. Poor survival of physical areas in which activities occur or are associated. Areas with few intangible cultural heritage associations or vestiges surviving.	Russia: National Cultural Heritage Register of Russia & State Code of Particularly Valuable Objects of Cultural Heritage of the Peoples of the Russian Federation

Continued…

Sensitivity and Value	Description, based on ICOMOS 2011 Guidance on Heritage Impact Assessments for Cultural World Heritage Properties (appendices 3A and 3B)	Applicable Legal Standards*
Negligible (A)	Assets with little or no surviving archaeological interest. Buildings or urban landscapes of no architectural or historical merit; buildings of an intrusive character. Areas with few intangible cultural heritage associations or vestiges surviving.	-
Unknown	The importance of the resource cannot be ascertained.	-

*These standards are theoretically applicable to impact assessment; however, there are no instances of World Heritage Sites, Representative Intangible Heritage, Category III Marine Protected Areas, Geoparks, MAB Biosphere Reserves or Ramsar sites with cultural heritage linkage within the Project Area of Influence.

Complete.

Taking into account the criteria presented in Table 16.9, Table 16.10 and Table 16.11 define terrestrial and marine cultural heritage receptor sensitivity, respectively (also refer to Appendix 16.1 and 16.2 for the cultural heritage inventories, and Figure 16.5, Figure 16.7 to Figure 16.9 for details of receptor location).

Table 16.10 Terrestrial Cultural Heritage Receptor Sensitivities

Terrestrial Cultural Heritage Receptor	Condition	Receptor Sensitivity
RU-TCH-01 – Grave of DS Kalinin, Hero of the Soviet Union (1910 – 1943)	The grave of DS Kalinin is a National Monument (local protection category). This public monument is in good condition, set back from the coastal highway.	High
RU-TCH-02 – Burial mound (kurgan)	The kurgan is a National Monument (local protection category). The perimeter of the 2.97 m high monument protection extends 125 m from the edge of the monument. The centre of the burial mound has been robbed in the past and the site is overgrown with trees and vegetation.	High
RU-TCH-03– Varvarovka-1 settlement, Antiquity	Occupation strata destroyed by vineyard ploughing, surviving only where cut into bedrock. Undesignated, area of unstratified (redeposited) cultural layers.	Low

Continued…

Terrestrial Cultural Heritage Receptor	Condition	Receptor Sensitivity
RU-TCH-04 – Varvarovka-2 settlement, Bronze Age to early Middle Ages	Occupation strata destroyed by vineyard ploughing, surviving only where cut into bedrock, including a possible oven or kiln. Undesignated, area of unstratified (redeposited) cultural layers.	Low
RU-TCH-05 – Varvarovka-3 settlement, Bronze Age to early Middle Ages	Occupation strata destroyed by vineyard ploughing, surviving only where cut into bedrock. Undesignated area of unstratified (redeposited) cultural layers.	Low
RU-TCH-06 – Varvarovka, village cemetery (within Site RU-ARCH-04), Armenian and Russian cemetery	Cemetery includes a National Monument, the common grave of Soviet soldiers and civilians killed or executed in 1942 – 1943. In good condition, well-maintained. The cemetery is an undesignated asset of local importance and the site of intangible cultural heritage activities of local significance. The sensitivity of the site is raised due to the presence of a National Monument.	High
RU-TCH-07 – Varvarovka, Armenian cemetery	20th century cemetery. In good condition, well-maintained. Undesignated asset of local importance and the site of intangible cultural heritage activities of local significance.	Low
RU-TCH-08 – Varvarovka, Russian Orthodox church under construction	Modern church under construction. Undesignated asset of local importance and the site of intangible cultural heritage activities of local significance.	Low
RU-TCH-09 – Varvarovka, monument and memorial to local people killed during the Great Patriotic War	Two war memorials which are National Monuments. In good condition. Both public monuments are located adjacent to main roads through the village.	High
RU-TCH-10 – Gai Kodzor Armenian Church and Cemetery	20th century church, cemetery and memorial chapel. In good condition. Undesignated asset of local importance and the site of intangible cultural heritage activities of local significance.	Low

Continued…

Terrestrial Cultural Heritage Receptor	Condition	Receptor Sensitivity
RU-TCH-11 – Gai Kodzor war memorials commemorating residents killed during the Great Patriotic War	Two war memorials which are National Monuments, a mass grave of fallen soldiers and executed villagers, and an obelisk to Soviet soldiers. In good condition. Both public monuments are located adjacent to the main road through the village, Str. Shaumyan.	High
RU-TCH-12 – Gai Kodzor Armenian Apostolic Church (Church of St Sarkis (St. Sergius))	Modern church built in 1997. Single red brick cell with a khachkar cross stone (RU-TCH-13). Non-replicable tangible cultural heritage of local importance and the site of intangible cultural heritage activities of local significance.	Low
RU-TCH-13 – Gai Kodzor Armenian khachkar	Cross stone brought from Armenia and erected in 1992. In good condition. The symbolism and craftsmanship of khachkars is inscribed on the UNESCO Representative List of the Intangible Cultural Heritage of Humanity, so this monument reflects Intangible Cultural Heritage associated with a movement of national or global significance.	High
RU-TCH-14 – St. Barbara's Source, Varvarovka	Natural spring reputed to have healing powers. Undesignated asset of local importance and the site of intangible cultural heritage activities of local or regional significance, as visited by non-local pilgrims.	Moderate
RU-TCH-15 – Cross, Supsekh	Large concrete cross erected in 2005 commemorating the 60th anniversary of the end of the Great Patriotic War. Used as a place of prayer. Undesignated asset of local importance and the site of intangible cultural heritage activities of local significance. Landmark.	Low
RU-TCH-16 – Sacred tree, Sukko/ Anapa road	Tree located west of the road between Sukko and Anapa. Prayer ribbons and cloth rags are suspended from its branches. Undesignated asset of local importance and the site of intangible cultural heritage activities of local significance.	Low
RU-TCH-17 – 'Walls of the Sea', west of Supsekh	A series of mortared sandstone walls of uncertain date and function at the base of a cliff. Undesignated. Subject to natural erosion.	Unknown

Continued…

Terrestrial Cultural Heritage Receptor	Condition	Receptor Sensitivity
RU-TCH-18 Varvarovka settlement	Varvarovka medieval settlement. Area 2ha (200x100 m). Located within vineyards. Designated, area of stratified cultural layers.	Low

Complete.

Table 16.11 Marine Cultural Heritage Receptor Sensitivities

Marine Cultural Heritage Receptor	Condition	Receptor Sensitivity
RU-MCH-001 Undesignated aircraft wing Continental shelf Modern period	A 20th century metal aircraft wing with integrated fuel reservoir. No other associated material appears to be in the immediate vicinity of this object. This undesignated modern site has limited complexity or contextual associations, and low potential for contributing to the understanding of aviation or aircraft construction techniques.	Low
RU-MCH-002 Metal component from either a marine vessel or an aircraft (possibly a wing) Continental slope Modern period	A 20th century metal object that is a component of either a marine vessel or aircraft (possibly a wing, the object is in a state of disrepair). No other associate material appears to be in the immediate vicinity of this object. This undesignated modern site has limited complexity or contextual associations, and low potential for contributing to the understanding of ship/aircraft construction techniques.	Low
RU-MCH-003 Single ceramic amphora Continental shelf c. Medieval period	A single intact ceramic amphora that may date to the medieval period. This isolated find has limited complexity or contextual associations, and moderate potential for contributing to the understanding of maritime trade interactions and cargoes.	Moderate
RU-MCH-004 Undesignated wooden shipwreck Continental slope Probably medieval to post-medieval periods	This undesignated site has potential to contribute to the understanding of Black Sea ship construction techniques and maritime trade. Mostly protected by covering silts on the sea floor. There is no evidence that the wreck has been disturbed after it sank.	High

Continued...

Marine Cultural Heritage Receptor	Condition	Receptor Sensitivity
19 potential CHOs	These potential CHOs had not been investigated at the time of developing the EIA and it has been conservatively assumed that they are CHOs for the purpose of the assessment.	High

Complete.

16.6.2.2 Impact Magnitude Criteria

Table 16.12 presents a description of the magnitude of change to cultural heritage receptors that can be caused by a project, using the classifications High, Moderate, Low and Negligible, based on the current ICOMOS standard (Ref. 16.145).

Table 16.12 Cultural Heritage Impact Magnitude Criteria

Magnitude	Description, taken from ICOMOS 2011 Guidance on Heritage Impact Assessments for Cultural World Heritage Properties (appendices 3A and 3B)
High	Changes to most or all key archaeological sites such that the resource is totally altered. Changes to key architectural and artistic building elements such that the resource is totally altered. Change to most or all key historic landscape elements, parcels or components; extreme visual effects; gross change of noise or change to sound quality; fundamental changes to use or access; resulting in total change to historic landscape character unit. Comprehensive changes to setting (refer to the Glossary for definition). Major changes to an area affecting intangible cultural heritage activities, associations, visual links and cultural appreciation.
Moderate	Changes to many key materials of archaeological sites, such that the resource is clearly modified. Changes to setting that affect the character of the asset. Changes to many key historic building elements, or to the setting of an historic building, such that the resource is significantly modified. Change to many key historic landscape elements, parcels or components; visual change to many key aspects of the historic landscape; noticeable differences in noise or sound quality; considerable changes to use or access; resulting in moderate changes to historic landscape character. Considerable changes to an area affecting intangible cultural heritage activities, associations, visual links and cultural appreciation.

Continued…

Magnitude	Description, taken from ICOMOS 2011 Guidance on Heritage Impact Assessments for Cultural World Heritage Properties (appendices 3A and 3B)
Low	Minor changes to key archaeological sites, such that the resource is slightly altered or clearly modified. Slight changes to setting, or changes to setting that affect the character of the asset. Slight changes to the setting of key historic building structures. Changes to many key historic building structures, or to the setting of an historic building, such that the resource is slightly different and noticeably changed. Change to many key historic landscape elements, parcels or components; slight or minor visual change to many key aspects of the historic landscape; limited but noticeable differences in noise or sound quality; changes to use or access; resulting in limited to minor changes to historic landscape character. Minor changes to area that affect intangible cultural heritage activities, associations, visual links and cultural appreciation.
Negligible	Very minor or no changes to archaeological asset, historic building fabric or setting. Very minor or no changes to elements, parcels or components of landscapes or seascapes; no visual or audible changes. Very minor or no changes in amenity or community factors.
No change	No change.
Uncertain	The extent of data on the site or feature, or the nature of construction activities does not enable a determination of likely effects to be made at this stage.

Complete.

16.6.2.3 Impact Significance

Chapter 3 Impact Assessment Methodology details how impact significance (High, Moderate, Low, Not Significant) can be defined through the consideration of impact magnitude and receptor sensitivity criteria. The impact significance matrix presented in Table 16.13 has been applied in order to assign levels of significance to defined cultural heritage impacts.

Table 16.13 Impact Significance Matrix

		Receptor Sensitivity (Vulnerability and Value)			
		Negligible	*Low*	*Moderate*	*High*
Impact Magnitude (Extent, Frequency, Reversibility, Duration)	*Negligible*	Not significant	Not significant	Not significant	Not significant/Low*
	Low	Not significant	*Low*	Low/Moderate†	Moderate
	Moderate	Not significant	Low/Moderate	Moderate	High
	High	Low	Moderate	High	High

* Allows technical discipline author to decide if impact significance is Not Significant or Low.
† Allows technical discipline author to decide if impact significance is Low or Moderate.

16.6.3 Assessment of Potential Impacts: All Phases

16.6.3.1 Impact Sources

The cultural heritage baseline conditions as described in Section 16.5 have the potential to be impacted by various Project activities (as described in **Chapter 5 Project Description**). This section identifies the activities that are likely to take place during the Construction and Pre-Commissioning and Operational Phases of the Project that have an ability to generate an impact on cultural heritage receptors. The Project activities that have a potential to impact on cultural heritage within the terrestrial and marine Study Areas are discussed in below and summarised in Table 16.14.

The majority of the activities occur during the Construction and Pre-Commissioning Phase of the Project. Operational Phase activities have little potential to impact on terrestrial and marine cultural heritage receptors, as routine operational activities are infrequent, minimally invasive and will take place in areas that will have already undergone ground disturbance during the Construction and Pre-Commissioning Phase of the Project and have had any appropriate design control or mitigation measures implemented. Decommissioning Phase activities are not discussed further in this assessment (see Section 16.9).

Terrestrial Cultural Heritage Impact Sources

Table 16.14 outlined the Project activities that have the potential to impact upon cultural heritage receptors (both known and un-known) during the various Project phases – such activities have the potential to damage or destroy upstanding remains, surface scatters or buried, sub-surface remains.

Table 16.14 Project Activities that Could Potentially Impact Terrestrial and Marine Cultural Heritage

Phase	Activity	Onshore	Nearshore	Offshore
Construction & Pre-Commissioning (Terrestrial)	Preparation of access roads/ upgrades to junctions of existing roads	✓	x	x
	Open trench pipe-laying activities - from microtunnel entry pit to ESD valve stations by open trench method	✓	x	x
	Construction of landfall facilities	✓	x	x
	Establishment of microtunnel construction site	✓	x	x
	Increased site population	✓	x	x
	Increased construction related traffic	✓	x	x
Construction & Pre-Commissioning (Marine)	Pre-construction route surveys (ROV, side-scan sonar etc.) and as-built survey. Removal of any obstacles (e.g. wrecks, munitions, boulders). Construction of crossings of third party infrastructure with concrete mattressing or rock placement etc. Placement of grout bags, concrete mattresses etc. on the seabed to correct free-span pipeline sections	x	✓	✓
	Dredging the microtunnel exit pits and the pipeline trenches in the nearshore area	x	✓	
	Laying pipe on seabed by S-Lay method (30 -600 m water depth) Laying pipe on seabed by J-Lay method (>600 m water depth)	x	✓	✓
	Abandonment and recovery operations relating to ROV (if necessary due to weather or emergency conditions (e.g. anchor strike))	x	✓	✓
Operational	ROV and ROTV sonar and visual surveys along nearshore pipeline (initial ROV subsea leak inspection survey, surveys of critical sections, initially annually and subsequently more or less frequently, depending on actual findings). Maintenance/ repair to pipelines (e.g. span correction, corrosion or leakage repair). Abandonment and recovery operations (if necessary due to weather or emergency conditions (e.g. anchor strike))	x	✓	✓

The Construction Phase activities in the landfall section of the Project that have the potential to impact terrestrial cultural heritage are those involving ground clearance or excavation. In particular these may impact upon buried archaeological layers - such activities include:

- Vegetation and land clearance, grading and topsoil stripping;
- Open trench pipe-laying activities;
- Construction of shore crossing microtunnel facilities and foundations for shore pull winches and sheaves;
- Construction of landfall facilities;
- Excavation of foundations, underground chambers and areas for hardstanding formation, building foundations and piling; and
- Ancillary works, including:
    - The preparation of access roads and junction upgrades;
    - The preparation of temporary and permanent drainage channels, soakaways, diversions etc.; and
    - The establishment and use of temporary construction areas, topsoil storage areas, rubble and waste dumping.

It is considered that microtunnelling, which will occur at a depth of approximately 18 m below ground level in the vicinity of kurgan site RU-TCH-02, does not have the potential to physically impact upon archaeological deposits beyond the entry tunnels. This is because archaeological deposits and finds are generally located within the topsoil and subsoil, or cut into the uppermost surface of the underlying superficial geological deposits. In rural locations such as that of kurgan site RU-TCH-02, buried archaeological remains such as inhumations and structures associated with ritual activity are generally found at between 1.5 m and 0.1 m below ground level.

Use of construction vehicles may impact upon cultural heritage receptors through rutting or collision damage, whilst there are risks regarding the unauthorised removal of artefacts or vandalism as a result of increased human access to previously inaccessible areas (such impacts could also occur during pre-construction route surveys).

Some cultural heritage receptors, such as cemeteries, roadside war memorials (e.g. Varvarovka and Rassvet) which are located close to access routes may also be potentially impacted by noise and visual intrusion from Project traffic (which could occur during all Project phases). Visual aspects of setting are addressed in **Chapter 13 Landscape and Visual**.

As detailed in Section 16.6.3 operational activities have little potential to impact on cultural heritage receptors, as such activities will take place in areas that will have already undergone ground disturbance during the Construction and Pre-Commissioning Phase of the Project and may have had mitigation measures implemented. However, there would remain the potential for the illicit removal of archaeological remains or interference with sites as a result of limited increased movement of people undertaking routine operational tasks (**Chapter 5 Project Description**).

Marine Cultural Heritage Impact Sources

A number of Pre-construction and Construction Phase activities may impact upon the seabed or sedimentation regimes, resulting in potential disturbance of marine archaeological receptors (both known and unknown). The activities include the following and are summarised in Table 16.14:

- Use of underwater survey equipment (via ROV and any towed sensor arrays) during the pre-construction and construction pipeline route surveys (pre-lay, UXO, as-built), and during real time touch down monitoring of pipe-laying activity that may result in seabed contact by ROV strikes and thruster washing;
- Direct disturbance of the CHO as a result of pipe-laying;
- Direct disturbance of CHO as a result of anchoring activities associated with pipelaying. For the majority of offshore pipe-laying work the pipe-lay vessel will be manoeuvred along the pipe-lay route using DP. Anchored vessels can potentially be used in water depths of up to 600 m, although for the Project it is anticipated that anchoring will only be undertaken up to a water depth of approximately 350 – 380 m; and
- Seafloor intervention (which may cause disturbance and changes to erosion and sedimentation regimes) resulting from:
    - Removal of obstacles such as munitions, boulders etc.;
    - Drilling;
    - Dredging;
    - Placement of materials including concrete mattressing, rocks and grout bags; and
    - Pipe-laying and anchoring.

Operational Phase activities which may impact upon marine cultural heritage receptors include:

- Use of underwater survey equipment (via ROV and any towed sensor arrays) during the regular pipeline inspection activities that may result in seabed contact by ROV strikes and thruster washing(ROV sonar and visual surveys along pipeline e.g. initial ROV subsea leak inspection survey, surveys of critical sections, initially annually and subsequently more or less frequently, depending on actual findings); and
- Maintenance and repair to pipelines, which may result in seafloor intervention.

16.6.3.2 Project Design Controls

The engineering and design of the Project has incorporated a number of project control measures to ensure impact avoidance and minimisation; these measures are detailed in **Chapter 5 Project Description**. Design controls for cultural heritage include the following:

- Optimisation of the marine pipeline route to avoid known and potential CHOs by a 150 m buffer. This avoidance buffer distance was chosen after careful consideration of engineering and design constraints and after a review of commonly-used avoidance buffer intervals for similar marine construction projects;
- Microtunnelling for terrestrial cultural heritage;

- Selection of terrestrial transportation routes to avoid sensitive cultural heritage objects or sites; and
- Construction of road by-passes to avoid routing heavy traffic through the communities of Gai Kodzor and Varvarovka. The route of the Project temporary access road was moved further to the east during the detailed design phase of the route, placing a buffer of a gully and vegetation between the road and cemetery RU-TCH-06.

These design controls reduce the risk of any adverse impacts to many receptors, both terrestrial and marine, that have been identified in the previous sections.

Table 16.15 below lists the terrestrial cultural heritage receptors that have been excluded, or scoped out, of the Impact Assessment as a result of the Project design controls.

Table 16.15 Terrestrial Scoped-out Receptors

Terrestrial Cultural Heritage Receptor	Reasons for scoping out
RU-TCH-01 – Grave of DS Kalinin, Hero of the Soviet Union (1910 – 1943) (20th century)	Traffic routes do not pass in the vicinity of the site
RU-TCH-07 – Varvarovka, Armenian cemetery (modern)	Varvarovka bypass
RU-TCH-08 – Varvarovka, Russian Orthodox church under construction (modern)	Varvarovka bypass
RU-TCH-09 – Varvarovka, monument and a memorial to local people killed during the Great Patriotic War (modern)	Varvarovka bypass
RU-TCH-10 – Gai Kodzor Armenian Church and Cemetery (modern)	Gai Kodzor bypass
RU-TCH-11 – Gai Kodzor war memorials commemorating residents killed in during the Great Patriotic War (modern)	Gai Kodzor bypass
RU-TCH-12 – Gai Kodzor Armenian Apostolic Church (Church of St Sarkis (St. Sergius)) (modern)	Gai Kodzor bypass
RU-TCH-13 – Gai Kodzor Armenian khachkar cross stone (modern)	Gai Kodzor bypass

Continued…

Terrestrial Cultural Heritage Receptor	Reasons for scoping out
RU-TCH-14 – St. Barbara's Source, Varvarovka (uncertain date)	Varvarovka bypass
RU-TCH-15 – Cross, Supsekh (modern)	Heavy traffic will be not be routed through Supsekh
RU-TCH-16 – Sacred tree, Sukko/Anapa road (modern)	Traffic routes do not pass in the vicinity of the site
RU-TCH-17 – 'Walls of the Sea', west of Supsekh (uncertain date)	Traffic routes do not pass in the vicinity of the site

Complete.

For marine cultural heritage only CHOs or potential CHOs that fall within 150 m of the centreline of the route of any of the four pipelines have been included in the Impact Assessment. Table 16.16 lists the marine cultural heritage receptors that have been scoped out of the assessment.

Table 16.16 Marine Scoped-Out Receptors

Marine Cultural Heritage Receptor	Reasons for scoping out
RU-MCH-002 Metal component from either a marine vessel or an aircraft (possibly a wing) Continental slope Modern period	Pipelines have been rerouted to avoid potential objects by a minimum of 150 m.
19 potential CHOs	Pipelines have been rerouted to avoid potential objects by a minimum of 150 m.

16.6.3.3 Assessment of Potential Impacts (Pre-mitigation)

Taking account of the potential Project impact sources as detailed in Section 16.6.3.1, it is possible to define levels of impact magnitude on each of the identified cultural heritage receptors as detailed in Table 16.10 and Table 16.11. Using the impact significance matrix as set out in **Chapter 3 Impact Assessment Methodology**, it is then possible to define the significance of potential impacts on terrestrial and marine cultural heritage prior to mitigation. Table 16.17 below defines both levels of impact magnitude on terrestrial and marine cultural heritage receptors, as well as defining impact significance.

Where different activities and Project phases are assessed to have different levels of potential impact on a given receptor, the highest level of potential impact has been assigned in Table 16.17.

Table 16.17 Summary of Predicted Impacts on Terrestrial and Marine Cultural Heritage (Without Mitigation)

Cultural Heritage Receptor	Phase	Impact	Receptor Sensitivity	Magnitude of Impact	Impact Significance Without Mitigation
RU-TCH-02 – Burial mound (kurgan) (Antiquity to medieval)	Pre-construction Construction Operation	Damage or destruction of archaeological deposits and layers	High	Low, since preserved in place	Low adverse
RU-TCH-06 – Varvarovka, village cemetery, Armenian and Russian cemetery	Construction: traffic	Changes to setting - increased noise and vibration	High	Low	Moderate adverse
RU-TCH-18 – Varvarovka, medieval village	Pre-construction Construction	Damage or destruction of archaeological deposits and layers	Low	Low	Low adverse
RU-MCH-001 – Aircraft wing	Pre-Construction, Construction, Operational, (Decommissioning)	Destruction of submerged cultural resources	Low	Moderate	Moderate adverse
RU-MCH-003 – Single ceramic amphora (medieval)	Pre-Construction, Construction, Operational, (Decommissioning)	Destruction of submerged cultural resources	Moderate	High	High adverse
RU-MCH-004 – Wooden shipwreck (probably medieval to post-medieval)	Pre-Construction, Construction, Operational, (Decommissioning)	Destruction of submerged cultural resources	High	Moderate	High adverse

Table 16.17 indicates that a number of cultural heritage receptors are potentially impacted – the sections below consider these receptors in terms of their sensitivity, impact magnitude during the various Project Phases, and the significance of potential impacts (without mitigation).

16.6.3.4 RU-TCH-02 – Burial Mound (kurgan) (Antiquity to Medieval)

- **Description:** National Monument (No. 363). Circular burial mound, 29 m in diameter and 2.97 m high. The centre has been robbed. Surrounded by a 125 m National Monument (No. 363) protection buffer zone;
- **IFC Classification:** Non-replicable tangible cultural heritage (archaeology);
- **Proximity to Project Works:** The microtunnels pipeline cross the 125 m National Monument (No. 363) protection buffer zone at a depth of approximately 18 m below ground level. The monument itself is located approximately 50 m north of the most northerly microtunnel (Figure 16.6); and
- **Sensitivity:** High (National Monument local protection category). The monument is assessed as being of regional value as it can contribute to regional research objectives. It has been subject to an unknown degree of tomb-robbing at some point in the past, the extent of which cannot be determined without intrusive investigation. It is assumed that its integrity is slightly compromised.
- **Magnitude of Impact:**
  - **Pre-construction works** may impact upon the burial mound. It is not considered that vehicle tracking (i.e. wheel damage from vehicles) or collision damage is likely to occur, as the monument is protected by dense vegetation. The site may be impacted by the unauthorised removal of artefacts or vandalism. The magnitude of this potential impact is low;
  - **Construction works** including vegetation clearance along the corridor, works associated with microtunnel insertion c.250 m to the northeast, traffic movements etc. may put the monument at risk of damage. The designated monument protection perimeter defines the extent of the registered monument which would experience changes to setting due to vegetation clearance. The magnitude of this potential impact is assessed as low; and
  - **Operational activities** will give rise to a small increase in the working population accessing the general area, increasing the risk of unauthorised removal of artefacts or vandalism. The magnitude of this impact is assessed as low.
- **Significance of impact:** A potential low magnitude impact during the Construction Phase on this high sensitivity receptor would result in an impact of low adverse significance; and
- **Overall impact:** Overall impact may be local (within the boundaries of the archaeological site), direct (directly affecting the archaeological receptor), permanent and of **low adverse** significance (see summary in Table 16.18).

Table 16.18 Impact on Receptor RU-TCH-02

Impact	Receptor	Receptor Sensitivity	Impact Magnitude	Significance of Potential Impact (Without Mitigation)
Adverse	Archaeological site	High	Low	Low adverse

16.6.3.5 RU-TCH-06 – Varvarovka, village cemetery, Armenian and Russian cemetery

- **Description:** This cemetery lies to the east of Varvarovka village, close to vineyards. The cemetery is extensive and divided into family plots. Includes the common grave of Soviet soldiers and civilians killed in the fighting and executed by the fascist invaders in 1942 and 1943 (National Monument No. 380);
- **IFC Classification:** Non-replicable tangible cultural heritage (historical, cultural, artistic and religious values);
- **Proximity to Project Works:** Cemetery located 398 m northwest of the north-western-most pipeline. Located approximately 10 m south of Gazprom Invest Road and approximately 100 m west of South Stream Transport temporary microtunnel access road. The alignment of the South Stream Transport temporary access road was designed to avoid running close to the cemetery;
- **Sensitivity:** High, as the site contains a National Monument;
- **Magnitude of Impact:** During the Construction Phase, the cemetery and cemetery visitors may be impacted by increased construction traffic movements (noise, visual intrusion and change to setting). Impact magnitude assessed as low. No impacts are anticipated during other Project phases;
- **Significance of impact:** A potential low magnitude impact during the Construction Phase on this high sensitive receptor would result in an impact of **moderate** adverse significance. Impacts limited to changes to setting, but noticeable differences in noise or sound quality and minor changes to area can affect intangible cultural heritage activities, associations, visual links and cultural appreciation; and
- **Overall impact:** Overall impact will be local (within the boundaries of the cemetery), indirect (affecting cemetery visitors), temporary and reversible (Construction Phase South Stream Transport temporary microtunnel access road) and permanent (Gazprom Invest Road permanent access road) and of **moderate adverse** significance (see summary in Table 16.19).

Table 16.19 Impact on Receptor RU-TCH-06

Impact	Receptor	Receptor Sensitivity	Impact Magnitude	Significance of Potential Impact (Without Mitigation)
Adverse	Cultural heritage site	High	Low	Moderate adverse

16.6.3.6 RU-MCH-001 – An Aircraft Wing on the Continental Shelf (78 m Water Depth) (Modern)

- **Description:** The site measures approximately 7.4 m long by 3.9 m wide, and is primarily constructed of metal. Located in the marine environment in less than 350 to 380 m of water. It dates to the modern period (20th century). The site does not appear to have any post-depositional anthropogenic disturbance;

- **IFC Classification:** Marine cultural heritage object with historical significance, assessed as being less than 100 years old by experts of the Russian Academy of Sciences;
- **Proximity to Project Works:** This undesignated aircraft wing lies 56.7 m west of pipeline #3;
- **Sensitivity:** The receptor's sensitivity is assessed as low due to its limited complexity and contextual associations, and low potential for contributing to the understanding of aviation or aircraft construction techniques;
- **Magnitude of Impact:**
  - **Pre-construction element of Construction Phase.** Pre-construction route surveys may impact upon the aircraft wing. There is a potential for underwater vehicle (e.g. ROV and AUV) damage resulting from collision, improper tether management fouling the object, or damage from thruster/propeller washing. Magnitude of impact is assessed as moderate, as the site is just over 50 m from the construction corridor;
  - **Construction Phase.** It is not anticipated that Construction Phase activities will have a direct impact upon the site. However, the increased activity near to the site increases the risk of potential ROV strikes. As this site is located in less than 350 to 380 m of water, it also has the potential to be impacted by vessel anchoring. Magnitude of impact is assessed as moderate; and
  - **Operational Phase.** Operational activities will give rise to a small increase in ROVs accessing the general area, increasing the risk of potential ROV strikes. Magnitude of impact assessed as moderate.
- **Significance of Impact:** A potential moderate magnitude impact on this low sensitive receptor would result in an impact of **moderate** adverse significance (**not significant** during the Decommissioning Phase); and
- **Overall Impact:** The overall impact will be local (within the boundaries of the receptor), direct (affecting the receptor), irreversible and of **moderate adverse** significance (see summary in Table 16.20).

Table 16.20 Impact on Receptor RU-MCH-001

Impact	Receptor	Receptor Sensitivity	Impact Magnitude	Significance of Potential Impact (Without Mitigation)
Adverse	Marine CHO	Low	Moderate	Moderate adverse

16.6.3.7 RU-MCH-003 – A Single Ceramic Amphora on the Continental Shelf (72 m Water Depth) (Medieval Period)

- **Description:** A single ceramic amphora that appears to be an isolated find, as there are no other associated objects or materials in the immediate vicinity. A determination on the exact cultural affiliation could not be made from the available data, but an examination of the object's shape suggests it could approximately date to the medieval period (4th to 15th centuries AD);
- **IFC Classification:** Movable marine cultural heritage object with archaeological significance;
- **Proximity to Project Works:** Amphora lying 23.9 m east of pipeline #3;
- **Sensitivity**: The receptor's sensitivity is assessed as moderate due to the potential for contributing to the understanding of maritime trade interactions and cargoes;
- **Magnitude of Impact:**
  - **Pre-construction element of Construction Phase**. Pre-construction route surveys may impact upon the amphora. There is a potential for underwater vehicle (e.g. ROVs and AUVs) damage resulting from collision, improper tether management fouling the object, or damage from thruster/propeller washing. Magnitude of impact is assessed as high, as the site is less than 50 m from the construction corridor and may require additional geophysical surveys;
  - **Construction Phase.** There is some potential that Construction Phase activities will have a direct impact upon the object. The increased activity near to the site increases the risk of potential ROV damage or unauthorised removal of the amphora. As this site is located in less than 350 to 380 m of water, it also has the potential to be impacted by vessel anchoring. Magnitude of impact is assessed as moderate; and
  - **Operational Phase.** Operational activities will give rise to an increase in ROVs accessing the general area, increasing the risk of potential ROV strikes or unauthorised removal of the object. Magnitude of impact is assessed as low.
- **Significance of Impact:** A potential high magnitude impact on this moderate sensitive receptor (during the Pre-construction Phase) would result in an impact of **High** adverse significance. Impact significance would be **Moderate** during the Construction Phase, **Moderate** during the Operational Phase and **Not Significant** during the Decommissioning Phase); and
- **Overall Impact:** Overall impact will be local (within the boundaries of the receptor), direct (affecting the receptor), irreversible and of **High** adverse significance (see summary in Table 16.21).

Table 16.21 Impact on Receptor RU-MCH-003

Impact	Receptor	Receptor Sensitivity	Impact Magnitude	Significance of Potential Impact (Without Mitigation)
Adverse	Marine CHO	Moderate	High	High adverse

16.6.3.8 RU-MCH-004 – A Wooden Shipwreck on the Continental Slope (442.8 m Water Depth) (Probably Medieval to Post-medieval)

- **Description:** An undesignated wooden shipwreck that is mostly buried beneath the seafloor, but has one end protruding up from the seafloor. A determination on the exact cultural affiliation or age could not be made from the available data. An assessment of visible construction features suggests this shipwreck could potentially date from the medieval to post-medieval periods (13th to 19th century);
- **IFC Classification:** Marine cultural heritage object with archaeological significance;
- **Proximity to Project Works:** Shipwreck located 69.7 m west of pipeline #1;
- **Sensitivity:** The receptor's sensitivity is assessed as high due to its potential for significant contributions to the understanding of early boat construction techniques and maritime trade on the Black Sea. It does not appear to have any post-depositional anthropogenic disturbance;
- **Magnitude of Impact:**
    - **Pre-construction element of Construction Phase.** Pre-construction route surveys may impact upon the shipwreck site. There is an increased potential for underwater vehicle (e.g. ROVs and AUVs) damage resulting from collision, improper tether management fouling the shipwreck, or damage from thruster/propeller washing. The site may be impacted by the unauthorised removal of artefacts during ROV examination of the site as a result of increased human access to previously unknown sites. Magnitude of impact is assessed as moderate, as the site is over 60 m distant from the construction corridor and will likely be exposed to additional geophysical surveys;
    - **Construction Phase.** There is potential that Construction Phase activities will have a direct impact upon the site. Given that this site is located in water depths greater than 350 to 380 m there are no impacts expected as a result of vessel anchoring. The increased activity near to the site increases the risk of potential ROV strikes, thruster washing, or unauthorised removal of artefacts. Magnitude of impact is assessed as moderate; and
    - **Operational Phase.** Operational activities will give rise to an increase in ROVs accessing the general area, increasing the risk of ROV strikes or unauthorised removal of artefacts. Magnitude of impact is assessed as low.
- **Significance of Impact:** A potential moderate magnitude impact on this high sensitive receptor (during the Pre-construction and Construction Phases) would result in an impact of high adverse significance. Impact significance would be **Moderate** during the Operational Phase and **Not Significant** during the Decommissioning Phase); and
- **Overall Impact:** Overall impact will be local (within the boundaries of the receptor), direct (affecting the receptor), irreversible and of **High** adverse significance (see summary in Table 16.22).

Table 16.22 Impact on Receptor RU-MCH-004

Impact	Receptor	Receptor Sensitivity	Impact Magnitude	Significance of Potential Impact (Without Mitigation)
Adverse	Marine CHO	High	Moderate	High adverse

16.7 Mitigation and Monitoring

Where the Project involves potential adverse impacts on cultural heritage, that have not been avoided through the application of Design controls (see Section 16.6.3.1), appropriate mitigation measures to avoid, minimise, mitigate and offset these impacts will be applied. The cultural heritage mitigation measures presented in this chapter are based on the policy, regulatory and administrative frameworks as outlined in **Chapter 2 Policy, Regulatory and Administrative Framework**, as well as national laws and regulations, international conventions ratified by the Russian Federation (Section 16.6.2) and Good International Industry Practice (GIIP).

An Environmental and Social Management Plan (ESMP) will be prepared for the Project before any on-site works begin (see **Chapter 22 Environmental and Social Management**). The ESMP will set out mitigation and monitoring measures, including those for cultural heritage mitigation and monitoring, as described in the sections below.

Mitigation and monitoring measures will include on-going engagement with the relevant authorities, as needed.

Mitigation measures will be designed and executed following national guidance as set out in **Chapter 2 Policy, Regulatory and Administrative Framework**:

- Guidelines for the design of archaeological work in areas of national economic construction (Ref. 16.26) and the Handbook of Instructions (HOI) on the Recommendations for Scientific Research, Survey, Design and Production Works, aimed at the preservation of the objects of the cultural heritage (monuments of history and culture) of the people of the Russian Federation (Ref. 16.73);
- Regulations on the Execution of Archaeological Fieldwork (archaeological excavations and surveys) and Compiling Scientific Report Documentation (Ref. 16.27);
- Order of the Federal Service for the Monitoring of Compliance with Legislation in the Area of the Protection of Cultural Heritage 'Regulation on procedure for issuance of authorizations (permits) for the right of works execution on determination and study of the archaeological heritage objects' (No. 15, 2011) (Ref. 16.146); and
- Archaeological survey and mitigation works will take account of SNiPs (Russian National Standards - Construction Norms and Rules) related to Engineering Surveys for Construction (SNiP 11-02-96; Ref. 16.22), Engineering and Environmental Investigations for Construction (SNiP 11-102-97; Ref. 16.23) and Pipelines (SNiP 2.05.05-85; Ref. 16.24), as well as

'Specifications for Project Documentation for Construction, Modernization and Reconstruction' (RD-91-010.ZO KTN-170; Ref. 16.25).

The overarching mitigation measure to prevent any adverse impacts on CHOs, which will be applied throughout the Project life cycle, consists of the adoption by South Stream Transport of a cultural heritage stewardship programme. The objective of such programme is to ensure that all parties involved in the construction, operation and decommissioning of the Pipeline are at all times aware of the importance of cultural heritage and that compliance with national legislation and international conventions is achieved during any activity associated with the Project.

Systematic stewardship of cultural heritage can be ensured throughout the Project life-cycle by developing and implementing a Cultural Heritage Construction Management Plan (CMP) during the Construction and Pre-Commissioning Phase of the Project (see Section 16.7.1) and Operational Management Plans (OMPs) during the Operational Phase (see Section 16.7.2). The Cultural Heritage CMP will be developed and implemented in consultation with the Department on the Protection, Restoration and Exploitation of Historical Cultural Values (Heritage) of Krasnodar Krai. Any archaeological survey and mitigation works will be performed in consultation with the Department on the Protection, Restoration and Exploitation of Historical Cultural Values (Heritage) of Krasnodar Krai.

Appropriate staff training in cultural heritage awareness will be undertaken by staff and subcontractors during all Phases of the Project to assist in the prevention of interference or accidental damage to cultural heritage. The approach to this training will be included within the Cultural Heritage CMP.

A Grievance Mechanism and on-going stakeholder engagement will be implemented as part of mitigation and monitoring measures.

A review of already-collected marine data suggests that chance finds of CHOs are highly unlikely to occur during Project construction and operation activities. A UXO survey will be carried out in advance of pipe-lay activities (see Section 16.7.1.1) to further reduce the possibility that a previously unidentified cultural heritage object, such as a small object that may not have been detected by geophysical surveys, will be encountered during pipe-laying activities. In addition, real time touch down monitoring of pipe-laying activity, using ROV, will be undertaken to confirm the absence of CHO along the pipeline route and to enable a prompt response in case of chance finds.

Should chance finds of cultural heritage objects occur during Project construction activities (including during UXO and pre-lay surveys and site mobilisation activities undertaken prior to construction), the Chance Finds Procedure will be implemented to allow the monitoring archaeologist to record and assess the find, and carry out an appropriate avoidance or mitigation response. The Cultural Heritage CMP will be discussed with the relevant Russian authorities. The relevant authorities will be informed of all chance finds. A Chance Find Procedure appropriate to the Operational Phase of the Project will be developed in advance of the commencement of this Phase. The Chance Find Procedure for all Phases of the Project will be developed in consultation with the Department on the Protection, Restoration and Exploitation of Historical Cultural Values (Heritage) of Krasnodar Krai.

Reducing the risk of looting, vandalism and damage to cultural heritage objects during the Construction and Pre-Commissioning and Operational Phases of the Project will be achieved through implementation of the Cultural Heritage CMP including staff cultural heritage awareness training.

In addition to the implementing the Cultural Heritage CMP the Project will implement specific mitigation measures during the various Project phases. Table 16.23 provides a summary of the cultural heritage mitigation measures – as the principal impacts on cultural heritage will be associated with the Construction Phase, the majority of proposed mitigation measures relate to this phase of the Project. These mitigation measures are explained in more detail in the sections that follow the table.

Table 16.23 Summary of Cultural Heritage Mitigation Measures by Project Phase

Phase	Terrestrial	Marine
Construction & Pre-Commissioning, including Pre-Construction Surveys	Protective flagging/fencing Provide security if required by authorities	UXO survey Real time monitoring of the pipe-laying activity Careful piloting of ROVs during surveying and during installation monitoring (such as avoiding ROV strikes, minimising propeller or thruster washing, tether management, use of ultra-short baselines and acoustic tracking) Establish baseline to permit monitoring and evaluation of sediment load where technically feasible
	Archaeological watching brief on groundworks	Archaeological watching briefs on pipe-lay vessels & nearshore approaches Identification of nature of RU-MCH-001 (aircraft wing) and, if warranted, observation, lifting to surface or relocation with the recording and statutory reporting of new coordinates of the object. Recovery of RU-MCH-003 (amphora)
	Traffic Management component of the Russian Landfall CMP	Anchor Management Plan Monitoring and evaluation of sediment loading where technically feasible
	Chance Find Procedures	
	Staff cultural heritage awareness training	
	Plotting of location of CHOs on Project mapping and GIS	

Continued…

Phase	Terrestrial	Marine
Construction & Pre-Commissioning, including Pre-Construction Surveys	A Grievance Mechanism and on-going stakeholder engagement will be implemented as part of mitigation and monitoring measures	
Operational	Application of Chance Find Procedures Plotting of location of CHOs on Project mapping and GIS Careful piloting of ROVs during surveying and maintenance activities	
	A Grievance Mechanism and on-going stakeholder engagement will be implemented as part of mitigation and monitoring measures	
Decommissioning	The need for additional survey and further impact assessment will be revisited once plans for the Decommissioning Phase have been finalised.	

Complete.

16.7.1 Mitigation Measures – Construction and Pre-Commissioning Phase

A Cultural Heritage CMP will be developed by South Stream Transport and it will include a Chance Find Procedure. If chance finds are identified during construction, different procedures will be applied depending on the sensitivity of the receptor. The Cultural Heritage CMP will include a tiered approach that will assign responsibility for dealing with the chance find to the appointed watching brief archaeologist, institutional counterpart or national cultural agencies, depending on the significance of the find.

All terrestrial and marine archaeological fieldwork will be approved, permitted and supervised by the authorities. Archaeological works will be undertaken according to the stipulations of the eventual Russian Federation permit for archaeological excavations and surveys and Krasnodar region license (Department on the Protection, Restoration and Exploitation of Historical Cultural Values (Heritage) of Krasnodar Krai).

In addition, the Cultural Heritage CMP will include procedures to ensure the following:

- All known terrestrial and marine cultural heritage receptors will be delineated on digital and paper Project maps and in the Project GIS database, which will be available to the design team and construction contractors;
- Project mapping and GIS will be updated, as necessary, should any chance finds of cultural heritage objects occur.;
- Terrestrial receptors will be flagged and protective fencing established, if considered necessary, during ground clearance and during the Construction Phase (Ref. 16.3);

- Archaeological Excavations. Any excavations that may be required as a result of chance finds will be implemented in accordance with applicable laws;
- Conservation. Any post-excavation conservation and analysis, publication, dissemination or finds curation will be undertaken in accordance with Russian legislation and standard national practice (Ref. 16.26; Ref. 16.73);
- A UXO survey will be conducted to strengthen and enhance marine cultural heritage baseline data and further decrease the possibility of encountering a chance find during marine pipe-laying activities. This survey will be conducted in advance of the commencement of pipe-laying works;
- Real-time monitoring of the marine pipe-laying process to ensure that the pipeline is installed at the stipulated distance from any marine CHOs; and
- A Grievance Mechanism and on-going stakeholder engagement will be implemented.

Potential impacts from the use of ROVs for marine monitoring and surveying activities will be minimised by limiting propeller or thruster washing, proper tether management and avoiding ROV strikes by careful piloting. During surveying and pipe-laying works, archaeological watching briefs will be undertaken to monitor surveying and construction activities.

- At sea, South Stream Transport will ensure that an archaeological watching brief is conducted by a qualified archaeologist to monitor surveying and pipe-laying activities to determine the presence or absence of potential cultural heritage objects and to ensure that known cultural heritage sites are not impacted by surveying and pipe-laying activities, including in all nearshore areas; and
- On land, South Stream Transport will ensure that an archaeological watching brief is conducted by a qualified archaeologist on all areas of terrestrial ground disturbance, including clearance activities, groundworks and excavation works associated with the construction of the terrestrial pipeline route; and all associated temporary and permanent construction areas, access routes and areas of ancillary works, including the Temporary Access Road and Varvarovka bypass road. This constitutes GIIP and IFC PS8 requirements, and was advised in discussions between Peter Gaz and Krasnodar Krai Department for the Protection, Restoration and Exportation of Cultural Heritage Objects of Value and Peter Gaz in 2012-2013 (Appendices 16.3, 16.4, 16.5, 16.9 and 16.11) and by the State Historical-Cultural Expert Evaluation (Ref. 16.70; Appendix 16.8).

Terrestrial and marine archaeological watching briefs will be undertaken by appropriately qualified and experienced cultural heritage professionals approved and permitted by the competent authorities. Specifically, the watching briefs will be undertaken in order to ensure that:

- The avoidance distance of 150 m for known marine CHOs is adhered to during marine pipe-laying;
- The agreed mitigation measures are appropriately implemented to ensure the prevention of damage to presently known marine CHOs from the use of ROVs or other surveying and construction activities; and

- The procedure for chance finds, as outlined in the Cultural Heritage CMP, and detailed in the Contractor's CMP, is appropriately implemented.

Specific mitigation measures that will be applied to identified terrestrial receptors include the following:

- Terrestrial site RU-TCH-02 (Kurgan burial mound) will be protected by flagging and/or fencing and security provided, if required.

Specific mitigation measures that will be applied to identified marine receptors include the following:

- Aircraft wing RU-MCH-001 lies within 150 m of the centreline of one of the pipelines and cannot be avoided by the 150 m avoidance distance. The wing will be subject to further identification and, if warranted, observation, lifting to surface or relocation with the recording of new coordinates of the object. If the object remains in place, use of avoidance buffering of approximately 60 m (due to geotechnical constraints);
- Amphora RU-MCH-003 lies within 150 m of the centreline of one of the pipelines and cannot be avoided by the 150 m avoidance distance. It will be recovered by lifting it to the surface prior to the start of construction;
- Wooden shipwreck RU-MCH-004 lies within 150 m of the centreline of one of the pipelines and cannot be avoided by the 150 m avoidance distance. The wreck will be further investigated via ROV as part of the pre-construction UXO survey and details recorded. Avoidance buffering of approximately 70 m (due to geotechnical constraints) will be implemented; and
- Relocation and recovery measures will be established in consultation with the Russian Ministry of Culture and implemented using the best available techniques. The areas adjacent to these objects (i.e., a radius of 150 m to 200 m) will also receive high-resolution survey and documentation prior to recovery activities to ensure that no additional cultural material is present. Nationally and internationally recognised practices for the protection, field-based study and documentation of the cultural heritage will be implemented.

Where anchoring vessels are used for Project activities, there is a potential to impact marine cultural heritage sites. The survey data that has been used to identify the CHOs described in this study covers an approximately 2 km wide corridor. In water depths in excess of approximately 100 m the anchors could be laid outside the currently surveyed area, potentially impacting currently unknown objects.

- An Anchor Management Plan will be developed to enable marine works to proceed in a manner that safely avoids marine archaeological sites in water depths where anchoring will take place by placing the anchors at a distance of no less than 150 m from currently known receptors and any that are identified as a result of the anchor corridor survey. The Anchor Management Plan will be developed by the chosen contractor; and
- A survey of the Anchoring Spread Area will be conducted by the pipeline construction contractor using high resolution side scan sonar. The survey will record data at high enough resolutions to discern CHOs, including those observed during prior geophysical surveys of the pipeline corridor. Side scan sonar will overlap and provide 100% coverage of the sea

floor. Based on the CHO/potential CHO that are identified anchor avoidance buffers of 150 m will be established to ensure no associated anchoring impacts (drags, sweeps or drops) will occur.

16.7.2 Mitigation Measures – Commissioning and Operational Phase

As no significant intrusive work will be carried out on the pipelines during their operation no significant impacts are expected. However, in the nearshore and offshore sections of the Project, inspection and maintenance activities that may involve the use of ROVs may be required. In such cases, the mitigation measures will be as per the Construction Phase and will include the limitation of ROV propeller or thruster washing, proper tether management and avoidance of ROV strikes by careful piloting. On land, similar measures as per the Construction Phase will be implemented to address any potential impacts from inspection and maintenance activities. As during construction, Project mapping and GIS will be updated, as necessary, should any chance finds of cultural heritage objects occur. A Grievance Mechanism and on-going stakeholder engagement will be implemented as part of mitigation and monitoring measures.

A Chance Find Procedure appropriate to the Operational Phase of the Project will be developed in advance of the commencement of operation of the pipelines and will be included in the Operational Management Plans. The Operational Management Plans will describe environmental and social mitigation, management and monitoring requirements and actions in relation to normal operating conditions and planned maintenance, minor repairs and minor incidents.

16.7.3 Monitoring Requirements

As set out in **Chapter 22 Environmental and Social Management**, a Cultural Heritage CMP would be implemented throughout the Project Construction and Pre-Commissioning Phase with OMPs implemented during the Operational Phase, as appropriate. Monitoring requirements will form part of the Cultural Heritage CMP and any Operational Phase Plans, including Chance Finds Procedures and staff cultural heritage awareness training.

Monitoring requirements identified during the Construction and Pre-Commissioning Phase comprise:

- Archaeological watching briefs on terrestrial groundworks;
- Archaeological watching briefs on marine works, including the pipe-lay vessel and nearshore approaches;
- Monitoring of the seafloor/CHO condition will be undertaken as part of the real time touch down monitoring of the material placement, pipe-laying activity and during the as-built pipeline route survey. This monitoring will include specific monitoring of cultural heritage objects RU-MCH-001 and RU-MCH-004, all of which lie within the marine Zone of Potential Influence, in order to confirm that the objects have been avoided during the pipe-laying process. The monitoring will also confirm that all other CHOs have been avoided by the specified 150 m buffer zone; and

- Where technically feasible, the sediment load baseline will be established via multi-beam echo sounder and side-scan sonar survey, as well as visual observation of the sea surface, and sampling to establish the suspended matter content and particle size distribution of matter within marine horizons (surface, thermocline, benthic and seabed), as part of the sea water monitoring programme and in accordance with Russian regulations (Refs. 16.147 to 16.150).

Monitoring requirements have been identified for the Operational Phase and comprise:

- Where a CHO is located within 150 m of the centreline of any one of the four pipelines (i.e. a currently unknown CHO discovered during the construction activities that could not be avoided by re-routing of the pipeline), monitoring of the CHO condition and seafloor between the CHO and the pipeline by ROV in the course of sonar and visual inspection and maintenance surveys during the Operational Phase. The purpose will be to monitor the condition of cultural heritage sites and their preservation contexts in case the Project gives rise to any unanticipated physical, chemical or environmental changes, and if so, to allow for the early identification of these changes and for corrective measures to be implemented.

16.8 Residual Impact Assessment – All Phases

Table 16.24 (terrestrial) and Table 16.25 (marine) present a summary of the potential residual impacts on cultural heritage receptors during the Construction and Pre-commissioning Phase and the Operational Phase respectively, following the implementation of the mitigation measures detailed in Section 16.7.

16.8.1 Terrestrial Cultural Heritage

Table 16.16 presented details of potential cultural heritage impacts without mitigation. Table 16.24 provides details of mitigation measures to be undertaken for those receptors that are potentially impacted by the Project, and post-mitigation levels of residual impact significance following the application of mitigation measures. For each of the receptors identified, the post-mitigation impact significances in Table 16.24 were determined.

Table 16.24 Construction and Pre-Commissioning Phase Residual Impacts (Terrestrial Cultural Heritage)

Receptor	Impact Significance Pre-mitigation	Mitigation Measure	Residual Impact Significance
Burial mound (kurgan) (RU-TCH-02)	High adverse	Site protection (flagging/fencing), provide security if required, archaeological watching brief, application of Chance Find Procedure and staff training via the Cultural Heritage CMP	Not Significant

Continued...

Receptor	Impact Significance Pre-mitigation	Mitigation Measure	Residual Impact Significance
Varvarovka village cemetery -Armenian and Russian cemetery (modern) (RU-TCH-06)	Moderate adverse	Detailed design routes the microtunnel temporary access road further to the east from the cemetery providing buffer.	Low
Varvarovka medieval settlement site (RU-TCH-18)	Low adverse	Site protection (flagging/fencing), provide security if required, archaeological watching brief, application of Chance Find Procedure and staff training via the Cultural Heritage CMP	Not significant

Complete.

During the Construction and Pre-Commissioning Phase:

- Potential adverse impacts:
  - Without mitigation, low adverse impacts are predicted for the burial mound (kurgan) (RU-TCH-02). The site will not be directly impacted by construction works as it will be preserved in place by microtunnelling. The proposed microtunnels will pass approximately 18 m below the receptor, but within the 125 m buffer area that surrounds it. The insertion of the microtunnels will avoid disturbance of non-geological deposits, and will not impact the topsoil, subsoil, and surface of natural horizons, which are the only strata liable to contain archaeological features or finds. In consultation between Peter Gaz and the Krasnodar Krai Department for the Protection, Restoration and Exportation of Cultural Heritage Objects of Value, the Department indicated that it would be best to avoid impacts on the monument and to protect and preserve the monument in situ. Mitigation will include Cultural Heritage Awareness Training, the implementation of site protection measures such as demarcation with suitable materials following the site warning colour codes, chance finds procedures and traffic control measures, including an appropriate fixed track policy, via the Cultural Heritage CMP. Following mitigation the residual impact is assessed as **Not Significant**.

The mound will be protected prior to any groundworks to prevent accidental damage. Flagging or fencing and signage (to be determined by the permitting authorities) will be subject to regular inspections and maintenance.

  - Without mitigation, Varvarovka village cemetery, Armenian and Russian cemetery (RU-TCH-06) may experience moderate adverse impacts. The route of the South Stream Transport temporary microtunnel access road has been designed to minimise impacts by implementing a road layout which moves construction traffic away from the cemetery area and its immediate surroundings. However, the Gazprom Invest permanent road will run immediately north of the cemetery, following the course of an existing road.

Mitigation will involve the preparation and implementation of the Traffic Management component of the Russian Landfall CMP, which will contain measures to manage traffic in proximity to the cemetery, and the Cultural Heritage CMP. Following mitigation, the residual impact is assessed as **Low**.

There is potential for unknown and unregistered buried archaeological remains and stray finds to be present within the construction corridor of the Project. The potential Project impact on such features may range between moderate and high adverse, depending on the character and sensitivity of the remains and their location. In accordance with legislation and to mitigate for the disturbance of potential sites, an archaeological watching brief will be conducted on all areas of ground disturbance. Mitigation will also involve the development and application of a Cultural Heritage CMP including Chance Finds Procedures (CFP) and appropriate staff training in cultural heritage awareness.

- Potential beneficial impacts:
  - The information gathered during the watching brief and any further investigations undertaken by Russian archaeologists may enhance the current archaeological knowledge and understanding of the region.

No impacts on terrestrial cultural heritage are expected during the Operational Phase.

In conclusion, after mitigation the residual impact on terrestrial cultural heritage is assessed as **Not Significant**.

16.8.2 Marine Cultural Heritage

For those marine receptors that are indicated to be potentially impacted by the Project in Table 16.17, applicable mitigation measures will be applied. Table 16.25 provides details of mitigation measures to be undertaken, and post-mitigation levels of residual impact significance.

Table 16.25 Construction and Pre-Commissioning Phase Residual Impact (Marine Cultural Heritage)

Site	Significance of Impact Pre-mitigation	Mitigation Measure	Residual Impact Significance
RU-MCH-001 aircraft wing	Moderate adverse	Additional visual survey via ROV, check military records Relocation, if warranted Anchor Management Plan Sediment load monitoring where technically feasible	Low Adverse
RU-MCH-003 amphora	High adverse	Additional visual survey via ROV Recovery (ROV)	Moderate Adverse

Continued…

Site	Significance of Impact Pre-mitigation	Mitigation Measure	Residual Impact Significance
RU-MCH-004 wooden shipwreck	High adverse	Pipeline optimisation Sediment load monitoring where technically feasible	Moderate Adverse

Complete.

Table 16.25 indicates the following:

During the Construction and Pre-Commissioning Phase:

Potential adverse impacts:

- Without mitigation, impacts of moderate significance are predicted for the aircraft wing (RU-MCH-001). This site can be impacted by pre-construction activities and Construction Phase works based on proximity to the nearest pipeline centreline. The proposed pipeline route cannot be optimised to accommodate an avoidance buffer of 150 m in this area due to geotechnical constraints. Following mitigation through further survey investigation and, if warranted, relocation or avoiding the site by a buffer of approximately 60 m (due to geotechnical constraints, the significance of the residual impact is assessed as being **Low Adverse**;
- Without mitigation, impacts of high adverse significance are predicted for the ceramic amphora (RU-MCH-003). This site can be impacted by pre-construction activities and Construction Phase works based on proximity to the nearest pipeline centreline. The proposed pipeline route cannot be optimised to accommodate an avoidance buffer of 150 m in this area due to geotechnical constraints, and therefore mitigation through archaeological recovery will be undertaken. Following mitigation through recovery, the significance of the residual impact is assessed as being **Moderate** adverse due to the removal of the object from its context;
- Without mitigation, impacts of high adverse significance predicted for marine site RU-MCH-004 (wooden shipwreck). This site may be impacted during the pre-construction activities and Construction Phase works based on proximity to the nearest pipeline centreline, and therefore mitigation through avoidance will be undertaken. The proposed pipeline route cannot be optimised to accommodate an avoidance buffer of 150 m in this area due to geotechnical constraints, but the site will be avoided by a distance of approximately 70 m. Following mitigation through avoidance controls (such as avoiding ROV strikes, minimising propeller or thruster washing, tether management, use of ultra-short baselines and acoustic tracking), the application of an Anchor Management Plan, sediment monitoring, ROV-based monitoring, CFP and staff training, the significance of the residual impact is assessed as being **Moderate** adverse; and
- Without mitigation, during the Construction and Pre-Commissioning Phase there is the potential for currently unknown cultural heritage to be impacted by the Project resulting in potential Low to High adverse impacts, depending on the importance of the find. Should

any currently unknown CHO be identified, the mitigation measures outlined in Section 16.7.1 will be applied and any residual impacts are anticipated to be **Low**.

Potential beneficial impacts:

- Information gathered from the watching brief and any further investigations, which will be supervised by Russian archaeologists, may enhance the current knowledge of maritime archaeology in the Russian Sector of the Black Sea.

Operational Phase impacts are summarised in Table 16.28.

Potential adverse impacts:

- Without mitigation, during the Operational Phase there is the potential for as yet unknown cultural heritage to be impacted by the Project resulting in potential Low to High adverse impacts, depending on the character and sensitivity of the find and its location. Should any currently unknown CHO be identified, mitigation measures outlined in Section 16.7 will be implemented where possible and any residual impacts are anticipated to be **Low**.

Potential beneficial impacts:

- Where a CHO is located within 150 m of the centreline of any one of the four pipelines, periodical monitoring of the CHO condition and seafloor between the CHO and the pipeline by ROV in the course of sonar and visual inspection and maintenance surveys will provide longitudinal data on the condition of CHOs.

In conclusion, after mitigation, the residual impact on marine cultural heritage is assessed as **Low**.

16.8.3 Summary of Cultural Heritage Residual Impact

Tables 16.26 (terrestrial) and Table 16.27 (marine) provide a summary of potential residual impacts upon cultural heritage receptors arising from the Project during the Construction and Pre-Commissioning Phase following the implementation of mitigation measures detailed in Section 16.7.1. Table 16.28 provides a summary of the potential residual impacts upon cultural heritage receptors arising from the Project during the Operational Phase following the implementation of mitigation measures defined in Section 16.7.2.

Table 16.26 Cultural Heritage: Construction and Pre-Commissioning Residual Impacts (Terrestrial)

Activity	Potential Impact	Receptor (s)	Receptor Sensitivity	Impact Magnitude	Pre -Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Open trench pipe-laying activities Construction of landfall facilities Establishment of microtunnel construction site Increased construction related traffic Increased site population	Direct damage to or destruction of archaeological site from: • Ground excavation and terracing work; • Drilling, blasting and boring work; • Vehicle and plant tracking and collision damage; and • Potential illicit removal of archaeological remains or interference with sites, due to increased site population.	Burial mound (kurgan) (RU-TCH-02)	High	Low	Low as preserved in place	Subject to consultation with the authorities, mitigation measures will include: Site protection Preparation and implementation of a Cultural Heritage CMP, Chance Finds Procedures, traffic management and appropriate staff training in cultural heritage awareness. Grievance Mechanism and on-going stakeholder engagement	Not significant (preservation in place due to microtunnelling)

Continued…

Activity	Potential Impact	Receptor (s)	Receptor Sensitivity	Impact Magnitude	Pre -Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Increased construction related traffic	Disturbance of tranquillity and local users from: • Increase in noise and visual intrusion.	Varvarovka, village cemetery, Armenian and Russian cemetery (modern) (RU-TCH-06) Rassvet cemetery /memorials	High	Low	Moderate adverse	Detailed design to route the Microtunnel temporary access road further to the east from the cemetery. Preparation and implementation of Traffic Management component of the Russian Landfall CMP and Cultural Heritage CMP Grievance Mechanism and on-going stakeholder engagement	Low

Continued…

Activity	Potential Impact	Receptor (s)	Receptor Sensitivity	Impact Magnitude	Pre -Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Preparation of access roads / upgrades to junctions of existing roads Open trench pipe-laying activities - Onshore excavation of pipeline trench and storage of excavated materials Construction of landfall facilities Establishment of microtunnel construction site Increased construction related traffic Increased site population	Potential damage / loss of archaeological receptors Tracking damage caused by vehicles from: • Ground excavation and terracing work; • Construction and realignment of roads and temporary road diversions; • Ground preparation activities, including building foundations and piling; • Diversion of utilities and drainage; • Drilling, blasting and boring work; • Vehicle and plant tracking and collision damage; and Potential illicit removal of archaeological remains or interference with sites, due to increased site population.	RU-TCH-18	Low	Low	Low adverse	Archaeological watching brief. Preparation and implementation of the Cultural Heritage CMP, Chance Finds Procedures and appropriate staff training in cultural heritage awareness. Grievance Mechanism and on-going stakeholder engagement	Not significant

Continued...

Activity	Potential Impact	Receptor (s)	Receptor Sensitivity	Impact Magnitude	Pre -Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Preparation of access roads / upgrades to junctions of existing roads Open trench pipe-laying activities - Onshore excavation of pipeline trench and storage of excavated materials Construction of landfall facilities Establishment of microtunnel construction site Increased construction related traffic Increased site population	Potential damage / loss of archaeological receptors Tracking damage caused by vehicles from: • Ground excavation and terracing work; • Construction and realignment of roads and temporary road diversions; • Ground preparation activities, including building foundations and piling; • Diversion of utilities and drainage; • Drilling, blasting and boring work; • Vehicle and plant tracking and collision damage; and • Potential illicit removal of archaeological remains or interference with sites, due to increased site population.	Currently unknown items and sites of heritage significance	Unknown (anticipated to be Low to High)	Moderate	Unknown (estimated to be moderate adverse to high adverse)	Archaeological watching brief. Preparation and implementation of the Cultural Heritage CMP, Chance Finds Procedures and appropriate staff training in cultural heritage awareness. Grievance Mechanism and on-going stakeholder engagement.	Unknown (estimated to be Low adverse to Moderate adverse)

Complete.

Table 16.27 Cultural Heritage: Construction and Pre-Commissioning Residual Impacts (Marine)

Activity	Potential Impact	Receptor (s)	Receptor Sensitivity	Impact Magnitude	Pre - Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Offshore and nearshore pre-construction Route Surveys & as-built survey ROV and ROTV sonar and visual surveys along nearshore pipeline Removal of any offshore and nearshore obstacles Placement of grout bags, rocks, concrete mattressing etc. on seabed Offshore pipe-laying on seabed by S-Lay method (30 - 600 m water depth)	Damage or loss of archaeological receptors from: • Seabed disturbance; • Anchor or ROV strikes; and • Changes to erosion and sedimentation regimes.	Aircraft wing (RU-MCH-001)	Low	Moderate	Moderate Adverse	Use of avoidance buffering of approximately 60 m (due to geotechnical constraints) Further investigation followed by relocation, if deemed necessary. Sediment load monitoring where technically feasible.	Low adverse

Continued…

Activity	Potential Impact	Receptor (s)	Receptor Sensitivity	Impact Magnitude	Pre - Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Offshore and nearshore pre-construction route surveys & as-built survey ROV and ROTV sonar and visual surveys along nearshore pipeline Removal of any offshore and nearshore obstacles Placement of grout bags, rocks, concrete mattressing etc. on seabed Offshore pipe-laying on seabed by S-Lay method (30-600 m water depth)	Damage or loss of archaeological receptors from: • Seabed; • Disturbance; • Anchor or ROV strikes; and • Changes to erosion and sedimentation regimes.	Single ceramic amphora (RU-MCH-003)	Moderate	High	High Adverse	Archaeological recovery of object	Moderate adverse (due to removal from context)

Continued…

Activity	Potential Impact	Receptor (s)	Receptor Sensitivity	Impact Magnitude	Pre - Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Offshore and nearshore pre-construction route surveys & as-built survey ROV and ROTV sonar and visual surveys along nearshore pipeline Removal of any offshore and nearshore obstacles Placement of grout bags, rocks, concrete mattressing etc. on seabed Offshore pipe-laying on seabed by S-Lay method (30-600 m water depth)	Damage or loss of archaeological receptors from: • Seabed disturbance; • Changes to erosion and sedimentation regimes; and • Anchor or ROV strikes.	Wooden shipwreck (RU-MCH-004)	High	Moderate	High Adverse	Minimise propeller or thruster washing Proper tether management Avoid ROV strikes by careful piloting Use of avoidance buffering of approximately 70 m (due to geotechnical constraints) ROV monitoring of material placement Anchor Management Plan Archaeological watching brief Use of Ultra-Short Baselines (USB) acoustic tracking system on pipe and ROVs Chance Finds Procedures and appropriate staff cultural heritage awareness training Sediment load monitoring where technically feasible Grievance Mechanism and on-going stakeholder engagement.	Moderate adverse

Continued…

Activity	Potential Impact	Receptor (s)	Receptor Sensitivity	Impact Magnitude	Pre - Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Offshore and nearshore pre-construction Route Surveys & as-built survey	Seabed disturbance Changes to erosion and sedimentation regimes Anchor or ROV strikes	Currently unknown marine archaeology	Low to High	Moderate	Low to High Adverse	Minimise propeller or thruster washing Proper tether management	Not Significant to Moderate adverse
ROV and ROTV sonar and visual surveys along nearshore pipeline Removal of any offshore and nearshore obstacles Placement of grout bags, rocks, concrete mattressing etc. on seabed Offshore pipe-laying on seabed by S-Lay method (30-600 m water depth)						Avoid ROV strikes by careful piloting Use of avoidance buffering to protect known sites ROV monitoring of material placement Anchor Management Plan Archaeological watching brief	

Continued...

Activity	Potential Impact	Receptor (s)	Receptor Sensitivity	Impact Magnitude	Pre - Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Offshore pipe-laying on seabed J-Lay method (>600 m water depth)						Use of Ultra-Short Baseline (USB) acoustic tracking systems on pipe and ROVs Chance Finds Procedures and appropriate staff cultural heritage awareness training Sediment load monitoring where technically feasible Grievance Mechanism and on-going stakeholder engagement.	

Complete.

Table 16.28 Cultural Heritage: Operational Phase Residual Impacts (Marine)

Activity	Potential Impact	Receptor (s)	Receptor Sensitivity	Impact Magnitude/ Likelihood	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Offshore and nearshore as-built surveys ROV and ROTV sonar and visual surveys along nearshore pipeline Maintenance/ repair to pipelines	Damage or loss of archaeological receptors from: • Seabed disturbance; and • Anchor or ROV strikes.	Known and as yet unknown marine archaeology	Low to high	Moderate	Moderate Adverse	Abate at source Minimise propeller or thruster washing Proper tether management Avoid ROV strikes by careful piloting CFP and appropriate staff cultural heritage awareness training Grievance Mechanism and on-going stakeholder engagement.	Not Significant

16.9 Unplanned Events

An unplanned event, such as the controlled detonation of a UXO, an ROV strike, the sudden abandonment of the pipeline, during construction, as a result of emergency situations, or a major pipeline breach and pressure loss during operation, may result in damage to or destruction of submerged archaeological material. The magnitude of this impact is assessed as high, and the significance is assessed as moderate to high adverse, depending on the sensitivity of the receptor. However, the likelihood of this event occurring is very low and therefore, for the purposes of this assessment, such potential impact has been discounted.

It should also be noted that during the Construction and Operational Phases, changes in the seafloor due to environmental conditions could have the potential to impact known and as yet unknown cultural heritage, resulting in potential Low to High adverse impacts, depending on the significance of the cultural heritage object.

Appropriate unplanned event contingency planning will be undertaken that minimises the likelihood of low probability events occurring, as well as minimising event consequences (**Chapter 19 Unplanned Events**).

16.10 Cumulative Impacts

The cumulative impact assessment considers the Project within the context of other development projects in the local Study Area and the wider regional area. The assessment is presented in **Chapter 20 Cumulative Impacts**.

16.11 Conclusions

The Project will generate beneficial impacts during all phases of the Project:

- Further survey work will be undertaken of the following marine sites: the wooden shipwreck (RU-MCH-004) and the aircraft wing (RU-MCH-001) as part of the pre-construction activities;
- A ceramic amphora (RU-MCH-003) will be recovered and if warranted, the aircraft wing (RU-MCH-001) will be relocated; and
- The conditions of any positively identified marine CHOs (including any chance finds) in close proximity of any pipeline will be monitored throughout the life cycle of the Project during routine inspection and maintenance works.

Information gathered from further investigations and on-going monitoring may enhance the current knowledge of terrestrial and maritime archaeology in the Russian Sector of the Black Sea.

With regard to potentially adverse effects the Construction and Pre-Commissioning Phase of the Project has the greatest potential to impact terrestrial and marine cultural heritage receptors.

- Potential impacts to terrestrial cultural heritage designated *kurgan* burial mound RU-TCH-02 are avoided as the result of the design control of microtunnelling which places the pipelines approximately 20 m below the receptor;
- Potential impacts on terrestrial cultural heritage will also be mitigated by archaeological watching briefs (monitoring), application of Cultural Heritage CMP, Chance Find Procedures and Cultural Heritage Awareness Training and, if warranted, archaeological excavation and the implementation of the Traffic Management component of the Russian Landfall CMP, including a fixed track policy. These mitigation measures will reduce operational impacts to cultural heritage receptors to **Not Significant**;
- Potential impacts to known marine cultural heritage receptors are avoided as a result of the design control of re-routing the pipelines to ensure a minimum separation distance of 150 m from these known and potential CHOs. Sites include potential CHO (B1_S0002; G-B1-0006; RS_21; RS_35; RS_394, RS_538; RS_942; RS_943, RS_993; R-B5-0010; R-B1-0010; R-B1-0011), potential shipwrecks (RS_77; RS_871; R-B1-0008), a shipwreck (RS_872) and a German Messerschmitt Bf 109 (Me 109) Aircraft (CHO) (RS_190);
- Potential impacts to known and potential marine CHOs in the anchor spread area will be mitigated via the Anchor Corridor Survey and Anchor Management Plan;
- Potential impacts on marine cultural heritage will also be avoided by real time touch down monitoring during pipe-lay and the as-built survey along with careful management and piloting of ROVs; and
- Potential impacts on known and as yet unknown terrestrial and marine CHOs will be mitigated by archaeological watching briefs (monitoring), Chance Find Procedures and Cultural Heritage Awareness training. These measures will reduce any potential impacts to **Low** significance.

These measures will reduce any potential adverse impacts during the Construction and Pre-commissioning Phase to **Low** significance.

Operational impacts on terrestrial cultural heritage are not expected.

Operational impacts on unknown marine CHOs are largely mitigated through careful ROV piloting. These mitigation measures will reduce operational impacts to cultural heritage receptors to **Not Significant**.

Throughout the Project life-cycle, impacts on cultural heritage will be systematically controlled and monitored by the application of a Cultural Heritage CMP and OMPs both of which will include Chance Find Procedures and provisions for Cultural Heritage Awareness Training.

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Ref. 16.150	RD 52.24.609-99 Procedural Guidelines. Organisation and Monitoring of the Pollutants' Content in the Bottom Sediments

Chapter 17: Ecosystem Services

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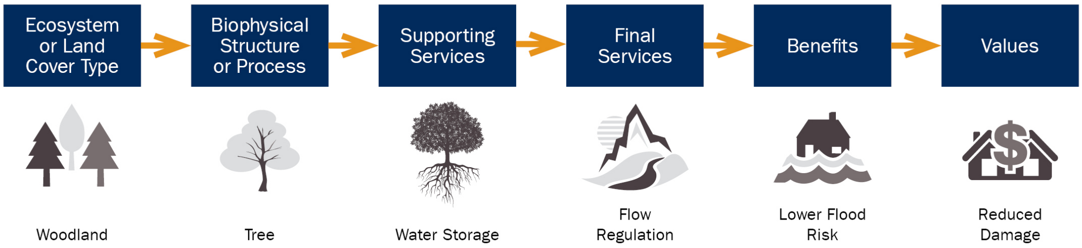
17.1 Introduction

International Finance Corporation (IFC) Performance Standard (PS) 6 defines ecosystem services as *"the benefits that people, including businesses, obtain from ecosystems"* (Ref. 17.10), which accords with the definition provided by the Millennium Ecosystem Assessment (MA) (Ref. 17.1). While there is no single system for categorising ecosystem services, the MA framework is widely accepted and, as acknowledged in IFC PS Guidance Note 6 (paragraph 2), provides a useful starting point. The MA identifies four broad categories of ecosystem service:

- **Provisioning services** – the products people obtain from ecosystems. These may include *inter alia* (i) crops, livestock, seafood and game, wild foods, and ethnobotanical plants; (ii) water for drinking, irrigation, and industrial purposes; and (iii) vegetated areas which provide the basis for many biopharmaceuticals, construction materials, and biomass for renewable energy. Goods may be provided by heavily managed ecosystems, such as agricultural and aquacultural systems and plantation forests, or by natural or semi-natural ones, for example in the form of capture fisheries and the harvest of other wild foods;
- **Regulating services** – the benefits people obtain from the regulation of ecosystem processes. These may include *inter alia* (i) local climate regulation and carbon storage and sequestration; (ii) natural hazard mitigation; (iii) purification of water and air; (iv) control of pests and disease; and (v) pollination;
- **Cultural services** – the cultural, educational, and spiritual benefits people obtain from ecosystems. These may include *inter alia* (i) cultural, spiritual, or religious upliftment from cultural heritage, spiritual, or sacred sites; (ii) opportunities for recreation such as sport, hunting, fishing, ecotourism; and (iii) opportunities for scientific exploration, knowledge-building, and education; and
- **Supporting services** – the natural processes that maintain the other services such as soil formation, nutrient and water cycling, or primary production.

Supporting services differ from provisioning, regulating, and cultural services in that, unlike the other types of service from which people can directly benefit, their impacts on human well-being are indirect (Ref. 17.2 and Ref. 17.3) and mostly long-term in nature; the formation of soils, for example, takes place over decades or centuries. All other ecosystem services – regulating, provisioning, and cultural – ultimately depend on them. Supporting services are strongly interrelated to each other and are generally underpinned by a vast array of physical, chemical, and biological interactions. Supporting services are linked to particular biophysical structures or processes of an ecosystem, such as the way water storage is linked to soils, trees, plants, and other vegetation, and underpin the provision of the services which are of direct value to people, such as reduced surface water runoff, filtering of air and water quality, timber provision, and wild foods. These final ecosystem services provide benefits to people such as reduced damages from flooding, which are valued by their beneficiaries (Table 17.1).

Figure 17.1 The Relationship between Ecosystems, Services, and Benefits



The benefits of ecosystems are conferred at many scales and often to multiple different beneficiaries. At the local level, ecosystem services are frequently the basis for rural livelihoods and subsistence, particularly for the poor. Artisanal fishing of coastal waters and rivers, for example, provides both cash income and food for low-income families. Similarly, harvesting of plants for traditional medicine can provide an important substitute for more expensive commercially available pharmaceuticals. Benefits can also be regional – such as the provision of flood protection and erosion control afforded to communities and businesses by coastal mangroves – or national, such as sites that form part of a country's cultural heritage. At a global scale, ecosystems regulate climate and support the biodiversity which underpins all biological production.

Businesses and projects may also benefit from ecosystem services through, for example, the direct use of inputs such as water or through protection from natural hazards such as flooding. Identifying and protecting such services can have further benefits such as avoiding punitive regulation and negative publicity, strengthening the organisation's reputation and, in some cases, providing effective natural alternatives to more expensive engineering solutions.

Despite the widespread benefits of ecosystem services, a number of recent high-profile reports have revealed that a significant number of global ecosystems are in a degraded state. In 2005 for example, the MA concluded that on a global scale the majority of ecosystem services have been degraded (Ref. 17.1). More recently, The Economics of Ecosystems and Biodiversity (TEEB), a major international initiative, published a series of reports which found that many ecosystem services are so degraded they are reaching tipping points, and highlighted the growing costs of biodiversity loss and ecosystem degradation (Ref. 17.5).

This has led to a growing shift in national and international policy, away from looking at the environment in separate *"silos"* – air, water, soil, biodiversity – towards a more integrated approach based on entire ecosystems. Identifying impacts in this manner stresses the linkages and trade-offs between different services, allowing the ecosystem approach to identify areas which provide multiple benefits. Further, the emphasis placed on looking at the environment in terms of the benefits that people derive from it helps to ensure that the full value of ecosystem services and people's preferences for these are incorporated into decision-making processes.

In 2010, the Conference of the Parties to the Convention on Biological Diversity (CBD) adopted a Strategic Plan with the aim of *"maintaining ecosystem services, sustaining a healthy planet, and delivering benefits essential for all people"* (Ref. 17.6). The EU also adopted a target to halt the loss of biodiversity and the degradation of ecosystem services by 2020 and restore them where possible (Ref. 17.7).

In 2012, the vision for a Green Economy outlined in Rio +20 recognised that economic performance depends on effective ecosystem and biodiversity management and the continued flow of ecosystem services (Ref. 17.8). In the same year, the IFC published its revised Performance Standards on Environmental and Social Sustainability which, in addition to the requirements set out in PS 6, included reference to ecosystem services throughout many of the other Performance Standards (Table 17.1). More recently, the European Commission has put forward a proposal to amend the European EIA Directive to specifically include consideration of ecosystem services (Ref. 17.9).

IFC PS 6 recognises that sustainable development cannot be achieved if either biodiversity or ecosystem services are lost or degraded by development efforts and therefore requires that *"where a project is likely to adversely impact ecosystem services, as determined by the risks and impacts identification process, the client will conduct a systematic review to identify priority ecosystem services"* (Ref. 17.10). Since ecosystem services are, by nature, cross-cutting they apply to several of the IFC Performance Standards as shown in Table 17.1 below.

Table 17.1 Ecosystem Services in the 2012 IFC Performance Standards

Performance Standard	Summary of Requirements
PS1: Assessment and Management of Environmental and Social Risks and Impacts	Where the project involves specifically identified physical elements, aspects, and facilities that are likely to generate impacts, environmental and social risks and impacts will be identified in the context of the project's area of influence. This area of influence encompasses, as appropriate...indirect project impacts on biodiversity or on ecosystem services upon which Affected Communities' livelihoods are dependent.
PS4: Community Health, Safety, and Security	The project's direct impacts on priority ecosystem services may result in adverse health and safety risks and impacts to Affected Communities. With respect to this Performance Standard, ecosystem services are limited to provisioning and regulating services as defined in paragraph 2 of Performance Standard 6…where appropriate and feasible, the client will identify those risks and potential impacts on priority ecosystem services that may be exacerbated by climate change. Adverse impacts should be avoided, and if these impacts are unavoidable, the client will implement mitigation measures in accordance with paragraphs 24 and 25 of Performance Standard 6. With respect to the use of and loss of access to provisioning services, clients will implement mitigation measures in accordance with paragraphs 25–29 of Performance Standard 5.

Continued…

Performance Standard	Summary of Requirements
PS5: Land Acquisition and Involuntary Resettlement	This Performance Standard applies to physical and/or economic displacement resulting from the following types of land-related transactions…restriction on access to land or use of other resources including communal property and natural resources such as marine and aquatic resources, timber and non-timber forest products, freshwater, medicinal plants, hunting and gathering grounds and grazing and cropping areas (natural resource assets referred to in this Performance Standard are equivalent to ecosystem provisioning services as described in Performance Standard 6).
PS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	Where a project is likely to adversely impact ecosystem services, as determined by the risks and impacts identification process, the client will conduct a systematic review to identify priority ecosystem services…with respect to impacts on priority ecosystem services of relevance to Affected Communities and where the client has direct management control or significant influence over such ecosystem services, adverse impacts should be avoided. If these impacts are unavoidable, the client will minimise them and implement mitigation measures that aim to maintain the value and functionality of priority services. With respect to impacts on priority ecosystem services on which the project depends, clients should minimise impacts on ecosystem services and implement measures that increase resource efficiency of their operations, as described in Performance Standard 3. Additional provisions for ecosystem services are included in Performance Standards 4, 5, 7, and 8.
PS7: Indigenous Peoples	If the client proposes to locate a project on, or commercially develop natural resources on lands traditionally owned by, or under the customary use of, Indigenous Peoples, and adverse impacts can be expected, the client will take the following steps…document efforts to avoid and otherwise minimise impacts on natural resources and natural areas of importance to Indigenous People. *"Natural resources and natural areas of importance"* as referred to in this Performance Standard are equivalent to priority ecosystem services as defined in Performance Standard 6…where a project may significantly impact on critical cultural heritage that is essential to the identity and/or cultural, ceremonial, or spiritual aspects of Indigenous Peoples lives, priority will be given to the avoidance of such impacts (natural areas with cultural value are equivalent to priority ecosystem cultural services as defined in Performance Standard 6). Where significant project impacts on critical cultural heritage are unavoidable, the client will obtain the Free, Prior and Informed Consent (FPIC) of the Affected Communities of Indigenous Peoples. Includes natural areas with cultural and/or spiritual value such as sacred groves, sacred bodies of water and waterways, sacred trees, and sacred rocks.

Continued…

Performance Standard	Summary of Requirements
PS8: Cultural Heritage	Where the client has encountered tangible cultural heritage that is replicable and not critical, the client will apply mitigation measures that favour avoidance. Where avoidance is not feasible, the client will apply a mitigation hierarchy as follows…minimise adverse impacts and implement restoration measures, in situ, that ensure maintenance of the value and functionality of the cultural heritage, including maintaining or restoring any ecosystem processes needed to support it (consistent with requirements in Performance Standard 6 related to ecosystem services and conservation of biodiversity).

Complete.

The assessment in this chapter has been undertaken in accordance with the 2012 IFC Performance Standards (Ref. 17.10), drawing on the Guidance Notes that accompany the Standards (Ref. 17.11). The approach is also informed by separate on-going dialogue between URS and the IFC's Environment, Social, and Governance Department (Ref. 17.12) and the World Resources Institute (WRI) (Ref. 17.13) regarding their risk screening procedures, expectations of ecosystem services assessments, and emerging guidance on consideration of ecosystem services in ESIAs.

This chapter presents an assessment of the potential impacts and dependencies on ecosystem services resulting from the Construction and Pre-Commissioning, Operational, and Decommissioning Phases of the Project. In addition, measures to anticipate and avoid, or where avoidance is not possible, minimize, and, where residual impacts remain, compensate / offset for risks and impacts on priority ecosystem services are presented.

Specifically, the purpose of this chapter is to:

- Systematically identify and assess the likely impacts of Project activities on ecosystem services (ESS) and the nature and significance of these impacts on ESS beneficiaries[1];
- Evaluate Project dependence on ESS in order to help manage risks and take advantage of opportunities related to ecosystem change; and
- Help inform, for unavoidable impacts, the selection of appropriate mitigation measures which aim to maintain the value and functionality of priority ESS and enhance the resource efficiency of Project operations.

This chapter is not intended to be read in isolation; instead it presents and assesses the key ecosystem service considerations relevant to the topics presented in other chapters of this ESIA Report, including key inter-linkages, to ensure that the values which ecosystem service

[1] The ESS framework focuses on assessing impacts on the beneficiaries of ecosystem services. Where impacts on ecosystem services reduce the benefits to beneficiaries, then these beneficiaries are identified as Project Affected Communities (PACs). Thus, not all ESS beneficiaries will necessarily be PACs. A beneficiary only becomes a PAC when the Project reduces the level of benefits provided to an individual or group of beneficiaries.

beneficiaries attach to ecosystem goods and services are appropriately considered and addressed throughout the ESIA process.

The findings of the assessment in this chapter have also been used to inform the baseline data collection process, impact assessment, and selection of appropriate mitigation options in other relevant technical chapters. This chapter brings together the findings of the other chapters to examine the issues at an ecosystem level and to assess how impacts on one aspect of the environment can affect others. As such, the chapter is heavily informed by the other chapters of the ESIA Report and cross references these where appropriate.

There are, therefore, significant overlaps between the assessment presented in this chapter and in the other technical chapters. For example, impacts on fisheries, crops, and tourism and recreation are all covered in both this chapter and in **Chapter 14 Socio-Economics**. While the assessment of these issues is broadly similar across the two chapters and each assessment has informed the other, it is important to note that this chapter uses an ecosystem services assessment framework to assess impact significance and, as such, there may be differences between the receptor sensitivities and impact magnitudes across chapters. This is due to the fact that the ecosystem services assessment considers the impact of the Project on ecosystem functioning and ability to continue providing services, as well as the ability of all those who access or benefit from those services to continue to derive services of the same value.

17.2 Approach

The approach to, and methodology for, the ecosystem services assessment in this chapter is based the Ecosystem Services Identification, Valuation, and Integration (ESIVI) approach (Ref. 17.14). The ESIVI tool was created in order to provide a rigorous and transparent framework for ecosystem service assessments that meets the requirements set out in the 2012 IFC Performance Standards.

The development of the ESIVI tool was informed by both the conceptual framework established by the MA, which explicitly links ecosystem services and human well-being, and the WRI's conceptual framework for Ecosystem Services Review for Impact Assessment (Ref. 17.15). The WRI framework puts the Project at the centre of the interactions between human well-being, ecosystem services, ecosystems, and drivers of ecosystem change, recognising that the Project has the potential to affect all the components of the framework and is itself affected by them. It reflects the two ways the Project relates to ecosystem services in terms of:

- Potential impacts on the existing relationships between human well-being, ecosystem services, and ecosystems; and
- Project dependence on these relationships for the achievement of successful performance.

The development of the ESIVI tool was informed by expertise built up from carrying out policy and project level work on ecosystem service assessments over the past ten years as well as a number of Good International Industry Practices and guidelines, including:

- IFC Performance Standards 1, 4, 5, 6, 7, and 8 and their accompanying Guidance Notes (Ref. 17.11);

- Landsberg et al. (2011), 'Ecosystem Services Review for Impact Assessment: Introduction and Guide to Scoping' (Ref. 17.15);
- IPIECA/OGP (2011), 'Ecosystem Services Guidance: Biodiversity and Ecosystem Services Guide and Checklists' (Ref. 17.16);
- Convention on Biological Diversity (2006), 'Voluntary Guidelines on Biodiversity-Inclusive Impact Assessment' (Ref. 17.17);
- TEEB (2010), 'The Economics of Ecosystems and Biodiversity: Mainstreaming the Economics of Nature' (Ref. 17.5);
- Bateman et al. (2010), 'Economic Analysis for Ecosystem Service Assessments' (Ref. 17.2);
- Burkhard et al. (2009), 'Landscapes' Capacities to Provide Ecosystem Services – A Concept for Land-Cover Based Assessments' (Ref. 17.3);
- Landsberg et al. (2013), 'Weaving Ecosystem Services into Impact Assessment: A Step-by-Step Method' (Ref. 17.18); and
- UNEP-WCMC (2012), 'UK National Ecosystem Services Assessment' (Ref. 17.19).

The ecosystem services assessment process comprises four stages[2]:

- **Scoping –** to identify the services provided by affected ecosystems that could potentially be impacted by the Project or that the Project may depend upon;
- **Baseline establishment –** to assess the status of these services within the affected ecosystems in the absence of the Project, as well as the location of ecosystem service beneficiaries and the extent to which they benefit from the services provided;
- **Impact assessment –** to identify the likely impacts of Project activities on ecosystem services and their beneficiaries, the significance of these impacts, and which services should be considered priority ecosystem services; and
- **Mitigation and residual impact assessment –** to identify the range of measures that may be implemented to anticipate and avoid, or where avoidance is not possible, minimize adverse impacts on priority ecosystem services and to determine the residual impacts once mitigation is in place.

Figure 17.2 provides a schematic overview of the assessment process and the key sources of data at each stage.

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[2] Note that these stages of the ESIVI tool are consistent with the impact assessment methodology described in **Chapter 3 Impact Assessment Methodology** and used in other chapters.

Figure 17.2 The Ecosystem Services Assessment Process

Stage	Steps	Information sources
Scoping	• Identify ecosystem services the Project may impact and/or on which the Project depends • Identify potentially affected beneficiaries • Scope out those services on which impacts are likely to be insignificant	• ESIA technical chapters • Literature review • Mapping and imagery • Site visit
Baseline	• Establish provision of scoped in services • Identify key trends and threats • Identify beneficiaries use of services and assess sensitivity to changes in provision	• ESIA technical chapters • Stakeholder consultation • Literature review • Site visit
Impact Assessment	• Assess nature and significance of impacts on ecosystem services and effects on beneficiaries • Identify priority services	• ESIA technical chapters • Stakeholder consultation • Liaison with ESIA technical chapter authors
Mitigation	• Identify measures to avoid adverse impacts or to at least maintain the value and functionality of priority services where impacts cannot be avoided.	• ESIA technical chapters and literature review • Stakeholder consultation • Liaison with ESIA technical chapter authors

17.3 Scoping

The objective of the initial scoping exercise is to identify those ecosystem services which could potentially be affected by Project activities or that the Project may depend upon and which therefore ought to be subject to more detailed investigation.

Due to the complexity and interconnectivity of ecosystems, together with the uncertainty surrounding how each process within an ecosystem is likely to respond to change, isolating and assessing each of the likely impacts of a project on particular ecosystem services is a difficult task. Further, the potentially wide range of people who benefit from ecosystem services and the different values they attach to such services mean that assessing the impacts and dependencies of a project on ecosystem services is an extensive undertaking.

As such, a comprehensive assessment of every impact or dependency on each ecosystem service and an economic valuation of each type of use is beyond the scope of an ESIA[3]. An effective ESIA should therefore focus resources on assessing the services which are likely to be of highest priority, with further, more detailed assessments being carried out where necessary to inform the development of follow up reports. For example, while it is not appropriate to undertake a full economic valuation for each ecosystem service within an ESIA, valuing certain services may be a useful exercise for informing the development of Livelihood Restoration Plans which depend on ecosystem based forms of income such as fishing and farming.

An important element of the scoping stage is therefore to identify which services can be excluded from the ESIA in order to provide a comprehensive and manageable assessment. This was done using the ESIVI tool which contains a checklist of ecosystem services that has been compiled using the guidance, checklists, and other relevant information contained in the studies listed in the previous section.

In this assessment the ESIVI checklist (Table 17.2) was used to systematically identify the services which may potentially be impacted by the Project or upon which the Project may depend. Definitions and examples of each of the ecosystem services are provided in Appendix 17.1 Ecosystem Services Checklist.

Table 17.2 Ecosystem Services Checklist

Provisioning Services	Regulating Services	Cultural Services
Crops	Local climate regulation	Tourism & recreation values
Livestock & fodder	Global climate regulation	Cultural & spiritual values
Capture fisheries	Air quality regulation	Scientific & knowledge values
Aquaculture	Hazard regulation	Wild species diversity
Wild foods	Water quality regulation	
Timber	Pollination	
Energy	Disease and pest control	
Biochemicals / medicine	Noise regulation	
Water (supply)	Soil quality regulation	

Continued…

[3] Note, IFC Guidance Note 6 states that *"client requirements are focused on the mitigation of impacts on ecosystem services and the benefits that ecosystem services might bring to companies rather than on the economic valuation for such services".*

Provisioning Services	Regulating Services	Cultural Services
Fibres and ornamental resources		
Genetic resources		

Complete.

It is important to note that impacts on supporting services are not explicitly accounted for in the ESIVI ecosystem services assessment in order to avoid double-counting. This follows from Bateman *et al.* who draw the distinction between supporting ecosystem services (e.g. nutrient cycling), final ecosystem services (e.g. growth of trees), goods (e.g. timber), and benefits (e.g. livelihoods) (Ref. 17.2).

Final ecosystem services are the last item in the chain of ecosystem functioning which inputs to the production of goods. They are the aspects of the natural environment which most directly affect human well-being. This focus on the final item in the chain of ecosystem services is to avoid the double counting which would occur if an attempt is made to value those intermediate ecological processes or outcomes (e.g. weathering, photosynthesis, nutrient cycling, etc.) which are captured elsewhere in the provisioning, regulating, and cultural services that they support. For example, the impacts of supporting services such as photosynthesis are accounted for in terms of their support of crop growth and timber production.

An important exception is nevertheless made in the case of biodiversity. The authors of the MA argued that biodiversity underpins ecosystem function and should therefore be categorised as a supporting service. As such, biodiversity in itself would be excluded from the ecosystem service assessment in order to avoid double counting. However, a number of other studies suggest that the existence of biodiversity is itself a service, regardless of whether or not it provides a supporting role in the provision of any other services, and that people are willing to pay to preserve global biodiversity even if they do not benefit from any of the ecosystem services it supports (Ref. 17.20, 17.21 and 17.22). Excluding biodiversity from the ecosystem services assessment would fail to capture such values.

Therefore, in order to capture as wide a range of benefits as possible, and following the approach of the landmark UK National Ecosystem Assessment (Ref. 17.19), "*wild species diversity*" is included in the assessment as a distinct cultural service in its own right. To avoid double counting, the ecosystem services assessment distinguishes between biodiversity as a supporting function, and wild species diversity that is valued for its own sake (i.e. the existence value that people are willing to pay for the preservation of particular species, or local values attached to particular species which are not captured within other services). As a result, the assessment for wild species diversity focuses on any threats to populations of locally, regionally, nationally, or globally significant species.

Using the ESIVI checklist (Table 17.2), the range of ecosystem services potentially provided by the affected ecosystems, and the likely beneficiaries (direct or indirect) of each of those services were identified. As set out in PS 1, the emphasis during the initial identification stage is on covering the broadest possible scope of beneficiaries, including:

- Local beneficiaries, such as those who benefit from growing crops in a household plot close to where they live;
- Regional beneficiaries, such as those living within a watershed who benefit from flood protection;
- National beneficiaries, such as those across the country who visit an area for tourism / recreational purposes; and
- Global beneficiaries, such as those across the world who for example, benefit from carbon sequestration.

Identifying the type of beneficiary is important at this stage because different types of beneficiary are assessed differently with regards to mitigation requirements. For example, IFC PS 6 applies to ESS whose beneficiaries are at the local or regional scale, while PS 1 applies to ESS with global beneficiaries, such as carbon sequestration. Further, the type of beneficiaries also informs whether an ecosystem service is classed as a Type 1 service, where impacts on ecosystem services may adversely affect communities, or a Type 2 service, where the project directly depends on an ecosystem service for its operations. Identification of beneficiaries at this stage also informs the baseline data collection plan by identifying the particular groups or individuals who need to be consulted about the extent to which they presently benefit from (or value) each of the ecosystem services identified.

Once the broadest possible range of potential ecosystem services and their associated beneficiaries were identified, each service was systematically reviewed and scored against the inclusion criteria shown in Table 17.3 to identify which ecosystem services should be included in the more detailed impact assessment and which should be scoped out of the assessment.

Table 17.3 Criteria for Determining the Scope of the Ecosystem Services Assessment*

Inclusion Criteria	Assigned Score		
Is this service provided by affected ecosystems?	No 0	Potentially 1	Yes 2
Is the Project likely to have an impact on the ecosystem which provides this service?	No 0	Potentially 1	Yes 2
Is the Project likely to reduce any of the benefits that any people derive from this ESS? **	No 0	Potentially 1	Yes 2
Does the Project depend on this ESS for successful performance?	No 0	Potentially 1	Yes 2

Continued...

Inclusion Criteria	Assigned Score		
Does the client have direct management control or significant influence over this ESS? †	No 0	Potentially 1	Yes 2
Is the Project likely to have an overall beneficial impact on service use or provision?	No 0	Yes 15	

Ecosystem Service Relevance		Score
Negligible	Service not present and unlikely to be affected Does not have to be assessed further	0
Low	Project may have an insignificant impact / dependence on the service Does not have to be assessed further	1-4
Moderate	Project likely to have a significant impact on beneficiaries of the service or likely to be dependent on the service Must be assessed further	5-8
High	Project likely to have a significant impact on beneficiaries of the service and likely to be dependent on the service Must be assessed further	9-10
Benefit	Project is likely to have a positive impact on service provision Does not have to be assessed further	>10

* Note, under the scoring system set out in Table 17.3, a service can only be classed as high relevance if it is both a Type 1 and a Type 2 service i.e. the Project could reduce the benefits that people derive from the service and the Project itself depends on the service for successful performance.
** Note, this criterion specifically refers to potential impacts on users of a service while the preceding criterion refers to potential impacts on the ecosystem which provides the service. This is an important distinction because a Project may have significant impacts on an ecosystem (such as by withdrawing significant amounts of water from a river), however, whether or not people are using this service is an important factor in assessing the significance of the impact.
† Note, this criterion follows the guidelines set out in the IFC PS and identifies whether a client can be said to have control over a Project's impacts on an ecosystem service (this may exclude, for example, upstream manufacture of inputs or downstream use of a product) and whether the impacts are likely to be of significant influence (while a Project may impact on a service, for example, it may be possible to exclude these impacts from the assessment if it is known at the scoping stage that the impacts will be insignificant in terms of beneficiaries well-being).

The purpose of this initial scoping exercise was to identify any ecosystem services that may be provided by affected ecosystems, the extent of use, and how likely each of these services are to be impacted by the Project. Once the likely relevance was assessed, a shortlist of ecosystem services to be included in the baseline and impact assessment sections was compiled. Since this is a scoping exercise, the potential impact ratings shown in Table 17.4 should not be interpreted as an ultimate determination of impact significance; rather they are intended as an indication of the potential for an impact on a service to occur and the potential level of that impact.

The scoping exercise was undertaken through a review of both the information and data collected for the Russian Sector EIA and other ESIA chapters, including satellite mapping, site visits, and stakeholder consultation. A review of published literature was also carried out to supplement the existing evidence and to provide more detailed technical information where needed. As further information became available throughout the baseline and impact assessment process, the initial scoping exercise was revisited and updated where necessary in order to ensure that all relevant ecosystem services were included in the impact assessment.

The scoping exercise resulted in the identification of ten ecosystem services to be taken forward for more detailed assessment. These are:

- Crops;
- Capture fisheries;
- Water (supply);
- Hazard regulation;
- Air quality regulation;
- Water quality regulation;
- Soil quality regulation;
- Tourism and recreation values;
- Cultural and spiritual values; and
- Wild species diversity.

The full results of the scoping exercise are found in Appendix 17.2 Scoping Results while a summary of the rationale for inclusion or exclusion of each ecosystem service is provided in the following table.

Table 17.4 Scoping Exercise: Summary of the Rationale for Inclusion or Exclusion of Each Ecosystem Service

Ecosystem Service	Relevance*	Include in Impact Assessment	Justification
Crops	Moderate	Yes	Construction of the Pipeline will require some temporary and permanent loss of agricultural land. Vineyards would be the primary crop affected. The loss of agricultural production could have an impact on the current and future income from productive land which could also impact on employment opportunities.
Livestock & fodder	Negligible	No	There is no evidence of livestock farming or any grazing areas within the vicinity of the Project Area and it is unlikely that provision or use of the service will be affected by the Project.
Capture fisheries	Moderate	Yes	Fishing is undertaken along the coast in the vicinity of the marine component of the Project. At the time of scoping it was identified that the Project could limit access to fishing areas and could disturb fish habitats and fisheries productivity, which could impact livelihoods and well-being. Furthermore, several fishing organisations voiced concerns during the stakeholder consultation meetings held between 10th and 14th December 2012 and in October 2013 around the potential for the Project to restrict access to fishing grounds, to act as a barrier to fish migration, or to impact upon fisheries productivity as a result of noise and vibration (**Chapter 6 Stakeholder Engagement**).

Continued…

Ecosystem Service	Relevance*	Include in Impact Assessment	Justification
Aquaculture	Negligible	No	There is a mussel farm located around 3.8 km to the south of the proposed Pipeline route, near Bolshoi Utrish marina. However, the Project is not expected to impact upon mussel farming activities due to the distance from Project activities (Appendix 14.1 Fisheries Study).
Wild foods	Low	No	Hunting is prohibited in the area in which the Project is located, although information suggests that poaching of species such as rabbit, deer, wild boar, tortoise, and game birds may occur. Due to the limited amount of habitat that will be impacted by the Project relative to the surrounding area, the Project is unlikely to significantly impact the numbers or distributions of such species. Rural households may also collect wild foods from forested areas within the vicinity of the Project Area and the Project could reduce the provision of such foods due to vegetation clearance and through restricting access to land within the Project Area. Conversely, however, vegetation clearance could increase accessibility to this resource by providing a path which could be used to exploit forest resources that are not directly affected by Project activities. Overall, the scale of vegetation loss is minor and the habitat is well replicated nearby. As such, any impact on provision or use of the service is likely to be low.
Timber	Negligible	No	The Project Area covers an area of forest owned by the State Forestry Department. However, there is no timber harvesting or woodland management regime in place within this area of forest so there is unlikely to be any impact on timber provision. At the time of scoping it was identified that rural households may collect timber from other forested areas surrounding the Project Area however these areas would not be impacted by the Project. The Project could have a temporary beneficial impact on this service if the timber cleared during construction is made available for rural households.

Continued…

Ecosystem Service	Relevance*	Include in Impact Assessment	Justification
Energy	Low	No	Forested ecosystems within the vicinity of the Project Area provide a supply of wood that could be harvested as an energy resource. At the time of scoping it was identified that rural households may collect wood from forested areas potentially impacted by the Project and that the Project has the potential to reduce the availability of such fuels due to vegetation clearance. However, the scale of vegetation loss is relatively minor and habitat is well replicated nearby. Further, vegetation clearance may increase accessibility to this resource by providing a path which could be used to exploit forest resources that are not directly affected by Project activities. As such, any impact on provision or use of the service is considered to be low. As with timber provision, the Project could have a temporary beneficial impact on this service if the vegetation cleared during construction is made available for rural households. There is no use of other ecosystem-based energy such as biofuels or hydropower that could be affected by the Project.
Biochemicals / medicine	Low	No	Consultation with the local administration and government agencies revealed that there may be some collection of flora and fauna within the vicinity of the Project Area which is believed to have medicinal and/or spiritual properties. Local households (particularly elderly members) may also harvest herbs and plants growing in and around the Project Area to produce family cures and teas. These species have been extensively catalogued (Ref. 17. 23). The Project could potentially reduce the provision of such resources due to vegetation clearance and habitat loss. However, the scale of vegetation loss is relatively minor and habitat is well replicated nearby. The construction of access roads and clearance of forest could also increase the accessibility of such resources. As such, any impact on provision or use of the service is considered to be low.

Continued…

Ecosystem Service	Relevance*	Include in Impact Assessment	Justification
Water (supply)	Moderate	Yes	At the time of scoping it was identified that there are several surface and ground water resources present within the Project Area which flow to and/or are used directly by beneficiaries for drinking and industrial / agricultural uses. The Project Area crosses water courses at several points and could impact downstream surface water flows. The clearance of vegetation could also impact surface flows and groundwater recharge rates. Changes in the availability of water resources could impact the well-being of potential beneficiaries. Freshwater is required for Project activities and so this is identified as a Type 1 and a Type 2 service. Water required by the Project will be abstracted from a Ministry of Defence owned well near Sukko and tankered in to the site. The abstraction of water could draw down water levels and impact the ability of other users to access water.
Fibres and ornamental resources	Low	No	Shells are collected from the marine environment, which are sold as handicrafts in local markets (particularly a certain species of conch with a large orange shell). The Project could temporarily (during construction) impact access to areas where shells are collected although this is likely to have minimal impact on service use and provision as shells may be collected from other sites along the coast and the supply of shells is unlikely to be significantly impacted.
Genetic resources	Negligible	No	There is no evidence of any use of flora or fauna within or immediately surrounding the Project Area for the conservation or preservation of genetic resources. While it is possible that there may be as yet undiscovered genetic resources, there is no recorded scientific interest in the immediate vicinity of the Project Area and the habitat and fauna is replicated nearby, particularly in the Utrish State Nature Reserve, which is likely to provide a more important source of genetic resources.
Local climate regulation	Negligible	No	Due to the small scale of the Project Area relative to the extent of the surrounding ecosystems, it is unlikely that the area impacted by the Project plays an important role in local climate control, e.g. the regulation of precipitation, cooling, or shading etc. As such there is unlikely to be any significant change in provision or use of this service.

Continued…

Ecosystem Service	Relevance*	Include in Impact Assessment	Justification
Global climate regulation	Low	No	Vegetation and soils play a role in sequestering and storing greenhouse gases. Construction of landfall facilities and the Pipeline, clearance of vegetation, and fuel burnt in generators and transportation will generate greenhouse gases. Disturbance of the seabed could also potentially lead to the release of methane deposits. However, the impact of these activities relative to global greenhouse gas emissions and their effects on the well-being of populations affected by climate change is considered to be negligible (**Chapter 9 Air Quality**).
Hazard regulation	Moderate	Yes	Both the Project and local communities depend on the capacity of natural systems to regulate natural hazards such as floods, mudslides, and erosion. Several stakeholders from Varvarovka and Gai Kodzor raised the potential for increased flood risk as an issue during the initial stakeholder engagement exercise held in December 2012 (**Chapter 6 Stakeholder Engagement**). The Project could potentially impact local flooding events through the crossing of water courses. The clearance of vegetation (which binds soil particles) could also lead to an increase in erosion. Marine dredging could affect natural coastal processes leading to changes in coastal erosion and flooding. Since both local communities and the Project itself depend on hazard regulation, this is both a Type 1 and a Type 2 service.
Air quality regulation	Moderate	Yes	Air quality regulation is an important service within Anapa Resort Town which is renowned and marketed for its health benefits (Ref. 17.24). At the time of the scoping exercise it was identified that the Project could impact air quality regulation through the clearance of vegetation which plays a role in absorbing pollutants from the atmosphere (Ref. 17.25) as well as through emissions from construction vehicles and equipment.

Continued…

Ecosystem Service	Relevance*	Include in Impact Assessment	Justification
Water quality regulation	Moderate	Yes	Good water quality is important for fishing, human consumption, tourism, as well as for general ecosystem functioning. The Project could impact marine, surface, and ground water resources through spills, leaks, disposal of wastewater etc. during construction. Any Project contamination of groundwater is likely to be an important issue where people are abstracting directly from groundwater resources. Dredging (which could potentially expose contaminants in the sea bed) and disposal of hydrotest water could impact marine water quality with potentially significant impacts on well-being for the tourism industry, recreational water users, and fishing.
Pollination	Low	No	Several Lepidoptera (in their butterfly or moth adult life stage) and bee species feed on flower nectar and play a role in pollination within the ecosystems surrounding the Project Area. The primary habitat types which support such species are secondary and mesophilic meadows. The terrestrial land take required by the Project is likely to lead to a small loss of secondary meadow. The limited extent of this loss in respect to the surrounding habitat means that the Project is unlikely to significantly impact the distribution or population of any important natural pollinators. As such, the impact on the provision and use of the service is expected to be low.
Disease and pest control	Negligible	No	There is no evidence to suggest that the ecosystems or any particular species within the vicinity of the Project Area play a significant role in pest control. There is also no evidence of any habitats (e.g. standing water) which may influence the incidence and abundance of human pathogens (**Chapter 15 Community Health, Safety and Security**).
Noise regulation	Negligible	No	There is no evidence that ecosystems within the vicinity of the Project Area play an important role in noise regulation.

Continued…

Ecosystem Service	Relevance*	Include in Impact Assessment	Justification
Soil quality regulation	Moderate	Yes	Terrestrial soil quality is important for landowners, workers, human health, flora, and fauna. Healthy soil also plays an important role in flood regulation through the capacity for water absorption. The Project could impact this service through excavation of top soil, clearance of vegetation, and contamination through leaks and spills. The potential Project impact on soils was raised by several Supsekh residents during the initial stakeholder engagement exercise.
Tourism & recreation values	Moderate	Yes	Tourism is an important and growing industry in the region and potential Project impacts on this service were raised during the initial stakeholder engagement exercise. The Project could affect both terrestrial and marine tourism and recreation (e.g. through temporary loss of access or disturbance to hiking trails, beaches, and the marine environment). In particular, the well-being of the owners of, and visitors to, the Shingari and Don resort complexes could be impacted by the Project due to restricted access to areas used for water sports, by visual and noise disturbance during the construction period, or by potential impacts on marine water quality. Potential impacts on Sukko beach were raised during stakeholder consultation (**Chapter 6 Stakeholder Engagement**).
Cultural & spiritual values	Moderate	Yes	The natural environment plays an important role in the cultural identity and aesthetic value of the area (including Anapa, Gai-Kodzor, Sukko, Supsekh and Varvarovka). There are also a number of sites of cultural (graves / cemeteries / war memorials), scientific (archaeological remains), and spiritual (churches / sacred springs / religious and community festivals) importance. The Project could temporarily disturb such sites and permanently change elements of the natural environmental setting of the area which could impact on the well-being of any beneficiaries.

Continued…

Ecosystem Service	Relevance*	Include in Impact Assessment	Justification
Scientific & knowledge values	Benefit	No	Marine surveys for the Project collected geophysical data from Black Sea locations not previously studied. Preliminary analysis of this data suggests that the Project has facilitated the discovery of information which will be valuable to scientific knowledge. Publication of the results of this research will be explored in appropriate academic publications when available. Bacterial life which has adapted to survive in extreme anoxic environments may be present in areas of deep water offshore. While some mussel / bacterial matts were identified there was no evidence to suggest that this life is of any unique interest to science. Due to the potentially significant contribution to science that such surveys have revealed, the impact of the Project on this service is considered to be beneficial.
Wild species diversity	Moderate	Yes	A number of terrestrial and marine species of national and global conservation importance are present in the ecosystems within and surrounding the Project Area, including critically endangered sturgeon species and a critically endangered tortoise species. The Project could impact such species through collisions, disturbance, severance, loss of habitat etc. Further, the most common concern raised by stakeholders during consultation (raised 33 times) was the Project's potentially negative impact on the natural environment, including the marine environment, the coastline, onshore valuable habitat area (e.g. the mountain area of the Kilberov Canyon), juniper trees, and local wildlife around the proposed compressor station (**Chapter 6 Stakeholder Engagement**). As such, impacts on wild species may potentially have a direct impact on the well-being of stakeholders including local communities and NGOs.

*As calculated using the approach set out in Table 17.3, see Appendix 17.2 for full details.

Complete.

17.4 Spatial and Temporal Boundaries

Ecosystem services are the contributions that ecosystems make to human well-being and business performance. As such, the focus of the ecosystem services assessment is on assessing changes in beneficiary well-being (including both Affected Communities and the Project itself), as a result of impacts on ecosystems and their associated services (Figure 17.3).

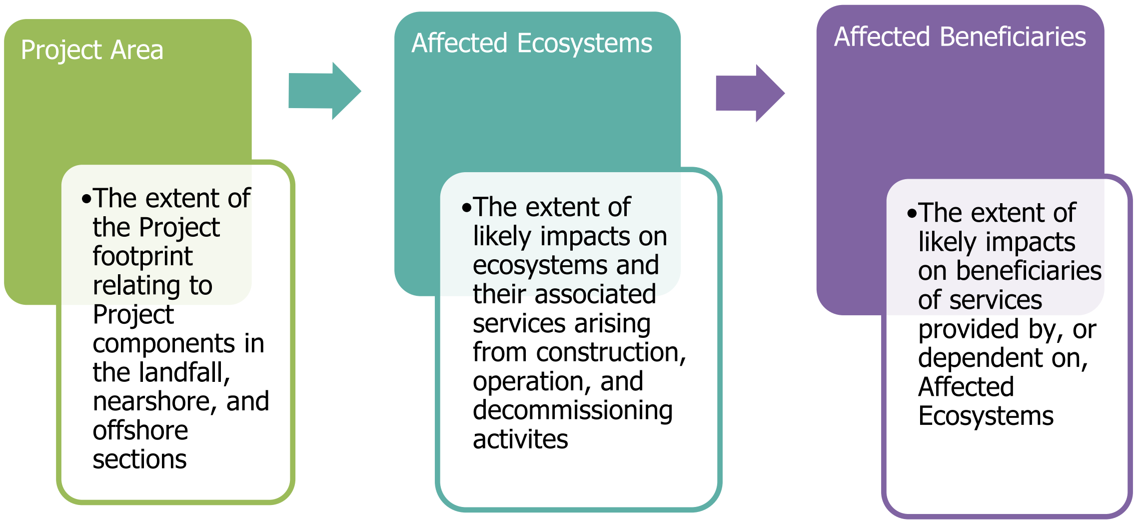
Figure 17.3 Impact Pathway for Assessing Impacts on Ecosystem Services

The assessment in this chapter therefore differs from other chapters in that it involves a two-stage process. First, the impacts on the ecosystem and its associated services (the physical receptor) need to be understood before the implications for ecosystem service beneficiaries (the social receptor) can be assessed.

As such, the spatial boundaries of this assessment are determined by: the Project Area and the ecosystems within it which are affected by the construction, operation, and decommissioning phases of the Project (a physically defined area); the flows of ecosystem services generated by these ecosystems; and ultimately, the locations of the ecosystem service beneficiaries (a socially defined area).

The relationship between the Project Area, the Affected Ecosystems, and the Affected Beneficiaries is illustrated in Figure 17.4 below. Further details on each of the assessment areas are provided in the following sections.

Figure 17.4 Defining Spatial Boundaries for Assessing Impacts on Ecosystem Services



17.4.1 Project Area

The Project Area includes landfall, nearshore, and offshore sections. These are described in detail in **Chapter 1 Introduction** and in **Chapter 5 Project Description**.

17.4.2 Affected Ecosystems

The Affected Ecosystems are defined by the extent of the ecosystems or land uses which are most likely to be impacted by the construction, operation, or decommissioning phases of the Project.

Since ecosystems make up interconnected areas of natural habitat they cannot be restricted to a particular spatial area on a map. However, drawing a defined spatial boundary at this stage provides a basis for identifying the ecosystems most likely to be impacted by the Project. Since the Project includes both onshore and offshore components, the potential impacts on both marine and terrestrial ecosystems (including inland freshwater bodies) are considered.

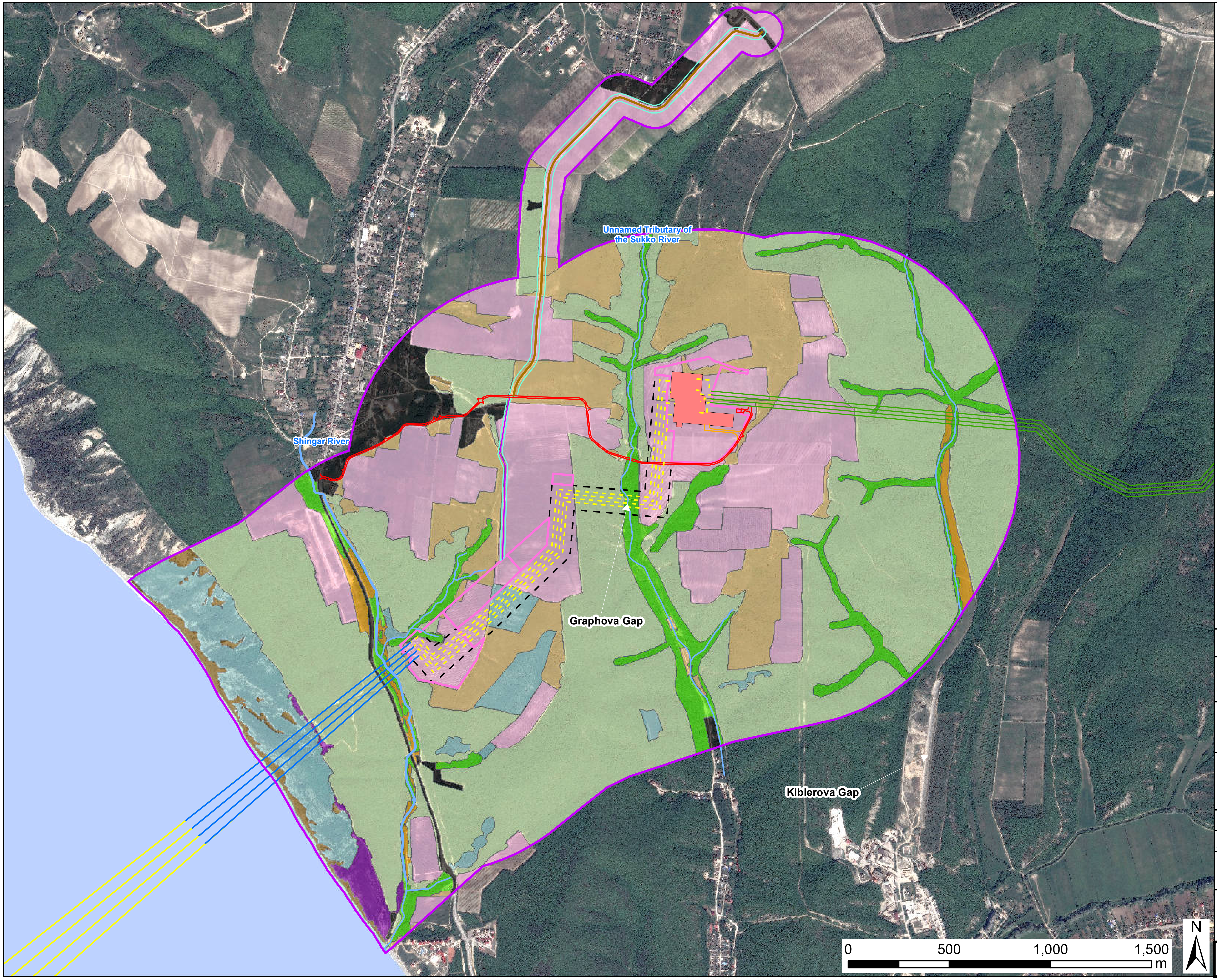
17.4.2.1 Terrestrial Affected Ecosystems

Any ecosystems which fall at least partly within the landfall section of the Project Area could potentially be impacted by the Project through habitat loss, vegetation clearance, compaction, etc., while certain activities such as leaks, spills or emissions could have physical impacts on ecosystems (or parts thereof) outside of the Project Area.

Further, while the area within the safety exclusion zone (a 410 m width surrounding the Pipeline and the landfall facilities) may not experience any direct physical impacts, there will be restrictions on land use and development within the exclusion zone which could potentially affect access to ecosystem services provided *in situ* (e.g. crops, wild foods, etc.).

For the purposes of the ecosystem services assessment, the starting point for identifying potentially Affected Ecosystems has been defined as a 1 km radius surrounding the landfall section, extending to the coastline (Figure 17.5).[4]

[4] Note, taking this as a starting point recognises that the extent of the Affected Ecosystem could extend beyond the 1 km boundary. These wider impacts are accounted for through the assessment of impacts on beneficiaries.



LEGEND

- Landfall study area
- Juniper Woodlands
- Mesophilic Forest
- Mesophilic Meadow
- Vineyards And Orchards
- Residential Area And Ruderal Habitats
- Rocky Outcrops
- Seaside Gravel
- Shiblyak (Undersized Xerophilous Forest)
- Steppefied Secondary Meadow
- Tomillyar
- Rivers

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Landfall facilities
- Proposed microtunnels
- Proposed offshore pipelines
- Construction corridor
- Temporary construction area for road construction
- Construction sites
- Permanent access road to be constructed by SSTTBV
- Temporary access road constructed by SSTTBV
- Varvarovka bypass road (used by Project during construction only)

United Gas Supply System

- United Gas Supply System pipelines
- Permanent access road to be constructed by Gazprom Invest

Projection: Lambert Conformal Conic

Purpose of Issue
For Information

Client
South Stream
Offshore Pipeline
ENERGISING EUROPE

Project Title
SOUTH STREAM OFFSHORE PIPELINE

Drawing Title
TERRESTRIAL AFFECTED ECOSYSTEMS

Drawn	Checked	Approved	Date
DH	RW	MW	05 Mar 2014

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Drawing Number
Figure 17.5

Rev

Plot Date: 05 Mar 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 17 Ecosystem Services\Figure 17.5 Terrestrial Affected Ecosystems.mxd

17.4.2.2 Marine Affected Ecosystems

As noted above, the Project Area is divided into landfall, nearshore and offshore sections. This division is based on technical consideration of different construction activities to be employed in each section, and has no connection to the ecosystems in which Project activities take place. For the purposes of assessing the impacts on marine ecosystem services, and following the approach taken in **Chapter 12 Marine Ecology**, the 'nearshore section' is therefore considered to also include the area between 0 to 23 m water depth, which forms part of the 'landfall section' in the Project Description. Because the nearshore and offshore sections of the Project Area are ecologically contiguous, they are considered as one in this chapter.

During the construction phase of the Project the nearshore section of the Project Area is defined by the maritime safety exclusion zones around the construction vessels, extending out 3 km either side of the outermost pipeline, encompassing:

- The area impacted by sediment dispersion, based on sediment models;
- The route of the four individual pipelines;
- The likely anchor spread and movement locations of vessels directly associated with the Pipeline installation and maintenance; and
- The proposed microtunnel exit pit and temporary dredge storage location.

The nearshore section Project Area is approximately 5.2 km^2.

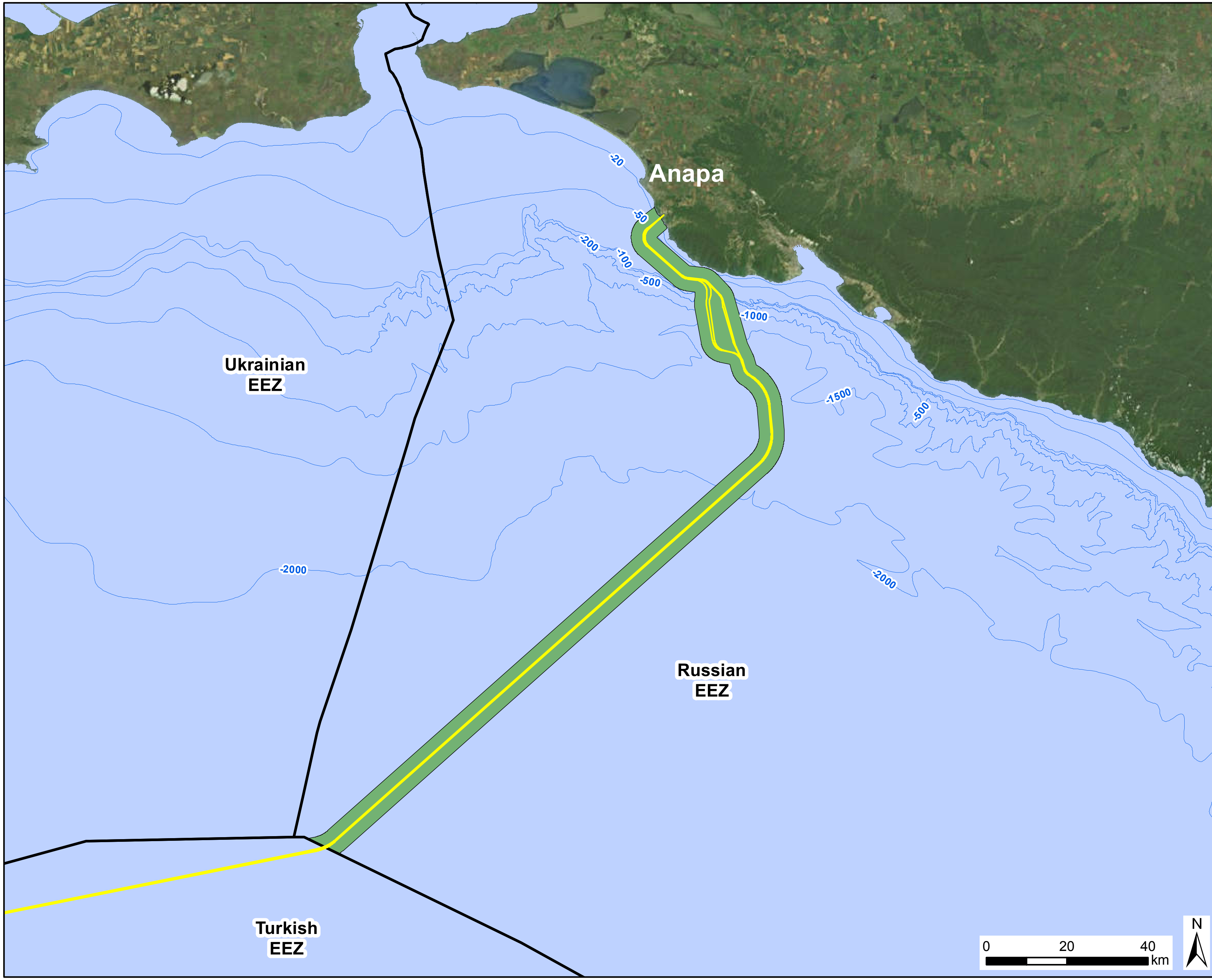
The offshore section is approximately 225 km in length and pipelines will be laid directly on the sea bed from the maximum water depth where dredging works will take place (30 m water depth), to the boundary between the Russian and Turkish EEZs. The Project Area of the offshore section consists of a corridor of 3 km from the boundary of the nearshore section to the 600 m water depth contour, after which the corridor decreases to 2 km width either side of the outermost pipeline from the 600 m water depth contour to the EEZ boundary. The offshore section of the Project Area encompasses:

- The area impacted by sediment dispersion, based on sediment models;
- The route of the four individual pipelines; and
- The likely anchor spread and movement locations of vessels directly associated with the Pipeline installation and maintenance.

The offshore section is approximately 1,080 km^2 which is 206 km^2 from the nearshore boundary to the 600 m water depth contour and 874 km^2 from this to the EEZ boundary.

During the operation phase the Project Area will be smaller, defined by the operation exclusion zone of 0.5 km either side of the outside pipelines from the microtunnel exit point to the Russian / Turkish EEZ boundary (end of offshore section).

The starting point for assessing the potential impacts on ecosystem services in the marine environment has been delineated as a 3 km wide corridor following the nearshore section of the Pipeline to the 600 m water depth contour, and then a 2 km wide corridor from the 600 m water depth contour to the EEZ boundary. Again, taking this as a starting point recognises that the potential extent of predicted impacts (e.g. noise disturbance) may extend beyond this boundary. These are captured in the assessment of impacts on beneficiaries.



LEGEND

Affected Ecosystems

Russian Sector of South Stream Offshore Pipeline

Proposed offshore pipelines

Exclusive Economic Zone boundary

Isobaths

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: For Information

Client: South Stream Offshore Pipeline – Energising Europe

Project Title: SOUTH STREAM OFFSHORE PIPELINE

Drawing Title: MARINE AFFECTED ECOSYSTEMS

Drawn	Checked	Approved	Date
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17.4.3 Affected Beneficiaries

Due to the interconnectedness of ecosystem processes and the flows of services they provide, impacts on Affected Ecosystems may also influence the ability of people to use or access particular services outside of the Affected Ecosystems.

For example, abstraction from surface waters within Affected Ecosystems, could reduce surface water flows which could impact the ability of beneficiaries to abstract water downstream. Likewise, fish species may breed at particular sites within marine Affected Ecosystems and then migrate throughout the marine environment supporting fishing industries across multiple countries.

As such, beneficiaries living outside of the Affected Ecosystems may be impacted by changes to the services provided and the assessment therefore needs to consider, *"project-related impacts across the potentially affected landscape or seascape…which does not necessarily correspond to any one pre-defined unit of geographical space"* (Ref. 17.26).

Further, the location of beneficiaries can vary depending on the type of service and, as such, beneficiaries are not restricted to a particular spatial area or landscape. For example, while the beneficiaries of the local climate regulation service may be restricted to the surrounding area, the beneficiaries of global climate regulation may be located throughout the world. As such, the extent of impacts on beneficiaries of ecosystem services can extend far beyond the Project Area or the Affected Ecosystems.

The Affected Beneficiaries are therefore defined by the location of the beneficiaries of the services provided by or dependent upon the Affected Ecosystems. While most of the beneficiaries are likely to be located within or around the ecosystems providing services, they vary across different services and can be located regionally, nationally, or even globally.

As such, the locations of Affected Beneficiaries are not restricted to a single pre-defined unit of geographical space and instead are defined for each ecosystem service depending on the beneficiaries of that service.

While the focus of the assessment in this chapter is on potential impacts on local beneficiaries living close to or within the Affected Ecosystems (defined as beneficiaries living in the Local Area[5]), impacts on regional, national, and global beneficiaries are identified and accounted for where applicable (Table 17.5 and Figure 17.7).

[5] Note: the definition of the Local Area is in alignment with the Local Communities identified in **Chapter 14 Socio-Economics** and encompasses the towns of Anapa, Gai-Kodzor, Sukko, Supsekh, Rassvet, and Varvarovka. Defining a Local Area in this manner is used to delineate between local and regional beneficiaries in order to provide a focus for the assessment. While beneficiaries living within the Local Area provide the main focus of the assessment, impacts on regional, national, global beneficiaries are identified where relevant and included in the assessment.

Table 17.5 Ecosystem Service Beneficiaries

Location of Beneficiaries	Definition
Local Area	Residents, landowners, and companies located within the towns of Anapa, Gai-Kodzor, Sukko, Supsekh, Rassvet, and Varvarovka who directly or indirectly benefit from services provided by, or dependent upon, the Affected Ecosystems (e.g. crops).
Regional	Residents, landowners, and companies within the wider region (Krasnodar Krai) who directly or indirectly benefit from services provided by, or dependent upon, the Affected Ecosystems (e.g. fisheries).
National	Residents, landowners, and companies within the Russian Federation who directly or indirectly benefit from services provided by, or dependent upon, the Affected Ecosystems (e.g. tourism).
Global	Residents, landowners, and companies within other countries who directly or indirectly benefit from services provided by, or dependent upon, the Affected Ecosystems (e.g. carbon sequestration).

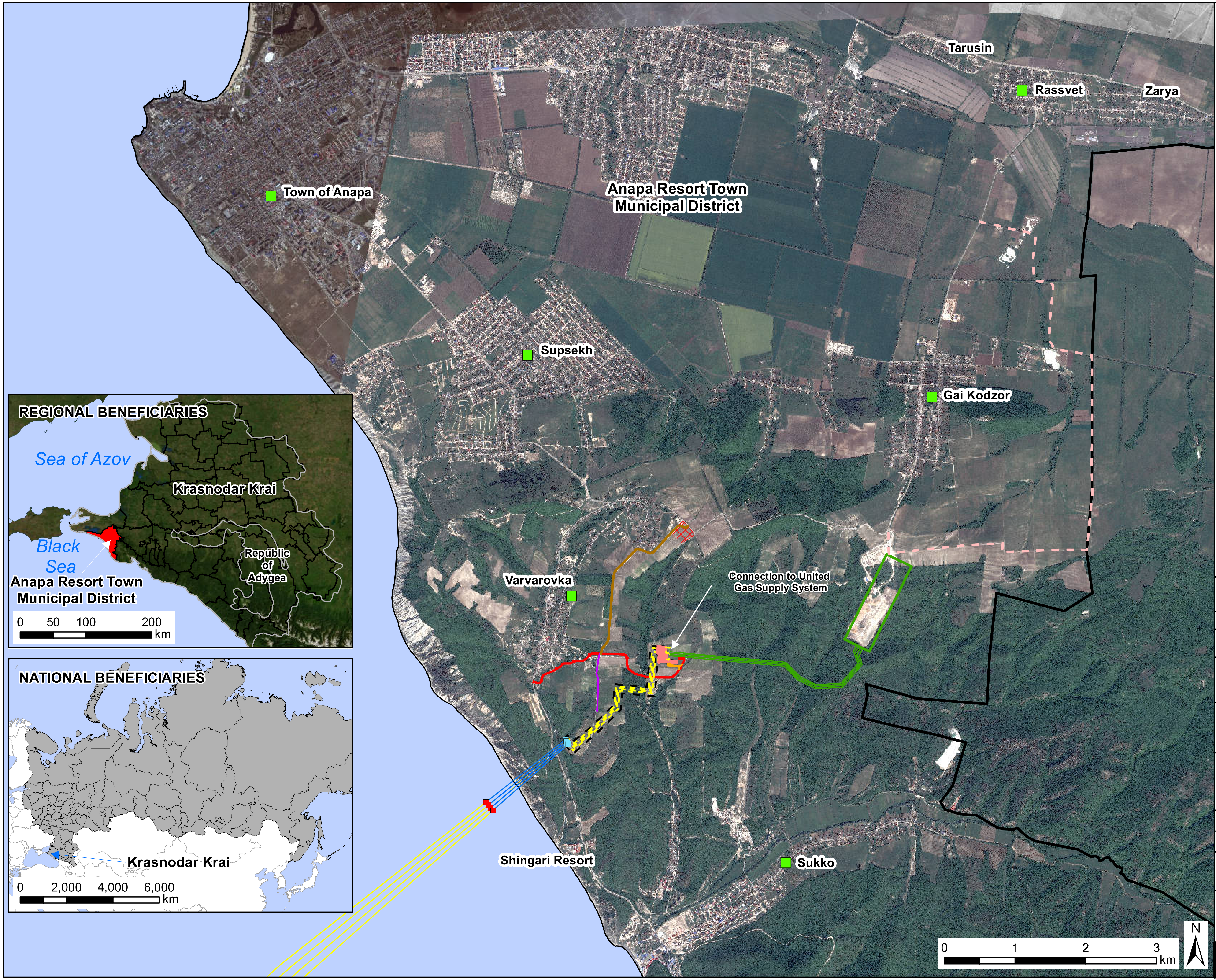
17.4.4 Temporal Boundaries

The temporal boundaries of this assessment are defined by the five key phases of the Project as set out in **Chapter 1 Introduction**. These include:

- Feasibility Phase (2007 to 2011);
- Development (or Design) Phase (2012 to 2013);
- Construction and Pre-Commissioning Phase (2013 to 2018);
- Operational Phase (2018 to 2065)[6]; and
- Decommissioning Phase (2065 onwards).

Unless otherwise indicated, the temporal boundaries of this assessment are assumed to be the life of the Project (i.e. 50 years).

[6] First gas from Pipeline #1 is scheduled for late 2015, and all four pipelines are expected to be fully operational by the end of 2017.



LEGEND

- Communities in local area
- Anapa resort town municipal district boundary

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Landfall facilities
- Proposed microtunnels
- Proposed offshore pipelines
- Microtunnel entry shaft
- Microtunnel exit pit
- Construction corridor
- Permanent access road to be constructed by SSTTBV
- Temporary access road constructed by SSTTBV
- Varvarovka bypass road (used by Project during construction only)
- Transfer site

United Gas Supply System

- Russkaya compressor station
- United Gas Supply System pipelines
- Permanent access road to be constructed by Gazprom Invest
- Gazprom Invest temporary bypass road to be utilised by SSTTBV

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File Name: \\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 17 Ecosystem Services\Figure 17-7 Affected Beneficiaries.mxd

17.5 Baseline Data

17.5.1 Methodology and Data

Following the scoping exercise, the next step was to establish the present condition of the scoped-in services as well as broad trends in their provision and use. The baseline provides an analysis of the existing condition of an ecosystem and the services it provides in the absence of the Project, taking into account external factors (i.e. not related to the Project) that may affect future service provision including, for example, climate change, population growth, and changes in land management. Ultimately, the baseline provides a counterfactual or reference scenario from which the impacts of the Project can be measured and covers:

- Current provision of services and how the habitat / land cover supports their delivery;
- The importance of ecosystem services to beneficiaries; and
- How ecosystem services and the benefits they provide are likely to change in future in the absence of the Project.

The data used for the baseline assessment was obtained from a wide range of sources including secondary sources (i.e. existing data including government or academic reports etc.) and primary sources (i.e. new data collected through interviews, field surveys, and stakeholder engagement activities as described in **Chapter 6 Stakeholder Engagement**).

Information collected during the baseline data collection stage revealed locally important ecosystem services which were not included in the initial scoping exercise, as well as some services initially thought to be important which were found not to be of significant value. As data was collected, the outcomes of the original scoping exercise were updated to ensure that these more accurately reflected the importance of each of the ecosystem services to beneficiaries as suggested by the evidence from the baseline data analysis.

The remainder of this section sets out the data sources in more detail and the limitations of the assessment in terms of the availability of data collected.

17.5.2 Secondary Data

Secondary data and information was obtained through a literature review of relevant peer-reviewed journal articles, research reports, newspaper articles, and publically available databases.

17.5.3 Data Gaps

Due to the fact that the importance of services provided by different ecosystems depends upon how people interact with and value them, the analysis revealed a number of information gaps in relation to the provision and use of services which were not captured through secondary data sources.

17.5.4 Primary Data and Baseline Surveys

In light of the data gaps that emerged from the review of secondary data, a data collection exercise was undertaken which sought to supplement the secondary data gaps as well as to verify and ground-truth the secondary data available. Primary data on ecosystem services was collected during field visits in 2012 and 2013. These visits included: stakeholder meetings; observations of conditions; and meetings and interviews with local government authorities, local businesses including fisheries enterprises representatives, and local landowners.

Since ecosystem services represent the intersection of the natural and human environment, this chapter also draws upon the baseline information and analysis conducted in other relevant chapters of the ESIA. Any gaps in the baseline data relating to ecosystem services were discussed with the relevant technical chapter specialists in case the information was readily available and/or could be obtained through on-going data collection and stakeholder engagement. In order to ensure a comprehensive and collaborative approach to this process, a workshop was held with the technical specialists from each of the environmental and social disciplines covered in the ESIA to discuss the baseline, impacts, and mitigation sections of this chapter. Following the workshop, the collaborative approach was continued with an on-going dialogue with each of the specialists and reviews of the assessment in this chapter being undertaken by the relevant specialists as necessary.

17.5.5 Data Assumptions and Limitations

Accurate, quantifiable data on the use of ecosystem services is used where possible (e.g. loss of potential crop yield), however, for many ecosystem services the data were not available to establish a detailed and quantifiable metric in terms of baseline provision or use for each ecosystem service.

While this is a potential limitation, it does not significantly undermine the results of the assessment since the ecosystem services assessment refers to and builds upon the assessments undertaken in each chapter of the ESIA which use measurable metrics for assessing changes in the natural environment. The emphasis of this assessment is placed on drawing together the other chapters in the ESIA to assess the impacts on the well-being of beneficiaries resulting from changes in the natural environment. As such, the ecosystem services assessment aims to quantify changes in well-being as a result of changes in the provision of ecosystem services.

Due to the fact that there is a high degree of variance between the values different beneficiaries attach to different services, measuring well-being impacts using a single metric across all services and beneficiaries is a difficult task. One approach is to use economic valuation techniques to estimate the value of changes in well-being resulting from changes in ecosystem service provision in monetary terms.

However, due to the need for detailed, high quality primary data to establish reliable economic valuation estimates, and the time consuming nature of undertaking such primary data collection exercises, it is considered beyond the scope of an ESIA to carry out an economic valuation of ecosystem service use.

In light of this, the value of services provided by Affected Ecosystems has been assessed in a qualitative manner through stakeholder engagement exercises, expert discussion, and literature review. Where residual impacts are identified on priority ecosystem services which require compensation, economic valuation may be considered to evaluate the effectiveness of proposed mitigation and/or the value of economic displacement and the appropriate level of compensation.

17.6 Baseline Characteristics

17.6.1 Crops

Definition:

The provision of cultivated plants or agricultural products harvested by people for human consumption.

Krasnodar Krai is one of the leading agricultural regions in the country and is commonly referred to as *"the granary of Russia"* (Ref. 17.27). Agriculture and the food industry are important sectors of the region's economy, with agriculture, hunting, and forestry contributing 12.6% of Gross Value Added[7] in 2011. Within Anapa Resort Town, the sector is the fourth largest in terms of employment; making up 4.7% of the workforce (although this is down from 6% in 2006) (**Chapter 14 Socio-Economics**).

The largest agricultural organisation based in the Local Area is Agrifirm Kavkaz[8]. Kavkaz owns 1,975 hectares of land; around 400 ha of which are planted with vineyards and produce around 10-11 tonnes of grapes per ha. Depending on the season up to 100 people are employed by Kavkaz, including 40 – 70 workers cultivating and harvesting vineyards and 30 office staff and other workers. Around 30-40 of those employed are seasonal workers who come from Dagestan every year in April and return to Dagestan in November. The migrant workers live in portable cabins located near the new Varvarovka cemetery.

There is another winery based in the Local Area of similar size called Russkya Loza (1,580 hectares) based partly in Varvarovka and partly in Supsekh, which employs approximately 50 workers in Supsekh Rural District and a further 7 to 8 in Gai Kodzor Rural District (Ref. 17.28; Ref. 17.29). This vineyard is not directly impacted by land acquisition associated with the Project.

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[7] Gross Value Added is a measure of the contribution to GDP made by an individual producer, industry, or sector and is calculated by the value of output minus the value of intermediate consumption.

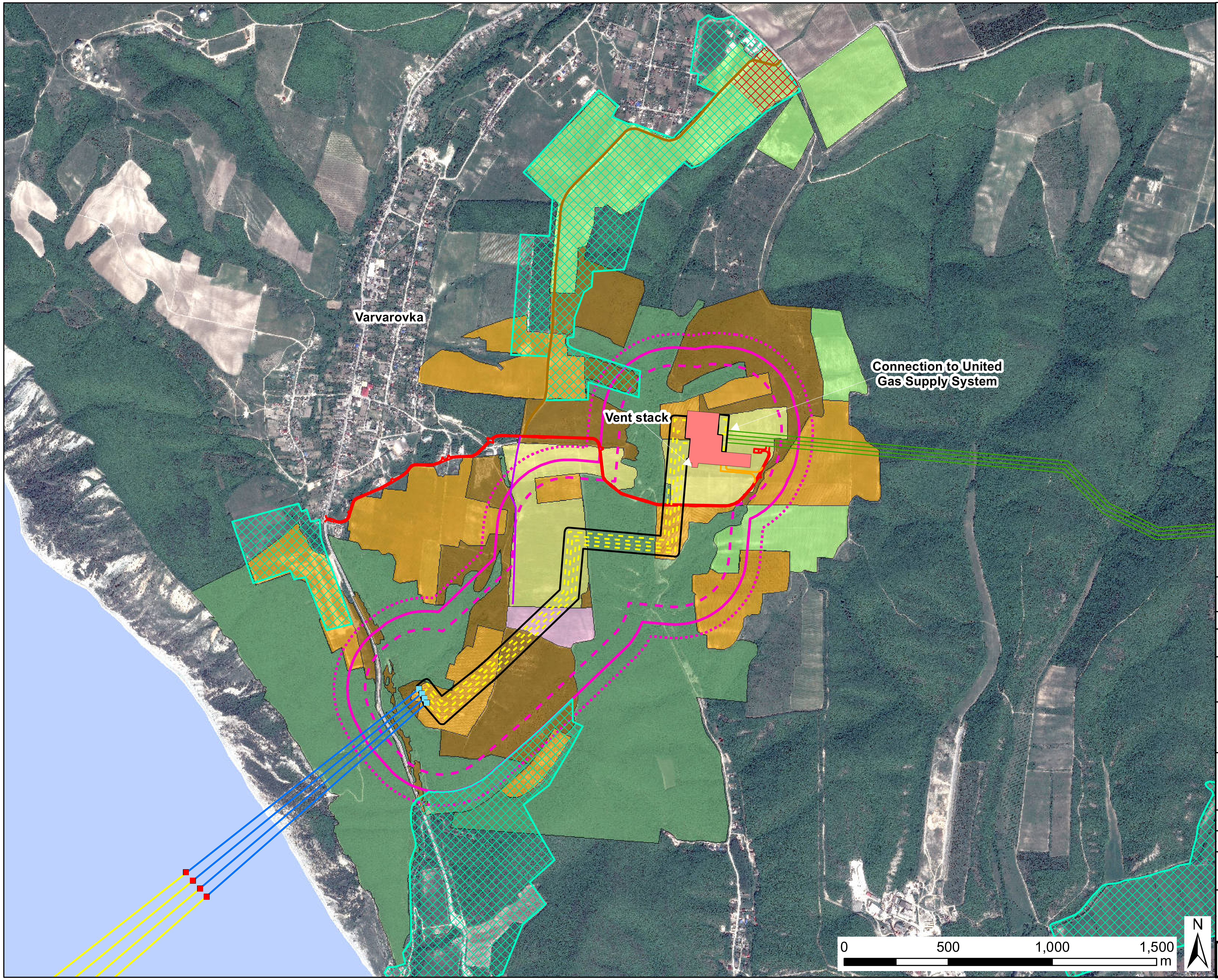
[8] Agrifirm Kavkaz is owned by a parent company – Fond Yug – which is a property development company with two subsidiaries – Agrifirm Kavkaz and Kavkaz Winery. Ultimately Fond Yug owns the land; although the winery land is in effect owned and managed by Agrifirm Kavkaz. Kavkaz Winery is a separate company which makes and retails the wine.

Of those employed in the viticulture industry, the most vulnerable to any changes in provision of this ecosystem service are likely to be migrant workers who are typically employed on a seasonal basis living in portable cabins nearby the vineyards.

Within the Affected Ecosystems the predominant land uses are agriculture (owned by Agrifirm Kavkaz), and woodland (owned and administered by the Russian Federation State Forestry Fund) (Figure 17.8). The land within the Project Area consists almost entirely of agricultural land, with the only exception being a strip of forest that separates two large agricultural fields. There is also a much smaller area of forest that falls within the boundary of the microtunnel construction site.

Historically, agricultural land in the Affected Ecosystems was planted with vineyards although the land is now a mixture of fallow fields, scrub, and abandoned vineyard. The exception to this is the proposed optional transfer site and the land within the temporary construction area for the Varvarovka Bypass Road. This land is currently productively used as vineyard but is also within the confines of a proposed luxury residential development known as Chateau Club Village; the plans for which would retain as much of the vineyard as possible with the exception of sites for the construction of luxury residential homes. The areas where vines appear to have been eradicated due to the ageing of the plants are now either scrub or fallow fields. It was confirmed by an Agrifirm Kavkaz staff member during stakeholder engagement that the majority of the planted vineyards within the construction corridor, transfer sites and right of way had been abandoned in the last two to three years. This includes a range of mature and young (i.e. recently planted) vineyards (see **Chapter 14 Socio-Economics**).

The vineyards owned by Agrifirm Kavkaz are used to grow grapes for commercial wine production which is mostly sold locally, but also within the Russian Federation. The vineyards do not form a significant part of the local tourism industry (i.e. they are not a tourist attraction) unlike Abrau-Dyurso (located on the shore of Lake Abrau, 14 kilometres west of Novorossiysk) which lies at the centre of Russia's most important wine-growing region. The settlement was founded in 1870 as a royal winery to provide wine for the Tsar's household and developed a reputation for producing sparkling wine marketed under the name of *Sovetskoye Shampanskoye* which translates as "*Soviet Champagne*" or "*Champagne for the people*" (Ref. 17.30).



LEGEND

Land use (adjacent to Project)
- Confirmed productive vineyards
- Fallow field
- Forest
- Mature vineyard (abandoned)
- Recently planted vineyard (abandoned)
- Shrubs/uncultivated
- Proposed Real Estate Developments

Safety Exclusion Zones
- C- and E-class: no isolated buildings (1-2 levels), dachas, agricultural farms
- B-class: no cities, settlements, apartments of 3 levels or more, no developments/buildings with less than 100 people
- A-class: no airports, railways station, no developments/ buildings with population of more than 100 persons

Russian Sector of South Stream Offshore Pipeline
- Proposed landfall section pipelines
- Landfall facilities
- Proposed microtunnels
- Proposed offshore pipelines
- Right-of-Way
- Microtunnel entry shaft
- Microtunnel exit pit
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- Varvarovka bypass road (used by Project during construction only)
- Transfer site

United Gas Supply System
- United Gas Supply System pipelines
- Permanent access road to be constructed by Gazprom Invest

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Drawing Title
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File Name: I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 14 Socio-Eco\Figure 14-8 Existing Land Uses within and adjacent to the project area.mxd

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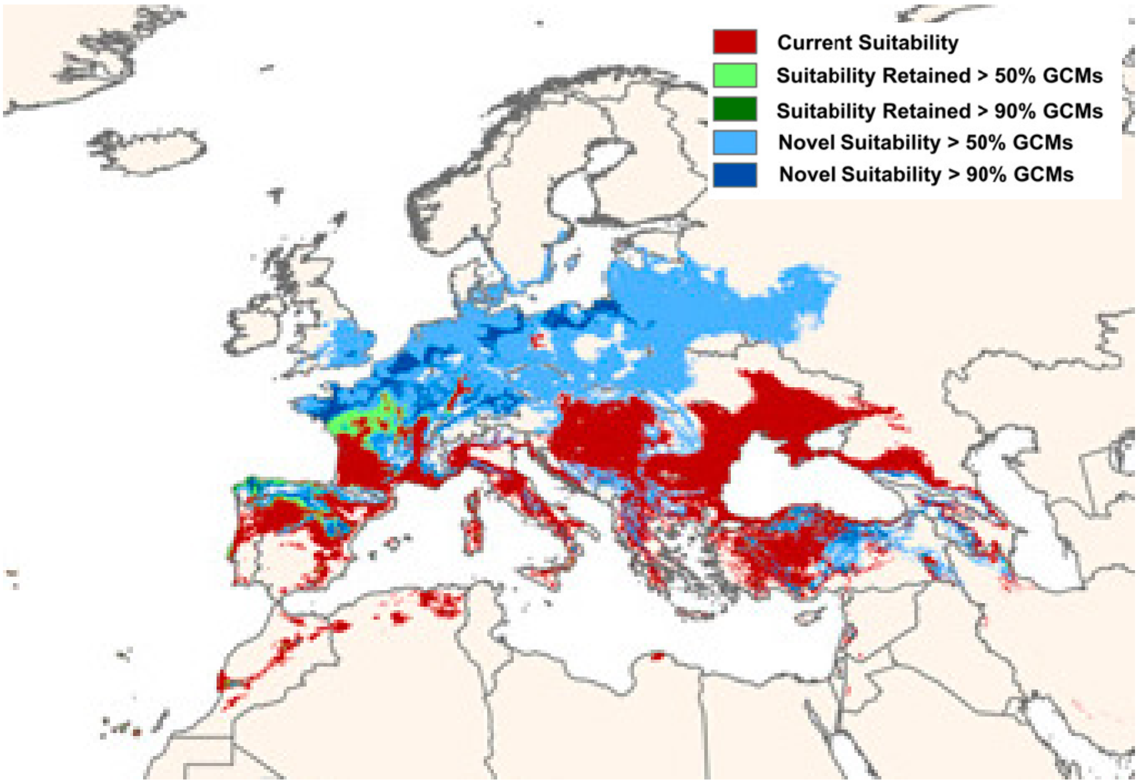
Climate projections suggest that the changing climate may impact the suitability of the region for agriculture and viticulture. In the last fifteen years, climate change has made it possible to expand winter grain production in Russia. More recently, however, the increasing incidence of drought and floods has begun to negatively affect agricultural production and offset the gains made through winter expansion (Ref. 17.27).

Due to a lack of detailed climate change projections in the Krasnodar region it is difficult to predict the likely impacts on agriculture in the Local Area with any certainty. However, a qualitative survey of the impacts on crop production and agricultural livelihoods under climate change was undertaken by Oxfam and the recorded observations of farmers across the Krasnodar Krai region may provide relevant insight (Ref. 17.27):

- Weather is increasingly becoming "*unpredictable*";
- Harsher, damper climate with precipitation more unevenly distributed through the year;
- Longer, colder, and damper springs;
- Hotter, more arid summers with air temperatures reaching 40°C and soil 60°C;
- More radical temperature changes especially during spring to summer; and
- Stronger winds in winters, springs, and summers which farmers relate to deforestation.

In addition to observational evidence, a recent study of the impact of climate change on global wine production found that it is likely to lead to significant changes in the productivity of current wine-producing regions (Ref. 17.31). The study forecasts a radical shift in wine production with the total area suitable for viticulture decreasing between 25-73% in major wine producing regions by 2050, including parts of the Krasnodar Krai region and potentially the Local Area (Figure 17.9).

Figure 17.9 Global Change in Viticulture Suitability (areas with current suitability that is predicted to decrease by 2050 are indicated in red) (Ref. 17.31)



As such, in the absence of any adaptation measures, climate change may mean that the productivity of agriculture, and particularly viticulture, in the Local Area could decline in future (although more detailed modelling is needed to be certain). In order to adapt to the changing conditions it may therefore be necessary to shift towards more drought resistant crops (maize, millet, etc.), invest in irrigation infrastructure, and increase the adoption of new technologies.

The impact of such changes is likely to be greatest on small household farmers who may lack the resources necessary to invest in such adaption strategies, as well as on the viticulture industry since wine grapes are particularly sensitive to subtle shifts in temperature, rain, and sunshine. The subsequent increase in demand for irrigation may also lead to increasing pressures on water supplies within the Local Area (see Section 17.6.3).

For further details see **Chapter 14 Socio-Economics**.

17.6.2 Capture Fisheries

Definition:

The capture of wild fish for consumption and recreation purposes through trawling and other non-farming methods.

The Russian Black Sea fishery has undergone significant change in the last 40-50 years. While average annual catches ranged between 65,000 and 80,000 tonnes in the mid-1970s and 80s, by 2011 this had dropped by more than half to 30,900 tonnes. There are a number of factors that have led to this decline, including pollution, the introduction of invasive species (notably the predatory ctenophore *Mnemiopsis leidyi*), overfishing, and the decapitalisation of the Russian fishing fleet and associated onshore infrastructure and facilities following the break-up of the Soviet Union.

Most fishing takes place within Russian territorial waters (i.e. up to 12 nautical miles (22.2 km) from the mean low-water mark) (Ref. 17.32). The Azov Fisheries Research Institute recognises two administrative fishing zones within the area that extend from the Strait of Kerch (in the north) to Arkhipo-Osipovka, southeast of Novorossiysk. One of these, the Kerch-Taman zone, which stretches from the Kerch Strait to Cape Utrish, encompasses the entire nearshore section of the Project as well as some of the landfall and offshore sections. The second area, known as the Caucasus zone, stretches from Cape Utrish to the mouth of the Psou River at the border with Georgia. These zones are approximately equal in area, but different in terms of bioresources and productivity. Of the two zones, the most productive is the Kerch-Taman zone. This is reflected in the fact that approximately 96% of the total Russian Black Sea catch comes from waters bordering Krasnodar Krai.

The contribution of fisheries to the regional economy (of Krasnodar Krai) is small (around 0.1% in 2009) (Ref. 17.33). In recent years the size of the fishing fleet has contracted from around 30 vessels in the period 2003-2006 to around 16 in 2013 (Ref. 17.33) and the number of commercial entities engaged in fishing has decreased from 19 to 14 over the same period (Ref. 17.32). The fishery sector can nevertheless make an important contribution to sustaining the livelihoods of certain individuals and families, as well as having historical and cultural significance.

Fishing is also evident and has been observed in Anapa. Based on observations, it is most likely that this tends to be for recreation, rather than as a primary means to support livelihoods. However, according to local officials there may be some isolated but unrecorded instances of fishing to support or supplement livelihoods, although the officials were not able to provide any records or specific examples (**Chapter14 Socio-Economics**).

There are around eight commercial fishing enterprises operating within the Russian Black Sea fishery between Temryuk and Novorossiysk, employing around 425 people. The two largest entities operating within the Kerch-Taman zone are RPK Briz (who employ around 30 staff, operating 1 trawler and 5 smaller boats) and OOO RAM (who employ around 14 staff, operating 1 trawler and 3 smaller boats). Most of their catch is sold in Anapa itself in various markets and other outlets, and some as far away as Krasnodar. While other enterprises are active in the Kerch-Taman zone these are generally relatively small (employing 2-3 people each) or they mostly fish in other areas (e.g. the Azov Sea) with only occasional trips into the Kerch-Taman zone.

Due to the anoxic nature of the Black Sea (see Section 17.6.6) species diversity declines with depth. Marine surveys undertaken for the ESIA recorded 64 species at a depth of less than 25 m and only 8 species in deeper water (50-85 m) (**Chapter 12 Marine Ecology**). The concentration of Russian Black Sea fishing activity / effort reflects this species gradient, with most commercial fishing occurring in nearshore waters out to a depth of around 100 m.

Anchovy (*Engraulis encrasicolus*) and sprat (*Sprattus sprattus*) are the most important species in the fishery, comprising 28% and 25% of the Russian Black Sea catch respectively, with an additional 16% from red mullet and 12% from whiting. Most of the commercial fish stocks in the Russian sector of the Black Sea show some seasonal movement and migration which are key factors in the fishery and also are relevant to the Project.

In the main, the sprat stocks spawn in the upper layers (at depths of 100-150 m) of the open waters of the Black Sea off the coast of Russia. This takes place in the winter months, from October to March, at which point the shoals are highly dispersed and not fished commercially. After spawning, the adults move inshore to the feeding grounds from mid-March to early June where they form shoals over the continental shelf in waters of 20 to 80 m depth. Sprats feed mainly on plankton in the upper layers of the water. These shoals form the main commercial concentrations for a trawl fishery in this area from April to September. The major concentrations are found on the continental shelf of the Kerch-Taman region as far south as Anapa and Utrish and also between Novorossiysk and Arkhipo-Osipovka. The narrow continental shelf further south restricts the aggregation of sprats and the fishery is therefore sparser.

The Black Sea anchovy feeds predominantly in the northwest area of the Black Sea in the vicinity of the rich inflows from rivers such as the Dneiper and Danube. In autumn they migrate southeast to winter and spawn along the coast of Turkey and Georgia. Only occasionally do concentrations occur in Russian waters so this has not normally formed part of the fishery in Russia (Ref. 17.32).

The Azov anchovy pass through the Straits of Kerch in March to early April and into the Sea of Azov where they both feed and spawn during the summer although some remain in the Black Sea to spawn over the continental shelf. During autumn they migrate to their wintering grounds, passing southwards along the coast to winter mainly in the southern Black Sea near Sochi and Adler and into Georgian waters. Thus, most of the Russian anchovy fishery is seasonal, targeting the migrating shoals in spring and autumn. To exploit these stocks, co-operative fishing brigades set nets across the main migration route. There are also some purse seiners[9] operating in the fishery as well as mid-water trawlers.

While not featuring significantly in the composition of catches in the Russian Black Sea fishery (the annual catch is only around 240 t), horse mackerel spawn and feed in shallow water during the summer then move south, overwintering in the area around Sochi and the Georgian shelf, returning north in the summer. One of their main summer feeding grounds is the continental shelf around Anapa (see Appendix 14.1 Fisheries Study). The horse mackerel stock is currently recovering after a sharp decline in the early 1990s. They are reported to be difficult to catch due to their mobility during migration and the main fishery is during winter using attractant lights at night with lift nets from small vessels.

[9] A purse seine is a very long net, which falls as a curtain from a floating head rope, that is use to surround shoals of open water fish. After encirclement, the bottom rope is pulled tight to trap the fish in the 'purse'. It never comes into contact with the sea bed.

Benthic and demersal fish typically migrate less extensively than pelagic species. Nevertheless, there are some appreciable migrations. The Black Sea turbot, *Scophthalmus maeoticus*, is probably the most valuable species with an international price of around $4,000 / t, although it is now very scarce with an average annual catch of 10.6 t over the last five years. The species tends to move from deeper water in the winter into the shallower zones to spawn and feed during April to September. Protection of this stock was one reason for the designation of the Anapa Bank, a protected area constituting 33% of the Kerch-Taman fishing zone, within which seasonal fishing restrictions apply to ensure stock recovery. The area in which fishing is prohibited has, however, been reduced.

A recent (2012) assessment of Black Sea fish stocks by the European Commission Scientific, Technical, and Economic Committee for Fisheries (STECF) found that sprat, anchovy, and whiting stocks are all subject to overfishing, although a lack of data prevented projections of stocks in the medium term (Ref. 17.34). The assessment also reported that the Black Sea turbot stock was at an historical low (10% of 1970 levels) and therefore classed it as severely depleted as a result of unsustainable exploitation. Given the dramatic decline in the stock of turbot in the Black Sea, and the extremely high annual estimates of fishing mortality, STECF recommended that there should be no fisheries for turbot and individuals caught unintentionally should be released. In order to avoid further declines in turbot stock, STECF also recommended that an international management plan should be initiated to restore spawning stock biomass to the level capable of producing maximum sustainable yield (Ref. 17.34).

The most common demersal species, the whiting (*Merlangus merlangus*) usually occurs from 30 to 100 m depth where the water is cooler. Whiting show very few systematic movements with the exception that the younger individuals move inshore. Dense concentrations of whiting are to be found on the Anapa Bank, Southern Ozereevka and Arkhipo-Osipovka. The annual catch has been very variable from 3 t in 1997 to 655 t in 2002 but in the recent decade catches have been relatively small, at some 50 to 100 t, largely due to a lack of demand (Ref. 17.32).

The other main bottom-dwelling target species is the red mullet or 'barabulka' (*Mullus barbatus*) which occurs in two populations, one sedentary, remaining around Sochi and Georgia, and one migratory which moves seasonally along the coast as far as the Straits of Kerch. The average annual catch is around 110 tonnes.

In addition to the offshore fisheries there is also a degree of nearshore fishing activity, these consist of fish traps and fixed nets. The closest traps are owned by the Zao Moresky Club, who operate out of Bolshoi Utrish. They operate at least four fixed traps and a mussel farm, all serviced by a fleet of small vessels located approximately 5 km to the south of the Project Area. The fish traps are designed to trap migrating fish, the most significant to the Zao Moresky club being the red mullet, with catches of around 50 t per year. Around 3 t of horse mackerel and small amounts of pontiac shad (about 0.5 t) are also caught.

The fisheries of the Russian Black Sea shelf as a whole are very seasonal, ultimately relating to the migratory movements of the target stocks described above. This is reinforced by the regulations of the Federal Fisheries Agency (Ref. 17.35) and the Azov Fisheries Research Institute (Ref. 17.36). The lifecycle of fish species in the Black Sea and the nature of Black Sea currents mean that certain species within the Kerch-Taman zone can be important to fishing industries operating across the entire Black Sea. For example, the life-cycle of the anchovy requires it to migrate extensively across the Black Sea, passing most coastal sections as well as open water, with important life stages (e.g. spawning, larvae, wintering, feeding) occurring in many different locations. Both migratory and non-migratory species regularly cross national territorial waters and EEZ boundaries. Any potential impacts on species stocks in the marine environment may therefore have the potential to influence fisheries in other Black Sea countries (**Chapter 21 Transboundary Impact Assessment**).

For further details see **Chapter 14 Socio-Economics**, Appendix 14.1 Fisheries Study and **Chapter 12 Marine Ecology.**

17.6.3 Water Supply

Definition:

The provision of freshwater in lakes, rivers, and underground aquifers.

The main inland freshwater body is the Shingar River, the source of which is a spring within the town of Varvarovka to the north of the proposed Pipeline route. The river is approximately 5.5 km long and runs parallel to the coastline. The river's channel in the upper reaches is stony and the basin territory is distinguished by a high level of wooded coverage.

The proposed Pipeline route crosses surface waters in two places: microtunneling underneath the Shingar River and crossing an unnamed tributary which drains the Graphova Gap (a small gully). For both water courses, intermittent low-water periods are typical. Low water flows are observed in the brief intervals of inter-flood periods during the whole year and longer periods of low flows are experienced in the summer period, during which the watercourses sometimes dry out and water in the channels stands in individual pools.

The hydrogeology of the area is characterised by a shallow alluvial aquifer overlying a carbonate aquifer. The alluvial aquifer is present along the narrow river valleys of the Shingar River and an unnamed tributary of the Sukko River. The anticipated depth to the water table varies between ground level to a few metres deep along the valley floors (where groundwater is in hydraulic continuity between the alluvium and carbonate aquifers) and up to 100 m beneath the higher areas. Groundwater recharge is through rainfall and discharge from surface water courses along their upper reaches. In the lower reaches of the valleys groundwater is likely to discharge to the river system and ephemeral springs during periods of high rainfall and corresponding high groundwater levels.

In addition to the Project itself, there are a number of beneficiaries of the ground and surface water resources in the area including the Russkaya compressor station which plans to abstract groundwater for drinking and industrial purposes from an aquifer approximately 3 to 4 km north of the Project Area. This abstraction is likely to be hydraulically upgradient from the Project Area and the Project does not lie within the designated sanitary protection zone for this abstraction.

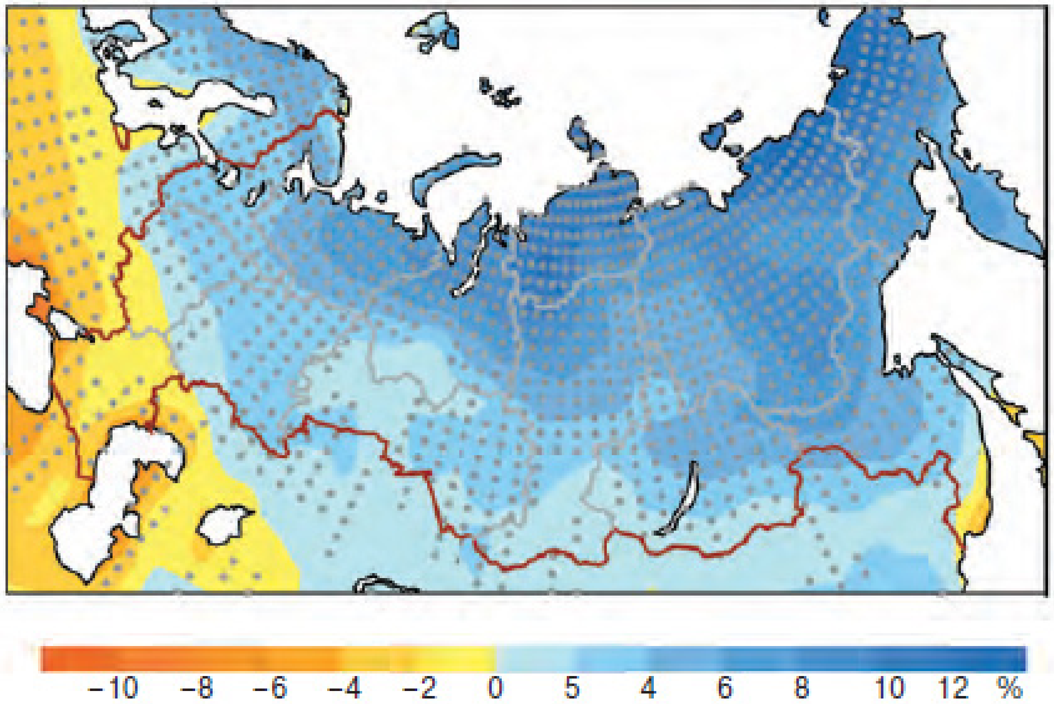
There is a well owned by the Ministry of Defence located near the settlement of Sukko drawing from an aquifer downgradient of the Project Area (Figure 17.10). The Project is dependent upon this resource for freshwater required in construction activities. While the water supply is owned by the Ministry of Defence it also utilised by third parties. Water may only be abstracted from the Sukko source between October and April; it is understood that the restriction on summer abstraction is in place to prevent derogation of the aquifer (**Chapter 8 Soils, Groundwater and Surface Water**).

There are no licensed surface water abstractions for drinking water within or downstream of the Project Area. There is, however, a small impoundment on the watercourse in the Graphova Gap located upstream of the proposed RoW crossing. This impoundment structure retains surface water flows to enable abstraction by the Agrifirm Kavkaz for use in viticulture. There is also a natural spring known as St. Barbara's Source reputed to have healing powers located in Varvarovka (upstream of the Project Area) which is of cultural importance to people living in the Local Area and to visitors.

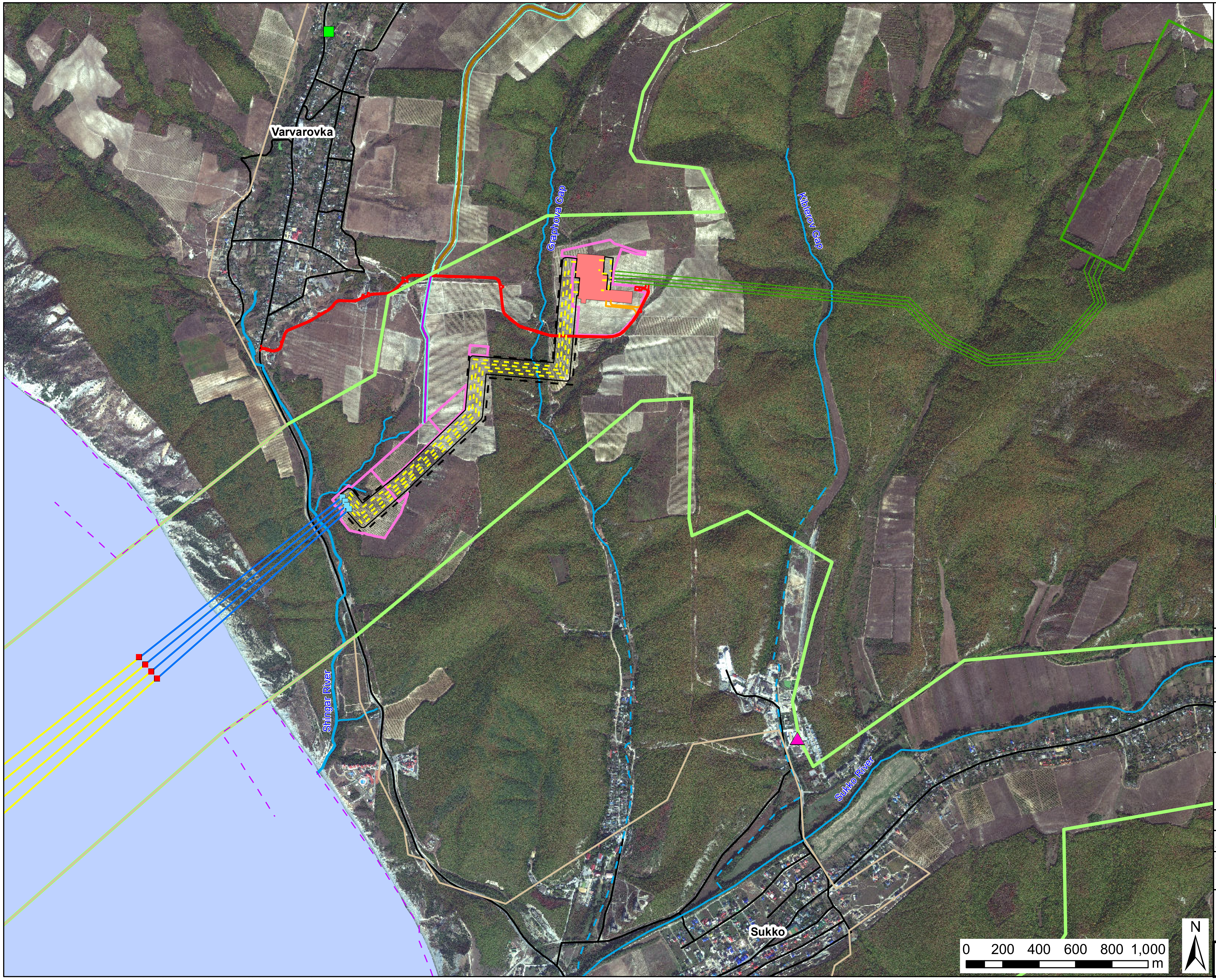
There is considerable variation amongst communities in the Local Area with respect to access to mains water supply. While all households in Supsekh and Gai Kodzor have mains water supply and 80% in Varvarovka, only 50% of households have access in Sukko with the remaining 50% obtaining water from wells on their property (**Chapter 14 Socio Economics**).

Across Russia as a whole, climate change is predicted to lead to an increase in surface water flows and precipitation levels. However, within the Krasnodar region, there is a projected decline in water availability (Figure 17.11); although there are no available projections specific to the Local Area (Ref. 17.37). Attempts to maintain or increase wine productivity in the face of a changing climate may lead to an increase in water use for irrigation as well as to cool grapes through misting or sprinkling. These factors could result in increasing pressure on water resources within the Local Area which could be exacerbated by population growth and growing demand for water for other uses.

Figure 17.10 Predicted Changes in Annual Runoff During the Period 2041–2060 (values are given in % change relative to the period 1980-1999 and dots denote areas where two thirds of the models show changes of the same sign) (Ref. 17.37)



For further details see **Chapter 8 Soils, Groundwater and Surface Water.**



LEGEND

- Ministry of Defence freshwater well
- St. Barbara's spring
- Rivers
- Inferred watercourses
- Existing roads
- The boundary of the first area of sanitary protection zone (exclusion zone)
- The boundary of the second area of sanitary protection zone (limitation zone)
- The boundary of the third area of sanitary protection zone (monitored zone)

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Landfall facilities
- Proposed microtunnels
- Proposed offshore pipelines
- Right-of-Way
- Construction corridor
- Temporary construction area for road construction
- Construction sites
- Microtunnel entry shaft
- Microtunnel exit pit
- Permanent access road to be constructed by SSTTBV
- Temporary access road constructed by SSTTBV
- Varvarovka bypass road (used by Project during construction only)

United Gas Supply System

- Russkaya compressor station
- United Gas Supply System pipelines
- Permanent access road to be constructed by Gazprom Invest

Projection: Lambert Conformal Conic

Purpose of Issue
For Information

Client
South Stream
Offshore Pipeline
ENERGISING EUROPE

Project Title
SOUTH STREAM OFFSHORE PIPELINE

Drawing Title
WATER RESOURCES IN THE AFFECTED ECOSYSTEMS

Drawn	Checked	Approved	Date
DH	RW	MW	20 Jun 2014

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Figure 17.11

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Plot Date: 20 Jun 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 17 Ecosystem Services\Figure 17.10 Water Resources in the Affected Ecosystems.mxd

17.6.4 Hazard Regulation

Definition:

The capacity of the natural environment to regulate water, soil, and sediment transfer so as to: maintain the integrity of land surfaces in order to reduce the hazards associated with mass movements (e.g. landslides and slumping), coastal erosion, and flooding; maintain *"intact"* soil cover and low suspended sediment loads in fluvial systems; and retain and store water and delay release from the land surface and attenuation of peaks as flood water passes through river networks to reduce the risks associated with runoff and flooding (Ref. 17.19).

There are a number of hazards associated with the Local Area, including gravity-induced landslides, linear erosion, mudslides, and flooding. The key features within the Affected Ecosystems which contribute to the regulation of natural hazards include vegetation which binds together soil particles and attenuates surface water flows; Phaeazom soils which absorb water and play an important role in flow regulation; and coastal habitats including underwater sandbars, beaches, and cliffs which dissipate energy from waves and regulate levels of coastal erosion and flooding.

Watercourses flowing through the Affected Ecosystems are predominantly precipitation fed, with frequent and short floods. Surface waters are partly recharged from high groundwater tables (often associated with springs) and flows typically peak during winter months when rainfall is highest. In addition to the natural watercourses, there are artificial drainage ditches which are used to manage flood risk locally.

Phaeozem soils in the Affected Ecosystems have a high water absorption capacity and play a key role in water regulation. During summer months when precipitation is limited, most surface water permeates the underlying soils and further reduces flow through the rivers. This typically results in watercourses becoming dry or the formation of discrete ponds within the river bed.

Storms and the associated surface run-off can lead to soil erosion, subsequent aggradation and accumulation of sediments on lower slopes, and degradation of water quality due to an increase in suspended sediments. Forested areas where trees line the valley slopes form a canopy to protect soils, take up water and reduce the amount of surface run-off, and reduce soil erosion as the roots bind together soil particles.

The sudden formation of mudflow and mudrock flows is possible in the valleys of the Shingar River and the unnamed tributary of the Sukko River. Retrospective analysis indicates that mudflows occur once every several (5 to 7) years (**Chapter 7 Physical and Geophysical Environment**). Mudflows are typically triggered by intense rainfall events and/or prolonged periods of rain (Ref. 17.38).

Erosional processes are associated with the coastal cliff zone. The relatively narrow beach provides limited protection to the base of the cliffs against direct wave action. Waves also assist in the removal of material at the toe of the cliffs resulting in periodic landsliding and slumping events. The risk of landslide activity is enhanced by seismic activity in the vicinity of the

Affected Ecosystems which typically has potential to cause earthquakes of magnitude 5 to 6 on the Richter Scale.

The wave climate adjacent to the Russian coastline of the Black Sea is heavily influenced by the shallow continental shelf which results in smaller, primarily wind driven waves. The typical maximum wave height in the marine Affected Ecosystems is around 2.9 m, reaching 4.8 m in 1 in 100 years. Short-term sea level variations are also associated with varying meteorological conditions and can result in localised sea level surges of up to 1 m, although they are typically less than 40 cm (**Chapter 7 Physical and Geophysical Environment**).

The risk of natural hazards to local communities is relatively low and natural ecosystems play a role in regulating the extent of such hazards through erosion and water flow regulation arising from soils and trees, as well as providing some level of protection from storms through coastal cliffs and beaches. The beneficiaries of this service are therefore widespread and diffuse, including landowners, residents, and workers in the area who benefit from the regulation of flooding and erosion, and users of the beach and coastal area for recreational uses and livelihoods. The Project also benefits to some extent from the regulation of such processes.

Climate change in Russia is projected to lead to an increase in the frequency of hazard events including floods, droughts, wild fires, and mudflows (Ref. 17.37). Across Russia as a whole, there was an annual increase in the number of hazardous weather events from 1991–2005 of 6.3% and this increasing trend is expected to continue (although there is a lack of projections available for the Local Area). Sea levels in the Black Sea have been rising steadily since the 1920s, with the rise becoming much more rapid since the mid-1980s (around 2 cm per year) (Ref. 17.37). The changing climate, together with further development within the Local Area which requires clearance of vegetation and increases use of impermeable surfaces, are likely to increase the pressure on the functioning of this ecosystem service and lead to higher rates of flooding, erosion, and mud slides in future.

For further details see **Chapter 7 Physical and Geophysical Environment** and **Chapter 8 Soils, Groundwater and Surface Water.**

17.6.5 Air Quality Regulation

> **Definition:**
>
> The natural environment influences atmospheric concentrations of air pollutants and their deposition to land and water surfaces through the removal and detoxification of pollutants from the atmosphere. Gases and particles, for example, are deposited to ecosystem (primarily plant) surfaces and pollutant gases enter leaves through stomata. The extent of this removal depends on a number of factors, including the turbulence of the air above the ecosystem (taller vegetation has a greater efficiency), the duration of leaf cover (evergreen tree species are more effective than deciduous species), and the stomatal aperture of the vegetation (deposition may decrease under drought conditions). The ability of ecosystems to provide this service also depends upon the extent of other pollutant sources (both manmade and natural) and the resulting concentration of pollutants in the atmosphere. If, for example, the concentration exceeds the assimilative capacity of an ecosystem to absorb and detoxify pollutants, critical thresholds can be reached above which the ecosystem can no longer provide this service. As such, this service depends on both the regulatory capacity of ecosystems and the inputs of pollutants to this system from other sources (Ref. 17.19).

There are several residential areas within the Local Area which are likely to be dependent on the regulation of air quality. These include residential areas in Rassvet, a kindergarten and school within Varvarovka, high schools in Gai Kodzor and Supsekh, outpatient facilities within local towns including Varvarovka, a hospital in Anapa, and the Shingari and Don holiday resorts (see Section 17.6.8).

In addition to residential receptors, there are also several nationally and internationally protected habitat sites that may be considered sensitive to air emissions attributed to the Project including the Utrish state national reserve, which is located approximately 3.2 km southeast of the microtunneling location, and critical (but not designated) habitat through which the landfall section will be constructed.

Further, the Anapa Resort Town (ART) municipal district was designated a health resort town in 1957 and is designated at a Russian federal level as a Specially Protected Natural Area (SPNA), for the purpose of providing a *"health improving (spa) resort area"*. The SPNA designation entails a series of development control regimes that apply to different zones within the SPNA area, the general purpose of which is to control development and protect the area from any activities that may cause adverse impact on the natural therapeutic resources and sanitary conditions of the resort town area.

As such, ART markets itself as a health tourism destination in an area with unique air and water quality (Ref 17.24). As a result, one of the main branches of the economy is the health resort complex which includes over 150 institutions (including 44 recreation facilities for children), about 250 hotels, and more than 2,000 private landlords (Ref. 17.39). Beneficiaries of this service are therefore likely to include people visiting the area for the air quality benefits, and anyone with respiratory conditions who lives in or visits the Local Area is likely to be particularly vulnerable to any impacts on air quality regulation.

Data provided by the Krasnodar Regional Centre for Hydrometeorology and Environmental Monitoring found that concentrations of pollutants in the Local Area generally comply with national and IFC limits, with the exception of NO_2 and particulate matter which are high. However, these values are derived from short term monitoring undertaken in central Anapa, Varvarovka, and Gostagaevskaya which are unlikely to be representative of the land in the vicinity of the Project Area which is more rural in character (**Chapter 9 Air Quality**).

Diffusion tube monitoring was undertaken for the ESIA and covered a greater spatial extent of the Local Area. The results easily complied with national and IFC guidelines for the parameters monitored; with NO_2 concentrations between 14-31% of the limit (considerably less than the concentration measured at the automated stations).

The main source of emissions in the Anapa and Krasnodar regions are road vehicles which contribute an estimated 92% of total atmospheric emissions in the Krasnodar region. Almost all of the remaining emissions are from industrial sources (7.9%), of which the main sources in the region are the Krasnodar Thermoelectric Power Plant, AO Novorostsement in Novorossiysk, and the Krasnodar combined cycle gas turbine Combined Heat and Power Plant.

The high levels of forest coverage within the Local Area are likely to play an important role in regulating air quality by directly absorbing pollutants such as volatile organic compounds and particulate matter (Refs 17.40 and 17.41). Studies have estimated that a single hectare of mixed forest can remove 15 tonnes of particulates per year from the air (Ref. 17.42), although this varies according to tree species, stomatal conductance, environmental conditions, and pollutant concentration in the atmosphere (Ref. 17.43). As set out in Table 17.6 in Section 17.6.10, there is approximately 490 ha of woodland cover within the Affected Ecosystems (including Shiblyak, Mesophillic forest, and Juniper woodlands), which suggests they could absorb up to 7,440 tonnes of pollutants each year.

The ability of ecosystems to regulate air quality is likely to come under increasing pressure in the Local Area due to economic development and population growth which can lead to increases in atmospheric pollutants and the clearance of vegetation which plays a role in regulating pollutants. Further, climate change and associated warmer temperatures can decrease the absorption rates of vegetation and thereby reduce the effectiveness of ecosystems at regulating air quality (Ref. 17.44).

For further details see **Chapter 9 Air Quality**.

17.6.6 Water Quality Regulation

Definition:

The natural environment can regulate marine and fresh water quality through processes such as: plant and microbial nutrient uptake, pollutant sequestration in soil and marine and freshwater sediments, biofiltration from marine and freshwater organisms, breakdown of organic pollutants, acidity buffering, and denitrification. These processes contribute to the detoxification and purification of water used for human uses such as drinking, agriculture, industrial uses, fisheries, tourism, and recreation (Ref. 17.19).

Similar to the air quality regulation service, the ability of ecosystems to regulate water quality depends on the extent to which ecosystems can purify water by filtering pollutants from, and reducing inputs into, water resources, and the level of pollutant inputs and pressures placed on the natural environment and its capacity to regulate.

Within the Local Area there are several freshwater resources for which quality is of particular importance to the local population, including the well at Sukko and St. Barbara's Source, Varvarovka. Water quality is also important for any direct abstractors of groundwater in the Local Area as any contamination can have lasting impacts on human health. There are also a number of mineral water deposits located in the ART and the high quality of these mineral water sources in ART has supported the development of a health tourism industry and designation of the region as an SPNA (see Section 17.6.5).

As part of the ESIA a number of water quality surveys were undertaken in the Local Area (**Chapter 8 Soils, Groundwater and Surface Water**). Groundwater samples were taken from three springs and hydrocarbons were detected in one of the samples at a concentration which exceeds the maximum permissible concentration for drinking and domestic water quality (Ref. 17.45). There was no evidence of contamination from other pollutants exceeding the national limit values. Four surface water quality samples were taken and for all samples, elevated copper levels exceeded the standards for fisheries. Water in the Shingar River exceeded the fisheries standard levels for several parameters including: phosphate, copper, nitrites, nitrates, sulphates, mercury, phenols, and oil products. Several parameters (including phosphate, copper, sulphate, ammonia and phenols) exceeded the fisheries standard levels in the Graphova Gap.

Marine water quality in the Affected Ecosystems plays an important role in supporting the recreational / tourism industry. Of particular importance in the Local Area are people engaged in water sports, bathing, scuba diving operations, and the Shingari and Don holiday complexes for which recreational water use is an important facility for visitors (see Section 15.6.8). Marine water quality is also important for human health, with contaminants in the marine environment potentially having significant impacts on those exposed to concentrations of contaminants, toxic algae blooms, or through bioaccumulation of contaminants and subsequent entry into human food sources.

Marine water quality surveys undertaken for the ESIA found that phosphate and nitrate content did not exceed maximum allowable concentrations for fisheries (Ref. 17.46). Generally, suspended solids concentrations varied between 0.2 and 7 milligrams per litre, the main sources of which are from river waters, wave induced disturbance of seabed sediments, and deposition of airborne particles (**Chapter 7 Physical and Geophysical Environment**). Surveys also indicated a low degree of eutrophication due to the prevalence of brown algae over green algae, the high population of pollution-intolerant species, and the low number of epiphytes (algae that grow on other species).

Many contaminants in the marine environment are able to bind to sediments (thereby being locked up indefinitely) and surveys of the Affected Ecosystems identified the presence of contaminants in marine sediments including petroleum hydrocarbons, phenols, anionic surfactants, and heavy metals (**Chapter 7 Physical and Geophysical Environment**).

Contaminants can also be accumulated by organisms such as invertebrates and macroalgae. Benthic macroalgae and grasses (macrophytobenthos), in particular, enrich water with oxygen, take up dissolved organic matter, and assimilate heavy metal contaminants, thereby increasing the quality of coastal waters (Ref. 17.47 and Ref. 17.48). Macrophytobenthos are also critical components of the marine ecosystem as primary producers, providing food and shelter to a wide variety of organisms either as living plant matter or detritus.

The bivalve *Mytilaster lineatus* is one of the main components of seaweed thickets throughout the Black Sea due to its high settlement density and resistance to pollution. This is of wider significance because *M.lineatus* is therefore the main provider of natural bio-filtration along the Black Sea coast and can be present in high densities.

Surveys of the Affected Ecosystems found that, in shallow waters (up to 2-3 m depth), macroalgae communities are characterised by a relatively low diversity and biomass. In the mid photic zone (between 3-10 m) algal communities are dominated by large structural brown algae. While at depths over 10-15 m, communities of Phyllophora and *Codium vermilara* are observed. The greatest diversity of algae is found in the mid photic zone which supports a high species diversity and considerable biomass of the mussel *Mytilaster lineatus* in some areas.

In deeper waters, marine water quality in the Black Sea is anoxic. Waters with hypoxic or entirely anoxic conditions are typically incapable of sustaining permanent populations of species dependant on aerobic respiration. Oxygen depletion occurs in layers below 80 to 150 m and hydrogen sulphide (H2S) builds up below these depths. Consequently, the potential for significant marine life occurring at depths of greater than 200 m within the Black Sea is likely to be limited to those organisms capable of anaerobic respiration (e.g. chemosynthetic life). Anaerobic respiration typically produces H2S and methane (CH4) as a by-product. Concentrations of H2S are known to be elevated within the bottom waters of the Black Sea.

Marine water quality throughout the Black Sea has been affected by rapid economic development and a lack of adequate management of marine resources in the later decades of the 20th Century, resulting in major environmental and ecological changes in the Black Sea ecosystem. In particular, eutrophication, due to excessive levels of nitrogen from land based sources into the Black Sea, and the introduction of invasive species, have given rise to massive increases in primary production and a shift in the abundance and composition of phytoplankton species. Larger and more frequent algal blooms have increased sedimentation of decaying plants and detritus to the seabed inducing a sharp decline of dissolved oxygen and a silting of benthic communities in many areas. Increased incidence of harmful algal blooms have led to the death of many fish and the increased turbidity of the water column has reduced light availability to macroalgae in deeper waters.

It is possible that pressures on the capacity of ecosystems to regulate water quality will increase in future due to a combination of climate change (which may lead to rising water temperatures, acidification of marine water, and concentration of surface water pollutants during periods of lower flows e.g. in summer) and increasing development (particularly any expansion in the agricultural industry and subsequent increase in surface water runoff from vineyard areas which could lead to eutrophication in both marine and freshwater environments).

However, since the early 2000s the governments of the Black Sea coastal states have adopted a basin-wide approach to pollution reduction and enhancement of cooperation of coastal and non-coastal states towards a strategic goal of achieving the ecological status of the Black Sea similar to the one observed in the 1960s (Ref. 17.49). Pollution pressure from land based sources, although still intense, shows a decreasing trend and some improvements in ecological status have been observed. This coordinated action, if continued, may offset and reduce the pressures on water quality within the Local Area.

For further information see **Chapter 7 Physical and Geophysical Environment, Chapter 8 Soils, Groundwater and Surface Water**, **Chapter 12 Marine Ecology**, and **Chapter 14 Socio-Economics**.

17.6.7 Soil Quality Regulation

Definition:

The capacity of natural processes to regulate soil quality through the storage and degradation of organic matter leading to replenishment of the topsoil layer; storing, degrading, and transforming materials such as nutrients and contaminants; mediating exchange of gases to the atmosphere; and maintaining a structural composition which supports growth of plants and water flow regulation.

There are a number of soil types within the Local Area including Cambisols, Phaeozem soils, Arenosols, Fluvisols, Abrazems / Regosols, and Anthropogenic soils. These soil types provide important services to a range of beneficiaries.

Agricultural areas (principally vineyards) in the Local Area are predominantly located on Arenosols and Abrazem / Regosol soils. These soils are predominantly used for agricultural production of grapes. Grapes are perennial crops and cultivation involves ploughing and tillage which can lead to soil compaction. These soils can also experience a homogenizing effect due to the fact that there is no organic matter influx which results in differences between the soils being evened out in terms of the vegetation contribution to humus- and soil-formation (Ref. 17.50).

Owners of land within the Affected Ecosystems (principally Agrifirm Kavkaz) benefit from the economic rents associated with good quality soil and productive use in agriculture. The regulation of soil quality by natural processes also provides a service to workers who come into contact with soils. Workers and owners of land adjacent to the Affected Ecosystems may also benefit from soil quality regulation processes since, depending on the physical properties of the soil (including soil porosity, soil potential for pollutant absorption, and soil saturation); contamination of soil within the Affected Ecosystems could lead to contaminant migration and impacts on soils in adjacent areas of land.

Phaeozem soils comprise a soft organic rich topsoil layer covered in vegetation and have a high water absorption capacity. As a result, they play a role in regulating water flows in the Local Area. The soil quality regulation service is therefore linked to hazard regulation and all households living within the area benefit from an indirect reduction in flood risk due to the role of soil quality regulation. These soils are structurally prone to compaction and erosion, and are vulnerable to contamination through surface spills.

Fluvisol soils are present in the valley bottoms and also play a role in the hydrological cycle. These soils are associated with watercourses and valley bottoms and can act as pathways for the movement of chemical contaminants into groundwater and surface water. As such, the regulation of soil quality is also linked to water quality processes. Fluvisol soils also support populations of the critically endangered Nikolski's tortoise.

Surveys of soil quality within the Local Area found elevated concentrations (above maximum permissible thresholds) of arsenic, copper, lead, zinc, benzo(a)pyrene, polychlorinated biphenyl, and pesticides. The sources could be natural or manmade (**Chapter 8 Soils, Groundwater and Surface Water**). There are also areas of soils used for informal waste disposal which could potentially be contaminated with substances such as asbestos. The contaminants present in the soil are known to be harmful to human health under certain exposure scenarios and concentrations appear to be highest in agricultural areas, at watercourse crossings, and near existing roads (**Chapter 8 Soils, Groundwater and Surface Water**).

Expansion of the agriculture and viticulture industry within the Local Area is likely to increase pressure on soil quality regulation. Further, increases in traffic and vehicle emissions could lead to greater deposition of airborne particles which could also increase pressure on soils.

For further information see **Chapter 8 Soils, Groundwater and Surface Water**.

17.6.8 Tourism and Recreation Values

Definition:

Natural environments such as woodlands, rivers, beaches, and marine ecosystems provide a variety of tourism and recreation opportunities such as: hiking, walking, camping, horse riding, health based tourism, scuba diving, picnicking, and beach based recreation.

The ART municipal district is a designated 'resort town' which provides for a regime of measures intended to safeguard the district's important tourism attraction features. Tourism is the most important industry in the ART municipal district and visitor numbers and accommodation facilities have displayed continuing strong growth over recent years (**Chapter 14 Socio-Economics**).

The town of Anapa is the key focus for tourist activity and accommodation within the municipal district and has a large number of hotels, restaurants and associated infrastructure to support the tourism economy. Sukko is also an important area and has a beach which is used by local residents and tourists as well as offering camping, horse riding, and fishing. Sukko beach is the principal and only easily accessible public beach between the town of Anapa and Utrish Specially Protected Natural Area (SPNA). Paragliding is undertaken off the cliffs of Sukko with gliders flying out to sea and special recreational programmes for children are carried out involving sea trips, diving, and environmental tourism / education (Figure 17.12).

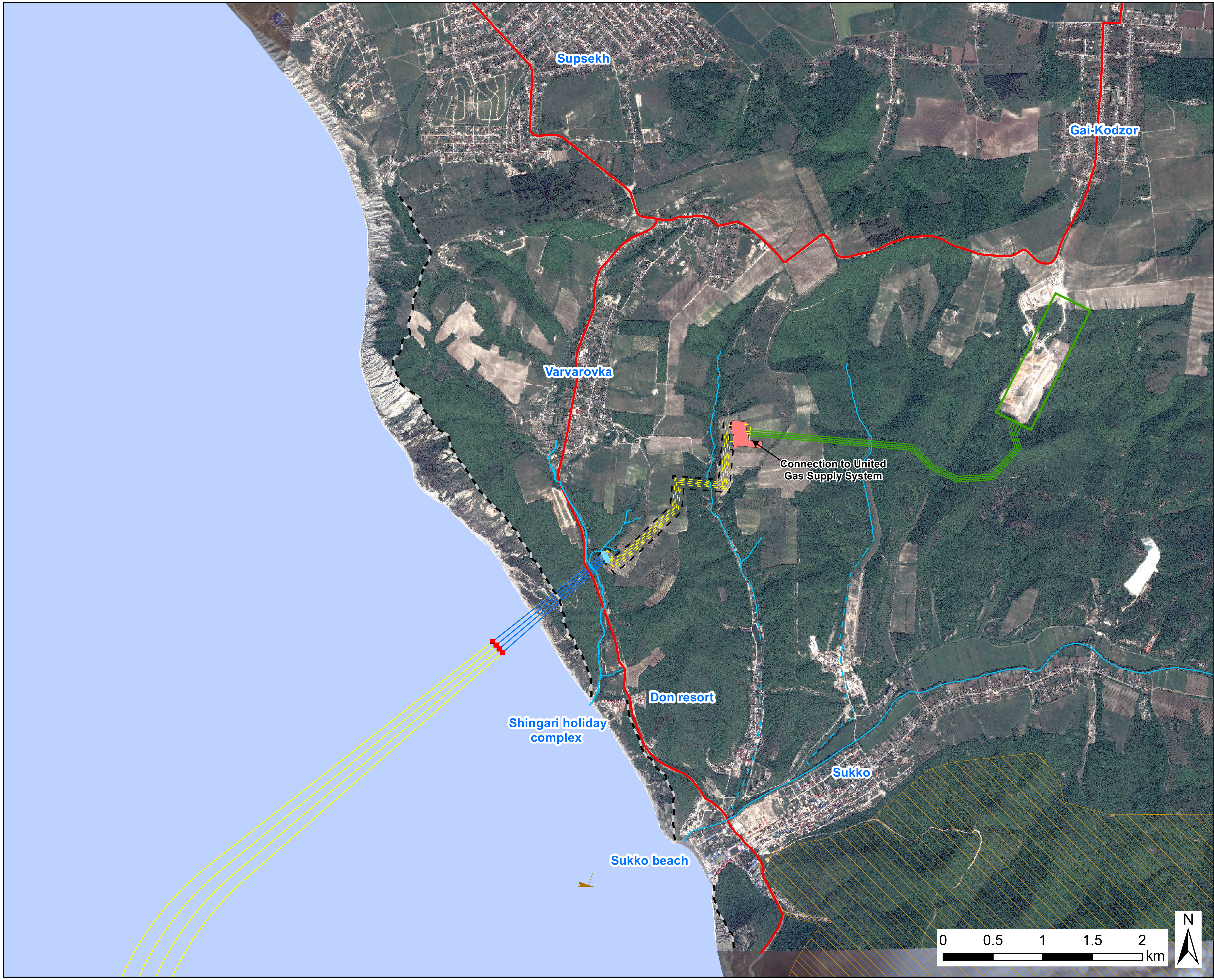
While most of the land based tourism activity takes place within and around Anapa or Sukko, rather than within the Affected Ecosystems themselves, the "*Mountains of the Caucasus*" trail (which involves hiking, waterfalls, and camping) starts in Anapa and finishes in Utrish, passing over a hill under which the microtunneling will take place. There is also a business based in Varvarovka, with approximately 30 horses, which offers horse-riding tours including a route that traverses the Agrifirm Kavkaz fields in the direction of a lake north of Sukko. The business has approximately 20 customers per day in the summer.

Within the marine environment, the area around Sukko beach and the nearby waters are used for sun bathing, swimming, fishing, and yachting. There is also a scuba dive operator in Anapa who utilises a number of sites along the coast. The closest site to the Affected Ecosystems is the ship "*Gordipiya*" which sank in February 1943. The ship is on an even keel at a depth of 18 metres and has become an artificial reef providing habitat for mussels.

Approximately 1.5 km south of the Project Area are two neighbouring holiday complexes (tourist resorts) known as Shingari and Don. Shingari is a privately owned complex of holiday residences built on the coastal cliff top adjacent to the Project Area. There is a private beach belonging to Shingari immediately below the complex, accessible by steps from the resort.

The Shingari resort receives around 6,000-7,000 people each year with the peak season lasting from June till the beginning of October (housing up to 380 people at a time). Most visits are arranged through company bookings and visitors are from different regions of Russia, with around 3% coming from other countries within the former Soviet Union. Around 150 people are employed by Shingari although this rises to 200 during peak season. Most employees are local and reside in Anapa.

Don is located on the north side of the roadway running between Varvarovka and Sukko. Don is a holiday complex owned by Russian Railways and is only open to its employees (or people invited by Russian Railways). Don is located opposite Shingari on the north side of the roadway running between Varvarovka and Sukko, and its residents also have access to the beach via a path that runs on the outside of the Shingari complex perimeter boundary.



LEGEND

- Sunken scow "Gordipia"
- Rivers (mapped within a 1km radius of Project)
- Inferred watercourses
- Coastal path (Mountains of the Caucasus Trail)
- Main roads
- Boundary of the state nature reserve "Utrish"

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Landfall facilities
- Proposed microtunnels
- Proposed offshore pipelines
- Construction corridor
- Microtunnel entry shaft
- Microtunnel exit pit

United Gas Supply System

- Russkaya compressor station
- United Gas Supply System pipelines

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue
For Information

Client
South Stream Transport AG ENERGISING EUROPE

Project Title
SOUTH STREAM OFFSHORE PIPELINE PROJECT

Drawing Title
TOURISM AND RECREATIONAL RESOURCES WITHIN THE LOCAL AREA

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File Name: I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA\Chapter 15 Ecosystem Services\Figure 15.12 Tourism and Recreation Resources in the Local Area.mxd

Beaches along the coast are important for recreation and tourism in the wider region and ecosystem processes underpin the continued provision and evolution of such natural landforms. The Anapa Bay Bar, for example, which lies within the wider region, is a 50 km long accumulation of sand which forms a natural beach barrier separating the system of firths and salty lakes from the Black Sea. The continuous strip of sandy beach, several hundred metres in width in places, is a natural reserve of significant recreational importance for Russia and makes Anapa a popular holiday destination.

Several mollusc species play a role in the lithodynamic processes of the marine environment and the accumulation of sand and shell plays a significant role in the balance of the beach and bottom sediments. According to unpublished data obtained in 2010 by the Department of the Coastline of the Southern Branch of the Institute of Oceanology of the Russian Academy of Sciences, the concentration of carbonates of mollusc origin, coming into the sand of the Anapa Bay Bar as shells, may reach up to 53% (Ref. 17.51).

The venus clam (*Chamelea gallina*), found in soft sediment habitats at depths of 5 to 10 m, is the major source of the shelly sand component of the beaches of Anapa Bay. The annual input of carbonates of biogenic original to the bay bar is estimated to be 3,500 tons, 91% from *Chamellea gallina*, the remainder from a range of other molluscs including the bivalve *Donax trunculus* and the gastropod snail *Rapana venosa*. These organisms contribute to the composition and aesthetic value of beaches in the wider region and thereby support the use and enjoyment of beach resources by beneficiaries.

The large scale ecological changes witnessed throughout the Black Sea have had a significant impact on benthic ecosystems including the diversity, abundance, and biomass of most mollusc species (Ref. 17.52). For example, only four of the 11 species of mollusc found in the shelly sand of the Anapa beach are now found as living individuals (Ref. 17.51) and the distribution, abundance and biomass of *Chamellea gallina* have declined significantly since the 1990s (Ref. 17.52). As such, in recent decades the supply of biogenic carbonate to the sands of the bar has been appreciably reduced, exacerbating an on-going process of erosion in the area. Over the past 40 years, the morphology of the Anapa spit barrier has changed probably due to a combination of natural processes and the impact of economic activities such as the sand recovery (Ref. 17.3) and the construction of a great number of recreation complexes at Anapa.

While there are no direct projections of the future growth of the tourism or recreation sectors in the region, the current steady growth is expected to continue and may experience an increase due to the impacts of the 2014 Winter Olympics in Sochi.

For further information see **Chapter 14 Socio-Economics**.

17.6.9 Cultural and Spiritual Values

Definition:

The diversity of ecosystems is one factor influencing the diversity of cultures and many religions attach spiritual and religious values to ecosystems or their components. Many societies also place a high value on the maintenance of historically important landscapes and value the "sense of place" that is associated with recognised features of their environment. Cultural services can include tangible services for which environmental processes or settings play an important role in their use or value (such as archaeological sites, shipwrecks, and natural springs), intangible services which are dependent on the natural environment (such as local festivals, cultural identity, and spiritual practices), and natural sites themselves with cultural importance (such as cultural landscapes and particular physical, biological, or geological formations).

The environmental setting of the Local Area is characterised by a deeply undulating, extensively wooded landscape. The woodland is interspersed with open, cultivated land comprising vineyards, orchards, and meadows. The coastline provides a combination of steep slopes, cliffs, rocky outcrops, beach, and maritime vegetation fronting the Black Sea which is valued for its combination of wildness and far-reaching, panoramic views of the coastline and open sea. As identified in **Chapter 13 Landscape and Visual Assessment**, the visual quality of the woodland and agricultural landscape is important for both residents and tourists who visit the region.

Baseline surveys identified a number of archaeological and cultural heritage sites in the Local Area. The earliest evidence for human activity in the area comprises Upper Palaeolithic stone tools found in the vicinity of Supsekh. There are also four Bronze Age *kurgans* (burial mounds) located on high points between the villages of Varvarovka and Supsekh, over 4.5 km north of the Project Area. A group of rural villas and farmsteads dating to the Antique period have been identified around 1.6 km northwest of Varvarovka. A burial dated to the 6th to 4th century BC is recorded between the villages of Varvarovka and Supsekh, located over 4 km north of the Project Area.

There is also a designated *kurgan* located approximately 50 m northwest of the pipeline microtunnel section which dates from the Antique to medieval period and is identified as critical cultural heritage. While there is extensive tourist interest in Krasnodar's Bronze Age dolmens, some of which are subject to tourist pilgrimages and offerings, no such activities have been observed to be associated with this *kurgan* site and the value is likely to be primarily scientific (**Chapter 16 Cultural Heritage**).

There is a designated statue of DS Kalinin, Hero of the Soviet Union and commander of the 2nd Reconnaissance Detachment Staff of the Black Sea Fleet (1910-1943), who was killed in action when leading a seaborne assault south of the village of Supsekh in May 1943. This event is commemorated with a major memorial erected close to the Anapa-Sukko road, 750 m east of the Project Area. Designated war memorials in the village of Gai-Kodzor commemorate Soviet soldiers killed during the Great Patriotic War and villagers executed at Gai-Kodzor in August and December 1942. At Varvarovka, there are monuments to the Soviet marines and villagers killed by invaders in 1942-1943, and to countrymen who died in the Great Patriotic War. Varvarovka village cemetery includes the common grave of Soviet soldiers and civilians killed in 1942-1943.

There are a number of cemeteries associated with the villages to the north of the Project. The closest of these to the Project Area is the Varvarovka village cemetery, a mixed Armenian and Russian cemetery approximately 398 m north of the northern pipeline centre-line and close to the Gazprom Invest Road (permanent access road) and 100 m west of the South Stream Transport temporary access road to the microtunnel site. The Varvarovka Armenian and Russian cemetery lies on the eastern edge of Varvarovka village, close to Agrifirm Kavkaz vineyards. The cemetery is extensive and divided into family plots. It includes the common grave of Soviet soldiers and civilians killed in the fighting and executed by the fascist invaders in 1942 and 1943 (National Monument No. 380). Further away from the Project Area are the Varvarovka Armenian cemetery, approximately 2.1 km northwest of the connection with the Russian gas network, and the Gai Kodzor Armenian cemetery and church, approximately 5.6 km northeast of the connection with the Russian gas network.

A new Russian Orthodox church is under construction at Varvarovka. The Armenian Apostolic Church of St. Sarkis (St. Sergius) at Gai-Kodzor was built in 1997 and a new Armenian church is also under construction on the same site. Adjacent to the churches is a Gai-Kodzor Armenian *khachkar* cross stone, erected in 1992. It depicts two phoenix birds, symbolizing the friendship between the Armenian and Russian peoples. Khachkars or Armenian cross-stones are carved outdoor stone stelae which act as a focal point for worship, as memorial stones and as relics facilitating communication between the secular and divine. They constitute a distinctive symbol of the identity of Armenian communities at home and abroad. The symbolism and craftsmanship of *khachkars* was inscribed on the UNESCO Representative List of the Intangible Cultural Heritage of Humanity in 2010.

Specific natural resources with a cultural or spiritual role within the area include St. Barbara's Source, Varvarovka, a natural spring reputed to have healing powers and the focus of an annual procession and ceremonies during the Feast of the Theophany in January. Attendees include local parishioners and pilgrims from further afield. St. Barbara's Source is located around 1.9 km northwest of the Project Area.[10] There is a sacred tree located west of the road between Sukko and Anapa. The species is Blackthorn (*Prunus spinoza*) and prayer ribbons and cloth rags are suspended from its branches. Sacred trees and groves occur in many cultures across the world. In the Kuban region, the custom may date back to Circassian / Adyghe traditions, which in turn overlie earlier practices.

Socially significant religious and secular events celebrated in the region include national and international festivals, processions, village days, and commemorations of military and historical people and events who have made a significant contribution to the development of Russia and Kuban. On Victory Day (9 May) and Anapa region Liberation Day (21 September) there are rallies, vigils, and wreath- and flower-laying ceremonies at monuments and war memorials. A festival is held at the *khachkar* in the last week of every May, involving representatives from all communities in the Anapa area.

[10] Note, there is some overlap with the Water Supply and Water Quality services, in order to avoid double counting, impacts on St. Barbara's Source will be assessed in the Water Quality section.

There are several cultural groups based in the Local Area including the Center of Armenian Culture, Council of Veterans, and Cossack Society. There are also a number of amateur associations and clubs such as folk dancing, choirs, and orchestral groups. Traditional Kuban Cossack culture and local folk arts and crafts are being revived with state support, and include weaving, traditional embroidery, pottery, woodworking, basketry, leather manufacture, wool felting and blacksmithing; masters of these arts are honoured with the title "*Master of arts and crafts of Kuban*".

The Local Area is characterised by an agricultural and coastal landscape which plays a role in the cultural identity of the area and of the aesthetic qualities of the landscape. Gastronomic specialities include local wine (Gai-Kodzor Vineyards, first harvested in 2008), as well as Kuban produce including pickles, boiled pork, lard, blinis (pancakes), and pastries. Distinctive local cultural elements of note include traditional Cossack costume, which dates back to the late 19th century. Baseline data collection did not identify any groups who have a particular interest in the natural environment (such as bird watching groups). If such groups are present, it is likely that such activities would take place within the Utrish protected area.

Marine surveys revealed that there are three archaeological objects located within 150 m of the Project Area, including: a modern period aircraft wing, a medieval period ceramic amphora, and a medieval to post-medieval period wooden shipwreck.

None of these sites were identified as being visited by local dive operators and their value is likely to be predominantly scientific. Due to the anoxic conditions in the Black Sea, which inhibit corrosion and microbial degradation, the preservation potential for objects is greatly enhanced below a water depth of 120 m to 200 m. As such, the nearshore and offshore sections have high potential for featuring archaeological elements such as: prehistoric sites that became submerged as a result of the Black Sea flooding; historic coastal settlements; shipwrecks and maritime structures; and remains associated with 19th and 20th century conflict.

For further information see **Chapter 16 Cultural Heritage**.

17.6.10 Wild Species Diversity

Definition:

People derive value from interaction with wild species as well as from knowledge of their continued existence, these values may extend locally, regionally, nationally, or even globally. Species are considered to be locally important if they are valued by local communities for reasons in addition to the other ecosystem services they may provide. For example, the importance of mussel species in providing water quality regulation services is discussed in the water quality chapter, however, some species do not provide any identifiable services and are not identified as being of conservation importance at any level. Nevertheless, they may be of importance to local communities and any impacts on their populations (such as the loss of commonly seen birds or butterflies) could impact the well-being of local beneficiaries. Species are considered to be regionally important if they are listed on the Krasnodar Red data list, nationally important if listed on the Russian Federation Red data list, and globally important if listed on the IUCN Red data list as being vulnerable, endangered, or critically endangered.

Terrestrial Affected Ecosystems

The most common concern raised by stakeholders during consultation (raised 33 times) was the Project's potentially negative impact on the natural environment, including the marine environment, the coastline, onshore valuable habitat area (e.g. the mountain area of the Kilberov Canyon), juniper trees, and local wildlife around the proposed compressor station.

There are a total of eight natural[11] and two modified[12] habitat types within the terrestrial Affected Ecosystems. While none of these habitats are protected sites designated for nature conservation, all forest or woodland habitat are identified as *"protective forests"*, as defined within the Forest Code of the Russian Federation (**Chapter 11 Terrestrial Ecology**). This includes all mesophilic forest, shiblyak, and juniper woodland. These forests are recognised as important features within the environment, as they perform important functions, such as protection of water resources and soils, and recreational spaces for local communities. This designation is not strictly related to the forest's intrinsic *"biodiversity value",* but rather is associated with the ecosystem services they provide.

Table 17.6 lists these habitats and the area of each habitat falling within the Affected Ecosystems. Full descriptions of each of these habitats are provided in **Chapter 11 Terrestrial Ecology.**

Table 17.6 Habitat Extent in the Terrestrial Affected Ecosystems

Habitat Type	Area of Habitat (ha)
Shiblyak	426
Mesophilic forest	63
Juniper woodlands	56
Tomillyar	7
Steppefied secondary meadow*	110
Mesophilic meadow	10
Rocky outcrops	8

Continued…

[11] As set out in IFC PS 6, nnatural habitats are areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary ecological functions and species composition.

[12] As set out in IFC PS6. modified habitats are areas that may contain a large proportion of plant and/or animal species of non-native origin, and/or where human activity has substantially modified an area's primary ecological functions and species composition.

Habitat Type	Area of Habitat (ha)
Coastal shingle	3
Urban and Agricultural habitats*	239
Running water	2

*Modified habitats

Complete.

The habitats within the terrestrial Affected Ecosystems have the potential to support a number of flora and fauna species which are of local value and some of which are of regional, national, and global conservation significance.

In terms of locally important species, juniper trees were identified to be of particular value to local communities. During consultation, stakeholders asked about the felling of juniper trees in both the Varvarovka / Sukko community meetings and the Anapa roundtable meeting. Stakeholders asked whether the juniper trees would be re-planted or the area restored (**Chapter 6 Stakeholder Engagement**).

In addition, surveys undertaken for the ESIA found 26 plant species listed within the Red Data Book of Krasnodor Krai, including two juniper species. These flora species make up part of the Juniper scrub / woodland, Shiblyak, and Tomillyar habitats which provide important habitat and play a role in air, water quality, and hazard regulation.

Regarding fauna, the Nikolski's tortoise is known to be present within areas of Shiblyak and Mesophilic forest. Nikolski's tortoise is a regionally, nationally, and internationally threatened species that is listed as critically endangered on the IUCN Red Data List. A population survey, undertaken during October and November 2013 recorded a total of 51 individual Nikolski's tortoises and the total population size is estimated to be around 150 individuals.

The major threats to this species include loss of habitat due to the expansion of agriculture and urbanisation. There is also evidence of local use of this species through the collection of tortoises for bush meat and the pet trade. Local ecologists identified the persecution of tortoises for their meat and carapaces as the most critical threat facing the species in the locality. In particular, inspectors of the Utrish reserve have reported isolated incidents of vagrants collecting tortoises for food and observations have been made of the illegal trade in Mediterranean tortoises in shops and markets of several towns on the outskirts of the Krasnodar region, including animal shops in Novorossisk (Ref. 17.53).

Other species of conservation importance identified include 38 species of invertebrate; six breeding bird species; and a range of mammal species including twelve species of bat (see **Chapter 11 Terrestrial Ecology** for a full list of species).

Due to the presence of two specific habitat types (Mesophilic forest and Tomillyar) and several endangered and endemic species, the Affected Ecosystems were identified as supporting Critical Habitat.

A Special Protected Natural Area is also located within the Local Area. The site is of federal significance and is located in Krasnodar Krai approximately 4 km south-east of the Project Area. The total reserve area is around 10,000 hectares and covers both the terrestrial and marine environments. It is adjoined to the south-east coast of the Abrau peninsula and the site is known to support a diverse range of flora and fauna including protected and notable plant species, herpetofauna (including Nikolski's tortoise), mammals, birds, and invertebrates. The reserve extends into the Black Sea and supports various notable ichthyofauna and marine habitats. The site was first established in 1987 to preserve the Mediterranean landscapes and their characteristic ecosystems which are typical of the North-Western Black Sea coast area of the Russian Federation.

As such, when viewed within the context of the Local Area, there are relatively large expanses of similar or higher quality habitat than are present within the Affected Ecosystems which are likely to be better suited to supporting any threatened plant and animal species.

Marine Affected Ecosystems

Potential impacts on the marine environment were raised by local communities and NGOs during consultation (**Chapter 6 Stakeholder Consultation**) suggesting that marine habitats and species within them are of importance to people living in the Local Area.

There are three broad habitat types in the Black Sea, including:

- Surface waters (typically 0 to 50 m water depth) which are well oxygenated, have a fairly low salinity, and have historically supported large populations of pelagic fish. There are a number of different benthic habitat types within these shallow waters including: rocky substrates which allow the development of macroalgal beds that in turn support a highly diverse array of fauna; sandy sediments which support a range of infaunal communities, typically bivalve dominated; and mud sediments which support infaunal communities;
- Mid-depth waters (approximately 50 to 100 m water depth) which show decreasing oxygen concentrations and increasing salinity. Benthic habitats at these depths are often muddy sediments; and
- Deep waters (below about 150 to 200 m) where conditions are anoxic. Muddy sediments predominate in deeper waters, and while little is known about the benthos of the deep Black Sea, chemosynthetic bacteria can occur here.

Within the marine Affected Ecosystems, surveys carried out for the ESIA found several species of macroalgae that are listed in the Red Data Book of Krasnodar Krai. Eight fish species of conservation importance have been observed from the Russian Black Sea coastline caught in fixed gear at commercial fishing stations and could potentially be found within the marine Affected Ecosystems. Of particular note are the Russian sturgeon (*Acipenser gueldenstaedtii*) and stellate sturgeon (*Acipenser stellatus*) which are listed by the IUCN as critically endangered (although they are not included in the Red Books of either the Russian Federation or Krasnodar Krai).

Long snouted seahorse, currently listed as data deficient by the IUCN (formerly considered vulnerable), were observed at depths of 1 to 30 m throughout the marine Affected Ecosystems. Seahorses have been significantly exploited by manufacturers of souvenir products and were initially included in the Red Data Book of the Krasnodar Territory as a protective measure. However, the population in the Black Sea has increased significantly and it was removed. It remains on a list of species that are prohibited for catching by the Fishing Rules for the Sea of Azov-Black Sea commercial fishing region.

A further species which may be found within the marine Affected Ecosystems is the tub gurnard. This species may have local importance in the manufacturer of souvenirs and to underwater hunters. Due to a combination of human exploitation, pollution of the marine environment, and illegal fishing, the species has become increasingly rare in the last decade. As a result, the tub gurnard has been entered into the Red Data Books of the Russian Federation and the Krasnodar Territory to ensure its strict protection.

Several bird species of conservation importance were also observed in the marine Affected Ecosystems including the Black-throated diver, Mediterranean gull, and Mediterranean shearwater. An additional protected species that is likely to occur but not directly observed in surveys is the gull-billed tern. This species is in both the Russian and Krasnodar Red Data Books.

Cetacean species of conservation importance off the Russian coast include the harbour porpoise (*Phocoena phocoena relicta*), bottlenose dolphin (*Tursiops truncatus ponticus*), and common dolphin (*Delphinus delphis ponticus*). All three are protected on a national level by environmental legislation and governmental decrees and were observed in surveys undertaken for the ESIA.

Charismatic and visible species such as dolphins are also likely to have local importance to people in the Local Area. Within Anapa, for example, there is a dolphinarium which offers dolphin therapy sessions to children with development difficulties which aim to: improve coordination, develop motor skills, stabilise mood, raise self-confidence, develop communication, and encourage thought development (Ref. 17.54).

During the 1980s to early 2000s, the number of facilities for dolphin shows and *"swim with dolphins"* programmes greatly increased in Black Sea countries. The export of bottlenose dolphins from Russia and Ukraine for permanent and seasonal shows also expanded to over 20 countries in Europe and the Middle East. According to CITES statistics, at least 92 individuals were removed from the Black Sea region during 1990-1999 and Russia reportedly has exported at least 66 for traveling shows since 1997.

Due to the presence of threatened species in the marine Affected Ecosystems the area has been identified as Tier 2 critical habitat as defined by the IFC. It should be noted that the Project Area does not, per se, represent particular habitat that is not replicated elsewhere in the Russian Black Sea; it is merely part of a wider zone that meets the requisite criteria (**Chapter 12 Marine Ecology**).

For further information see **Chapter 11 Terrestrial Ecology** and **Chapter 12 Marine Ecology**.

17.6.11 Baseline Summary

A summary of the baseline conditions of the ten key ecosystem services is provided in Table 17.7. Likely future trends are indicated as follows: ↗ increasing provision; ↘ decreasing provision; ←→ no overall change in provision; and ± some increases and some decreases in provision. The importance of the ecosystem service to beneficiaries is indicated by: high importance; moderate importance; low importance; and negligible importance.

Table 17.7 Baseline Summary

Service	Provision	Future Trend and Importance	Key Drivers of Change	Key Beneficiaries
Crops	Viticulture is a source of income to landowners in the Affected Ecosystems	↘	Climate change, water availability	Agrifirm Kavkaz Wine consumers Local individuals and migrant workers employed in sector
Capture fisheries	Important service for particular groups although insignificant part of local economy	↘	Overfishing, pollution, invasive species	Small and medium scale fishing companies (and their employees) Fishing companies (and their employees) operating throughout the Black Sea
Water supply	Several ground and surface water abstractors for a range of drinking, industrial, and agricultural uses	↘	Climate change, population growth, increasing demand	Ground and surface water abstractors (including Agrifirm Kavkaz and MoD) Visitors to St. Barbara's Source Project itself Households dependent on supply from Sukko aquifer
Hazard regulation	Natural habitat and vegetation regulate water flows and reduce erosion rates	↘	Climate change	Local households and private companies Recreational beach users Project itself

Continued...

Service	Provision	Future Trend and Importance	Key Drivers of Change	Key Beneficiaries
Air quality regulation	Important service in an area which has a reputation for therapeutic air		Traffic and industrial emissions	Local landowners, households, and workers Tourism industry in Anapa SPNA Tourists from wider region / country
Water quality regulation	Water quality regulated through a number of processes and supports range of uses		Eutrophication, climate change, legislation and control of pollutants, invasive species	Local abstractors Tourists, recreational users, and tourism industry in Anapa SPNA Fishing industry and fish consumers Visitors to St. Barbara's source
Soil quality regulation	Important service in reducing health risks, determining land productivity, and regulating surface flows		Airborne emissions, surface run-off	Landowners Workers who may contact contaminated soils Local residents benefiting from reduced flood risk
Tourism and recreation	Important sector of local economy and important resource for local recreational users		Expansion and development, Winter Olympics	Recreational beach and ocean users Visitors to resorts Tourism industry Users of hiking and horse riding trails
Cultural and spiritual	Cultural landscape with a number of unique sites		Development of landscape	Local and regional site users Local population National and global scientific community

Continued...

Service	Provision	Future Trend and Importance	Key Drivers of Change	Key Beneficiaries
Wild species diversity	A number of highly threatened terrestrial and marine species and species of local importance		Climate change, pollution, hunting, regulation, habitat loss, invasive species	Local communities and NGOs Regional, national, and global conservation community

Complete.

17.7 Impact Assessment

17.7.1 Impact Assessment Methodology

The assessment of impacts on ecosystem services broadly follows the approach set out in **Chapter 3 Impact Assessment Methodology**. It follows the same steps and uses the same assessment criteria but differs in one important respect: it assesses impacts from the point of view of the ecosystem service beneficiaries. The impact is therefore measured as the change in human well-being (relative to the baseline) as a result of a change in the level of provision of an ecosystem service.

The nature and significance of impacts are determined using a set of criteria that reflect the value of ecosystem services to beneficiaries, the resilience of ecosystems and their beneficiaries to change, and the extent, duration, reversibility, and frequency of the impacts. These criteria are explained more fully in the sections that follow.

17.7.1.1 Impact Assessment Criteria

Receptor Sensitivity

Receptor sensitivity is determined using information from the baseline and provides a detailed understanding of the importance of each ecosystem service to its respective beneficiaries, taking account of:

The **value** of ecosystem services to beneficiaries, i.e.:

- The extent to which beneficiaries are **dependent on the ecosystem service** (e.g. whether fishing is undertaken occasionally as a recreational activity or regularly as an important part of livelihoods); and
- The **scarcity value** of the ecosystem service (e.g. the availability of suitable alternatives or substitutes) and how readily replaceable it is considering accessibility and affordability.

And the **resilience** of ecosystems and beneficiaries to change, i.e.:

- The **sensitivity of the ecosystem** to change (e.g. as a result of climate change, population pressures, etc.). This will depend on *inter alia* the existing condition of the ecosystem, its functions, and its thresholds. For example, some fish species (such as sturgeon) are particularly sensitive to changes in water temperature (Ref. 17.55); and
- The **sensitivity of beneficiaries** to changes in ecosystem service provision. This will depend on *inter alia* beneficiaries' existing endowments of, or access to, factors such as financial, human, physical, natural, and institutional capital. For example, poorer rural households who collect water directly from the environment through household wells are likely to be more sensitive to changes in the supply and quality of their water than wealthier households in urban centres who are connected to a public water supply system.

The extent to which an ecosystem service fulfils each of these criteria is scored on a four point scale as shown in Table 17.8. Note that receptor sensitivity is independent of Project impacts and relates to the existing situation and the capacity of ecosystems and ecosystem service beneficiaries to adapt to any type of change (e.g. climate change, population growth, etc.).

Table 17.8 Criteria Used to Determine Receptor Sensitivity

	Significance Criteria	Assigned Scores			
		Score 1	**Score 2**	**Score 3**	**Score 4**
Value	What is the degree of dependence by beneficiaries on the ecosystem service? Note: this can include type of use e.g. subsistence vs. recreational and intensity of use e.g. occasional vs. continual	Negligible	Low	Moderate	High
Value	To what extent is this ESS replaceable? Or are good substitutes available without entailing significant costs? Note: this should specifically refer to the availability of alternatives	Service is widely available	Some alternatives available	Few alternatives available	No alternatives available
Resilience	What is the sensitivity of the ecosystem to change? Note: this should refer to the biological sensitivity of the ecosystem to change	Negligible	Low	Moderate	High
Resilience	What is the vulnerability of the human receptors to any change in ecosystem service provision? Note: this should refer to the socio-economic capacity of people to adapt	Negligible	Low	Moderate	High

The scores assigned to each criterion are then added together for each ecosystem service to arrive at the overall receptor sensitivity score as shown in Table 17.9.

Table 17.9 Approach to Determining Overall Receptor Sensitivity

Receptor Sensitivity		Score
Negligible	The service is of low value to beneficiaries (due to low dependency or the existence of widely available alternatives) and the environmental and human receptors are highly resilient.	4
Low	The service is of low value to beneficiaries (due to low dependency or the existence of widely available alternatives) and the environmental and human receptors are moderately to highly resilient. Alternatively, the service is of moderate value to beneficiaries and the environmental and human receptors are highly resilient.	5-8
Moderate	The service is of moderate value to beneficiaries (due to moderate dependency or the existence of some alternatives) and the environmental and human receptors are moderately resilient. Alternatively, the service is of high value to beneficiaries and the environmental and human receptors are highly resilient.	9-12
High	The service is of high value to beneficiaries (due to high dependency or the lack of suitable alternatives) and the environmental and human receptors have low resilience. Alternatively, the service is of moderate value to beneficiaries and the environmental and human receptors have low resilience.	13-16

Impact Magnitude

The assessment of Project impacts on ecosystem services follows the methodology described in **Chapter 3 Impact Assessment**. The magnitude of each of the identified impacts on ecosystem services is evaluated on the basis of the following criteria:

- The **severity of the impact** on the well-being of ecosystem service beneficiaries;
- The **reversibility** of the impact (i.e. how quickly is the ecosystem able to recover from the impact); and, based on this,
- The **duration** of the impact *on beneficiaries*; and
- The **frequency** with which ecosystem service beneficiaries are affected by the impacts of Project activities.

Each impact is scored against each of the criteria on a four point scale as shown in Table 17.10 below.

Table 17.10 Criteria for Determining Impact Magnitude

Magnitude Criteria	**Assigned Scores**			
	Score 1	**Score 2**	**Score 3**	**Score 4**
Severity: What is the likely severity of the impact on the well-being of any beneficiaries of the service, considering both the number of beneficiaries affected and the degree to which they are affected?	Negligible	Low	Moderate	High
Reversibility: How quickly is the ecosystem (or ecosystem functionality) able to recover from the impact?	Short term *Will recover completely in a short period of time once the activity ceases, e.g. turbidity levels in a water column*	Medium term *Reversible after some time with no intervention. Ecosystem functionality will recover with some changes to ecosystem function at natural recovery rates (e.g.re-establishment of riverbed)*	Long term *Reversible after some time with intervention. Recovery will occur but is retarded by impact (e.g. regrowth of vegetation once original topsoil has been replaced)*	Permanent
Duration: How long is the impact on beneficiaries expected to last?	Short term *Impacts occur over a few weeks or for a single season*	Medium term *Impacts occur over an extended period covering multiple seasons*	Long term *Impacts affect the current human generation, e.g. 25 years*	Permanent *Impacts extend over multiple generations, e.g. >25 years*
Frequency: How often are ecosystem service beneficiaries affected by the impacts of the Project activity?	Once off	Periodic *Effects are intermittent and sporadic over assessment period*	Regular *Effects are intermittent but regularly repeated over assessment period*	Continuous

The scores assigned to each criterion are added together for each ecosystem service to arrive at a total impact magnitude score for each ecosystem service which is classified as shown in Table 17.11.

Table 17.11 Determining Overall Impact Magnitude

Impact Magnitude		Score
Negligible	The impact is within the normal range of variation of the ecosystem and is not significant for the ESS beneficiaries	4
Low	The impact results in a small reduction in the availability or functionality of the ecosystem but is unlikely to give rise to any significant, lasting change in service provision or well-being of any beneficiaries and will not impact on Project operations	5-8
Moderate	The impact results in a moderate reduction in the availability or functionality of the ecosystem which may give rise to a change in service provision and the well-being of any beneficiaries and/or may compromise Project operations	9-12
High	The impact results in the loss of all or a significant proportion of the availability or functionality of an ecosystem which is likely to give rise to a significant change in service provision and the well-being of any beneficiaries and/or will compromise Project operations	13-16

17.7.1.2 Impact Significance

Once the receptor sensitivity and impact magnitude for each of the ecosystem services is estimated they are then combined to estimate the impact significance using the impacts significance matrix set out in Table 17.12 which is consistent with the overall approach to determining impact significance as set out in **Chapter 3 Impact Assessment Methodology**.

Table 17.12 Impacts Significance Matrix for Ecosystem Services

<table>
<tr><th colspan="2"></th><th colspan="4">Receptor Sensitivity</th></tr>
<tr><th colspan="2"></th><th>Negligible</th><th>Low</th><th>Moderate</th><th>High</th></tr>
<tr><th rowspan="4">Impact Magnitude</th><th>Negligible</th><td>Not Significant</td><td>Not Significant</td><td>Not Significant</td><td>Not Significant / Low</td></tr>
<tr><th>Low</th><td>Not Significant</td><td>Low</td><td>Low / Moderate</td><td>Moderate</td></tr>
<tr><th>Moderate</th><td>Not Significant</td><td>Low / Moderate</td><td>Moderate</td><td>High</td></tr>
<tr><th>High</th><td>Low</td><td>Moderate</td><td>High</td><td>High</td></tr>
</table>

Based upon the resulting impact significance score, ***priority ecosystem services*** i.e. those upon which the Project is likely to have a significant impact and which result in adverse impacts on beneficiaries, and/or those upon which the Project is directly dependent for its operations are determined as follows:

- **Not Significant** to **Low** impact significance – not a priority service and no mitigation required beyond that which is set out in other chapters; and
- **Moderate** to **High** impact significance – **priority service** and further mitigation measures required to maintain the value and functionality of the affected service.

Once the data necessary to inform the impact assessment was collated and entered into the ESIVI tool, the technical specialists from each of the environmental and social disciplines covered in the ESIA were invited to participate in a workshop in order to:

- Draw on the specialist knowledge of each of the participants to determine impact magnitude and impact significance and to identify which services should be considered priority ecosystem services;
- Identify where further information may be required to inform the ecosystem services assessment and/or where the ecosystem services assessment could inform the assessments presented in the other chapters of the ESIA particularly in relation to livelihoods, health, safety, and cultural heritage; and
- Begin to identify appropriate mitigation measures which aim to maintain the value and functionality of priority services using the mitigation hierarchy.

Following the workshop, the residual impact assessment was completed. This follows the same process as described above in terms of assessing impact magnitude but includes consideration of the effectiveness of the proposed mitigation measures. Where the proposed measures are not able to avoid or reduce impacts on priority services, or to restore ecosystem service functionality and value, then appropriate forms and levels of compensation have been discussed with the local communities.

17.7.2 Assessment of Potential Impacts: Construction and Pre-Commissioning

17.7.2.1 Introduction

The following sections provide a description of the nature and significance of Project impacts on ecosystem services and their beneficiaries during the Construction and Pre-Commissioning Phase. A detailed breakdown of the scoring assigned to each ecosystem service is provided in Appendix 17.3 Impact Assessment – Construction and Pre-Commissioning.

17.7.2.2 Assessment of Potential Impacts (pre-mitigation)

Crops

The service considered in this assessment is the provision of crops grown on agricultural land within the Affected Ecosystems. The key beneficiaries include:

- Agrifirm Kavkaz;
- Consumers of wine produced by Agrifirm Kavkaz; and
- Migrant workers temporarily living in the Local Area who depend on seasonal employment by Agrifirm Kavkaz.

Due to the relatively small extent of productive agricultural land which will be cleared by the Project, together with the fact that much of the land is scrub, fallow land, or abandoned vineyard (Table 17.13), it is unlikely that the Project will lead to any impact on the ability of consumers to purchase wine.

Further, since there is no provision under Russian Federal law for compulsory land purchase, South Stream Transport cannot expropriate land to make it available to the Project. South Stream Transport must therefore reach an agreement with land owners to acquire or temporarily use land (e.g. by leasing) through negotiated settlement according to a Project Land Acquisition Plan.

As land will be acquired by way of negotiated settlement, within the context of a legal system that does not sanction expropriation or other compulsory procedures, any impacts on the respective land owners will be identified and compensated accordingly as part of the negotiated settlement. It is therefore considered that there will not be any impacts on well-being associated with either the permanent or temporary change of use of the land needing to be acquired (**Chapter 14 Socio-Economics**).

As such, the impact assessment therefore focuses on workers employed by Agrifirm Kavkaz.

The Project activities which could impact provision of this service include:

- Clearance of vegetation within the Affected Ecosystems;
- Restrictions on re-vegetation and land use post-clearance;
- Smothering of crops due to dust released during construction activities; and
- Leaks or spills which could contaminate soils in the Affected Ecosystems and reduce productivity (impacts on soils are assessed in the Soil Quality Regulation section below).

Receptor Sensitivity

Due to the distance to which migrant workers travel to work on the vineyards within the Affected Ecosystems, it is likely that they are highly dependent on this service for employment and livelihoods. Agrifirm Kavkaz does have other land holdings in the Local Area (total land holdings are around 1,975 ha) which are currently fallow or uncultivated and could potentially be used as alternative locations for grape cultivation. While cultivation of such land could provide alternative sources of employment for workers and there are other potential alternative sources of employment (such as in the tourism sector), there is no certainty that jobs would be available on a like for like basis. As such, it is considered that there are some alternatives for this service.

Vineyard ecosystem services are considered to be moderately sensitive to change due to the sensitivity of grape production to shifts in temperature, rain, sunshine, and soil conditions. Further, the resilience of the ecosystem to change may come under increasing pressure as a result of climate change. While the effects of climate change may threaten the longer term sustainability of wine production, the winery itself is considered to be fairly resilient to relatively small changes in access to factors of production (particularly land) as it owns (and could acquire) other land holdings which could potentially be brought into production. However, migrant workers are likely to be highly vulnerable to any change in employment and may have limited capacity to adapt to such changes.

The overall receptor sensitivity is therefore considered to be high.

Impact Magnitude

Construction of the Project will require clearance of approximately 53.5 ha of agricultural land for construction of the landfall facilities, the access road, and for the Pipeline Right-of-Way. Of the land to be cleared, around 41.69 ha (78%) is scrub, fallow land, or recently abandoned vineyard and approximately 11.81 ha (12%) is productive vineyard.

Around 8.7 ha (16%) of agricultural land will be taken out of agricultural use permanently and 23.75 ha (44%) will require temporary clearance before being returned to the land owner following the construction period. The remaining 21.05 ha (39%) will be returned to the landowners but future use will be restricted. For this land within the Pipeline Right-of-Way, no deep rooting trees or permanent crops will be allowed to grow back following construction, although bushes and other shallow rooted vegetation, including grape vines, will be allowed to be replanted and the land will be returned to landowners.

However, it is considered unlikely that the land owner or manager would replant vines or other long term cultures within the Pipeline Right-of-Way because of the possibility that they may need to be dug up at any time in the operational phase to allow for maintenance of the pipelines, thereby causing substantial disruption. Therefore on balance, it is considered that the land that would remain within the right of way would not be likely to be replanted with vines (even if the precedent can allow for it) but will be able to be planted with seasonal crops.

Table 17.13 shows the breakdown by permanent, temporary, and restricted use land take for Kavkaz, according to the existing land use pattern of Agrifirm Kavkaz's arable land.

Table 17.13 Land take for Agrifirm Kavkaz

Arable Land take	Cultivated Vineyard (ha)	Scrub, Fallow, and Abandoned Land (ha)	Total (ha)
Permanent	1.7	7	8.7
Temporary	10.11	10.94	21.05
Restricted use	0	23.75	23.75
		Total	**53.5**

Emissions of dust from construction activities could have a temporary impact on productivity of cultivated land in the Affected Ecosystems although this is likely to be minimal. As such, the main impacts of the Project are likely to arise from a decrease in current and future crop production, and a corresponding decrease in employment opportunities, resulting from the permanent loss of 1.7 ha, and the loss of income and costs of-reestablishment following the temporary loss of 10.11 ha of cultivated vineyard. There could also be a reduction in future crop production due to the permanent loss of 7 ha, temporary loss of 10.94 ha, and restricted use of 23.75 ha of scrub, fallow, and abandoned land, although any losses are likely to be minimal.

The limited amount of cultivated land to be cleared means that it is highly unlikely that any loss of land will result in on-going economic displacement of workers, although there could be some temporary displacement during seasons which coincide with construction activities. The total area of vineyard currently under cultivation by Agrifirm Kavkaz is 416 ha and it is understood that there is sufficient land under production, with related tasks that can be undertaken, to ensure that the displaced workforce would be absorbed elsewhere in the vineyard. Part of the land is also set aside for the Chateau development which will require some clearance in the absence of the Project (e.g. for construction of the properties and driveways) and may lead to a change in demand for such labour if the new vineyard owners do not elect to hire migrant workers to cultivate their private plots. As such the magnitude of the impact on well-being is considered to be low.

Most of the land to be cleared for the Project will be able to be replanted with crops following construction allowing ecosystem functionality, crop productivity, and employment opportunities to be restored. For land which is to be replanted for viticulture, vineyard ecosystems are estimated to take around three years (or three growing seasons) to reach a productive state that is sufficient to enable harvesting for the purposes of wine making.

While there will be some loss of crop production due to the permanent clearance of 1.7 ha land for the landfall facilities and an on-going restriction on the ability to cultivate land for viticulture in future, this is likely to be very small. The main impacts are likely to be felt in terms of temporary loss of productive land during the construction period. For workers employed by Agrifirm Kavkaz there is unlikely to be a significant on-going impact on job opportunities although there could be some short term disruption during the construction period. Impacts would be felt periodically during harvests taking place within the construction phase.

The overall impact magnitude is therefore considered to be low (refer to Appendix 17.3 for the scores against each of the magnitude scoring criteria).

Impact Significance

In combination, the total impact significance on the crops ecosystem service is therefore judged to be **Moderate** and crops are identified as a priority service during the Construction and Pre-Commissioning Phase.

Capture Fisheries

The service considered in this assessment is the capture of wild fish for consumption and recreational purposes through trawling and other non-farming methods within an area that extends along the coast from the Kerch Strait in the north to Arkhipo-Osipovka in the south. The key beneficiaries are:

- The two main commercial fishing enterprises based in Anapa who operate in the Kerch-Taman fishing zone (RPK Briz and OOO RAM) and their employees;
- A number of smaller commercial fishing organisations operating out of Novorossiysk and Temryuk who fish in the Kerch-Taman zone; and
- Commercial fishing organisations based elsewhere (including other Black Sea countries) that harvest stocks of fish in the Black Sea that may migrate or spawn in waters within the Kerch-Taman zone.

The specific effects of Project pre-commissioning and construction activities which could potentially impact upon capture fisheries include and which were considered in the assessment include:

- Sediment disturbance during dredging, installation of pipelines, pipe-laying, and back-filling;
- Implementation of safety exclusion zones around anchored vehicles (during surveys) and during dredging, installation of pipelines, pipe-laying, back-filling and tie-ins; and
- Disturbance caused by noise, vibration and light from vessels used for surveying, dredging, installation of pipelines, pipe-laying, back-filling, and tie-ins.

Receptor Sensitivity

Given the relatively low importance of fisheries to the local economy, dependence on fisheries is generally low although, for particular individuals working for smaller fishing organisations who have less access to alternative sources of income, the dependence on this service for livelihoods is likely to be higher. Due to the extensive fishing grounds which are used by fishing organisations, the overall dependence on capture fisheries within the Project Area is likely to be low.

The available fishing grounds are extensive (from the Kerch Strait to the mouth of the Psou River on the border with Georgia) and therefore access to fishing grounds other than those within the Project Area are considered to be available. However, given the additional costs of travelling further afield and the declining level of fish stocks generally, the alternative fishing grounds are not considered to be widely available without incurring additional costs (i.e. the fuel used to access fishing grounds that are further afield and the opportunity cost of the additional time spent at sea).

Fish stocks within the Black Sea are sensitive to change and there are recorded declines in a number of species as a result of over-fishing, eutrophication, and the introduction of alien invasive species. The Anapa Bank has been specifically designated as a protected area in order to encourage the replenishment of fish stocks, particularly for the Black Sea turbot whose stocks are presently at historically low levels. As such, the ecosystem is considered highly sensitive to change.

Any change in fish stocks would impact upon all beneficiaries who would either incur greater expenditure in order to travel to alternative fishing grounds further afield or obtain smaller catches. While larger commercial fishing organisations are likely to be able to adapt to such changes by shifting to new fishing grounds, smaller organisations with smaller fleets and less access to technological / financial resources are likely to be more sensitive to any change in provision of this service. Further, due to the poor state of the fishery in terms of vessel age and infrastructure investment, the sector is likely to be highly sensitive to any changes.

Overall receptor sensitivity is assessed as being moderate.

Impact Magnitude

A fisheries study was undertaken in order to assess the potential Project impacts on fish stocks and the beneficiaries dependent upon them. The report identified three potential impacts: disturbance to fish through sedimentation from dredging; loss of access to fishing grounds due to the exclusion zone; and noise and light disturbance to fish species (Appendix 14.1).

The first potential impact is seabed sediment dispersion caused by the construction of the microtunnel and the seabed dredging process. Increased sediment may affect fish in two ways: through increased turbidity caused by high suspended sediment concentrations reducing the capacity of visual predators to locate prey; and through sediment settling on the seabed smothering eggs and possible prey items for some benthic feeders as well as restricting the settlement of larvae. Both of these have the potential to reduce the reproductive capacity of fish species causing a reduction in stocks over time or causing fish stocks to relocate elsewhere.

While there will be some disturbance of sediment during the dredging of the exit pits and transition trenches, sediment modelling undertaken for the ESIA shows that the duration of this operation will be approximately 1.5 to 2 days (depending on the scenario assumed). Modelling also shows that, in the most extreme case, the sediment plume disperses rapidly to the lowest detectable level as it is carried down the coast over a 4 to 5 day period. The extent of this sediment disturbance will therefore not be at an intensity or duration that would affect fish species or the ability of beneficiaries to undertake fishing activities.

The second potential impact is the imposition of a safety exclusion zone of approximately 3 km (1.6 NM) radius which will be enforced during construction to avoid incidents with marine traffic. The safety exclusion zone will mean that access to a certain area of the fishing grounds will be lost during construction which could potentially impact on the livelihoods of those in the fishing industry.

However, the loss of access to potential fishing grounds will be minimal relative to the fishing area. An estimate of the shelf area above 100 m depth between Arkhipo-Osipovka and the northerly limit of the Anapa Bank, which is largely coincident with the anchovy feeding grounds, is approximately 2,235 km^2, while the area of the 3 km exclusion zone around the near shore construction will be around 14 km^2, less than 0.01% of the shelf area which constitutes the fishing grounds. Interference with the sprat fishery, which is largely confluent with the anchovy grounds, is therefore also unlikely. Further, any loss of fishing area will be less important to the sprat, anchovy, and other pelagic fisheries since they use mid-water methods which are less dependent on specific areas.

More direct impacts might be felt by fishing operations for benthic and demersal species since there will be loss of access to a specific area of habitat. This, however, will be limited to 3 km either side of the works and will cover a relatively small area in relation to the total fishing grounds. The potential for impacts will be further limited due to the absence of any bottom fishing in the area. While smaller vessels can trawl for benthic and demersal species, it is likely that they do this using a midwater trawl setup and fish close to, rather than on, the bottom. In addition, demersal species make up only 9% of the total catch and are normally caught using fixed nets. While the 3 km exclusion zone around the pipe-laying vessel may cause some temporary inconvenience and increased costs due to the need for fishing vessels to avoid the safety exclusion zone around the construction spread, there are unlikely to be any significant impacts on catches or livelihoods.

The greatest potential impact during the Construction and Pre-Commissioning Phase, and the greatest concern outlined by the fishing companies interviewed, is the possible disturbance to fish migration due to noise and vibration.

The fish species migrating along the coast which are most likely to be impacted are anchovy, horse mackerel, and to a lesser extent some of the bottom dwelling species such as migrating red mullet. Anchovy migrate along the coast from the Kerch Strait to the southern wintering areas off Sochi and the coast of Georgia. The main north-south autumn migration is October to November while the return spring migration is April to June. The Pipeline cuts across this line of movement.

The pipe-laying vessel will be a moving source of continuous noise and light. The anticipated noise level from vessels used in the Pipeline construction is between 169 and 192 dB. Using weighted thresholds, it was found that behavioural effects may be apparent in some hearing specialist fish such as sprat in certain situations (though not shad or anchovy because they have a different hearing range). Anchor handling is the activity most likely to generate such responses, and in shallow water may extend up to 260 m from activity, with an affected area of approximately 0.2 km^2. In deep water, where anchor handling will not take place, the pipe-laying vessel itself may generate similar impacts at a lesser range of approximately 140 m (area of effect approximately 0.06 km^2).

As virtually all fishing takes place within 12 NM (equivalent to 21.6 km) of the coast, there should always be an undisturbed corridor of 5 to 6 km through which fish can pass. Moreover, since the vessel lays pipes at between 2.5 and 2.75 km per day over a 21.6 km distance, it should only take around nine days to traverse the fishing zone on the main continental shelf area down to 100 m water depth where the fish migrate. Since the periods of migration of both the anchovy and mackerel are at least 2 months, any disturbance will therefore only be temporary. Fish species are also likely to become habituated to vessel noise sources.

It is further noted that the authorities have put a ban on any construction activity taking place in waters to 100 m depth during the month of May, which coincides with the peak of the main spring anchovy migration, thereby further reducing the likelihood of any impact.

Due to the fact that the vessel will be brightly illuminated at all times, light disturbance could also potentially be an impact, although the attraction effect of light is relatively localised and is only a factor at night. As such, any disturbance can be bypassed by migrating fish during the day.

To provide an overall point of comparison with regard to disturbance from construction activities, in a similar situation for the North Stream pipeline, monitoring of fish densities showed no changes attributable to construction and there was no discernible impact on fish catches over the period (Appendix 14.1).

On the basis of the analysis presented above, it is concluded that there will be no distinguishable differences in fish catches outside of the normal annual fluctuations and it is unlikely that the fishing industry will experience a reduction in catch during the Construction and Pre-commissioning Phase. As such, there are unlikely to be any identifiable impacts on beneficiary well-being resulting from Project activities.

The impact magnitude is therefore considered to be negligible (refer to Appendix 17.3 for the scoring against each criterion).

Impact Significance

The overall significance of the impacts of Project activities on capture fisheries is assessed as being **Not Significant** and fisheries are not considered to be a priority service requiring mitigation.

Water (supply)

The service considered in this assessment is the use of ground and surface freshwater resources provided by, or dependent upon, the Affected Ecosystems. This includes water resources used throughout the Shingar catchment. The baseline identified a number of beneficiaries using freshwater resources within the Shingar catchment who are located upstream of the Affected Ecosystems, including:

- The Russkaya compressor station which abstracts groundwater from a source north of the Affected Ecosystems;
- Agrifirm Kavkaz which abstracts water from an impoundment in the Graphova Gap; and
- Visitors to St. Barbara's source located in Varvarovka.

Due to the hydrological gradient and distance from the Project Area of these abstractions, the Project is unlikely to lead to any impacts on the provision or use of these water resources and, as such, the assessment focuses on downstream beneficiaries including:

- The Project itself which is dependent upon the Ministry of Defence well in Sukko; and
- The Ministry of Defence and any households dependent on the water abstracted from their well.

The specific Project activities that could affect the water (supply) services provided by or dependent on the Affected Ecosystems include:

- Construction activities which require dewatering of groundwater resources;
- Abstraction from aquifers for use in construction leading to decreasing groundwater levels; and

- Alterations to surface water flows during construction due to crossing of surface waters and alterations to vegetation cover.

Receptor Sensitivity

Companies and households abstracting from groundwater resources (including the Project itself) are highly dependent on the water supply for their health, operation, and well-being. Alternative supplies of water are widely available through the use of other aquifers or surface water resources, the public water supply system, or tinkering / piping in supplies from other areas (although the last approach is likely to incur significant environmental and social costs).

The sensitivity of the Affected Ecosystems to change is likely to be moderate. While there are relatively large quantities of water resources available in the Local Area, the aquifer from which the MOD operates a well is under pressure from abstraction and is managed through a licencing system which sets limits on abstraction volumes to ensure sustainable use. Commercial organisations are likely to be of low sensitivity to change as the main direct abstractors (the Project itself and the Ministry of Defence) are likely to have the financial and technological resources to be able to adapt to changes in supply. Residents of Sukko currently drawing water from wells are likely to be of moderate sensitivity as they are reliant on the municipal authorities for any alternative sources of water should the well water sources be affected.

The overall receptor sensitivity is therefore considered to be moderate (refer to Appendix 17.3 for the scoring against each of the magnitude significance criteria).

Impact Magnitude

Construction activities are likely to require groundwater control at certain points. While this may involve dewatering abstractions[13], the impacts will be temporary and recovery is expected to be rapid. The Pipeline route crosses surface waters, the potential disruption of which could impact on the hydro-morphology of the river channel depending on the timing of the construction works. However, the channel crossings have been designed so as to minimise the impact on the river channel and to ensure that flows are maintained. As such, there is unlikely to be a significant impact on downstream flows (**Chapter 8 Soils, Groundwater and Surface Water**).

Alterations to surface water flows may occur, however, as a result of land clearance, changes to topography, and development of temporary construction areas. It is unlikely that there will be any significant impacts on water flows due to changes in topography although surface water run-off may increase due to the removal of vegetation and compaction of bare soils. However, as streams are ephemeral, any changes in water flows are likely to be minimal and there are no identified surface water abstractors dependent upon surface water flows within the Affected Ecosystems. Further, the extent of clearance of natural habitat is small relative to the surrounding extent and so impacts on downstream water flows are likely to be insignificant.

[13] A dewatering abstraction is the removal or draining of groundwater or surface water from an aquifer, riverbed, construction site, caisson, or mine shaft, by pumping or evaporation. Dewatering may be implemented before subsurface excavation to lower the water table.

Saltwater will be used for hydro-testing purposes although some freshwater will be required for construction activities such as the cleaning of plant and equipment, worker amenities, and in the use of construction materials such as concrete. All freshwater required during construction will be supplied from the Ministry of Defence well in Sukko. An estimated total volume of 37,000 m^3 of freshwater is required for the microtunneling process. In addition there will be a maximum usage of 25 m^3 per day for freshwater for general construction activities (domestic usages, wheel washing etc.) during peak periods. The water will be trucked to the construction areas from Sukko. There is a May – September (inclusive) exclusion period when water cannot be abstracted from the existing source at Sukko. Due to this restriction, a large quantity of water (up to 10,000 m^3) may need to be stored adjacent to the microtunnel construction site. A much smaller quantity of water (no more than 800 m^3) may need to be stored at the landfall facilities site.

Abstraction from the aquifer is managed through a licencing system which sets limits on abstraction volumes to ensure sustainable use. It is assumed that the licensed abstraction rate, including the seasonal exclusion period, has been set at a rate that will not cause the derogation, in terms of quality and quantity, of the aquifer resources, or of any other groundwater users within Sukko that utilise the same aquifer. Since all water required for Project activities will be managed through this licensing system and the rate of abstraction during construction will not exceed the licensed rate, Project impacts on the well-being of other water uses and the wider environment are likely to be negligible.

The overall impact magnitude is therefore considered negligible (refer to Appendix 17.3 for the scoring against each of the impact magnitude criteria).

Impact Significance

The overall significance of the Construction and Pre-Commissioning Phase of the Project on water (supply) is assessed as being **Not Significant** and water (supply) is not considered to be a priority service.

Hazard Regulation

The service considered in this assessment is the capacity of Affected Ecosystems to regulate natural hazards. The key beneficiaries include:

- Households and businesses located along the coastline and/or in areas that are vulnerable to flooding, erosion, and landslides;
- Recreational users who benefit from beaches along the coastline; and
- The Project itself which may be affected by flooding, erosion, and landslides.

The specific Project activities which could affect the hazard regulating services include:

- Site clearance and earthworks, particularly where these result in changes in topography and loss of vegetation;
- Impacts on the structural composition of Phaeozem soils which play an important role in water storage and flow regulation;

- Preparation of foundations may induce ground instability which could trigger mass movement of soils; and
- Dredging processes in the marine environment, particularly if this impacts upon coastal processes, and the effects of sea surges.

Receptor Sensitivity

The level of dependence on this service by the beneficiaries discussed above is assessed as low. The risk of surface water flooding and landslides to beneficiaries is low and vegetation within the Affected Ecosystems is considered to have a relatively limited role in regulating this risk relative to the surrounding habitat. Beneficiaries living in coastal areas, users of coastal beaches, and the Project itself are more dependent upon the regulation of coastal erosion and flooding, which could have significant impacts on health, operation, and well-being. However, the Affected Ecosystems again play a relatively small role in regulating this risk.

The role Affected Ecosystems currently play in regulating hazard risks could be replicated and improved through various engineered alternatives such as the construction of coastal flood defences, beach reclamation, creation of flood water attenuation ponds, or afforestation. Many of these approaches would, however, be expensive and/or take a long time to implement. It is therefore considered that there are few viable alternatives.

The Affected Ecosystems are considered to be moderately sensitive to change with respect to their ability to provide a hazard regulating service. Climate change is projected to lead to an increase in the frequency of extreme events including flooding and sea level rise over the next 50 years. Phaeozem soils are structurally prone to compaction and erosion which can reduce their ability to store and filter water and regulate flows. Subsequently, they are considered to have a low resilience to impacts, and would not readily return to their natural state within the Project's lifetime.

Beneficiaries of this service (including the Project itself) are considered to be moderately vulnerable to any change in the provision of this service. While the ecosystems currently play a relatively limited role in regulating this hazard, small changes in ecosystem functioning can lead to changes in hazard risk which can lead to significant changes in well-being. For example, a change in vegetation cover in an area or an increase in intense rainfall events can lead to an increase in frequency of mudflows which can lead to structural damage and loss of crops. Larger towns (such as Anapa) are likely to have access to the resources necessary to adapt to changes in hazard risk, although there are a number of individual households and smaller communities which may be less able to adapt to changes in flood or erosion rates.

Overall the receptor sensitivity is therefore assessed as being moderate.

Impact Magnitude

Around 12.4 ha of natural habitat in the Affected Ecosystems will require some form of clearance during the Construction and Pre-Commissioning Phase. The removal of this area of vegetation (which binds soil particles together and protects the soil surface from wind and rain exposure) will expose bare soils to erosion and/or compaction caused by weather and the movement of heavy machinery and vehicles. The loss of Phaeozem soils, in particular, or damage to their structural composition, could also impact on the ability of ecosystems to regulate water flows.

As such, it is likely that surface water run-off will increase which could in turn increase flood risk. However, the clearance of natural habitat is small relative to the service provision in the surrounding area and a qualitative flood risk assessment was undertaken within the catchment which found that impacts on surface water flows and flood risk are likely to be localised and are not likely to have a measurable impact on the well-being of any beneficiaries.

Construction of the stream crossing at the Graphova Gap could temporarily alter water flows during the works and could potentially result in flood flows being diverted onto the surrounding floodplain. Given the nature of the topography at the crossing site with relatively steep valley sides, any impacts on the flow regime are likely to be local to the crossing. The impacts of the construction works will be temporary and the watercourse will recover through natural processes. Further, it is proposed that any construction activities in the Graphova Gap will be undertaken during dry weather as far as is practicable, when the groundwater levels and surface water flows are expected to be lower.

Vegetation and soil also plays a role in maintaining slope stability and preventing landslides, mud flows, and erosion. Earthmoving activities (including vegetation clearance, construction activities for the facilities, trenching activities for the Pipeline, and road access construction) may cause ground instability due to overloading of slopes and stockpiles of excess spoil waste. This could lead to slope collapse, gravitational slides (including landslides), mass soil movement, ground subsidence, and the formation of slope erosion features.

Depending on the size and nature of the soil loading and potential for subsequent ground movement, this could cause soil stability impacts that may be on-going over several years. Incidents of prolonged and heavy rainfall during the construction period could lead to mudflows which may be exacerbated by soil instability. This could potentially impact the Project itself and beneficiaries in the Local Area.

However, as described in **Chapter 4 Analysis of Alternatives** and **Chapter 5 Project Description**, the design and proposed construction methodology for the landfall facilities and Pipeline route have taken into consideration the potential geohazards, mitigating the risks as far as is practicable and the likelihood of the Project causing any landslide activity that could affect any beneficiaries is low.

Excavation and removal of marine sediment during nearshore dredging could potentially lead to alterations in coastal processes leading to changes in coastal flooding and erosion rates. However, it is considered extremely unlikely that dredging will result in a change in coastal erosion or flooding rates, as the dredging is taking place in water depths which should not change the height of incoming waves i.e. the wave height is not limited by the water depth. If the dredging site were closer to the shore, where the wave climate is significantly influenced by the bathymetry, then it is possible that increasing water depths (dredging) would increase wave heights and thus result in an increase in coastal erosion potential and/or flooding. However, even if this were the case, the change in depth would need to be significant before there was any attributable impact on the coast. As such, any impacts on coastal processes and beach formation / erosion rates or their users are likely to be negligible.

Taken together, it is unlikely that the Project will have any significant impact on the well-being of beneficiaries in terms of increased flood risk or through coastal erosion and flooding. The Project could, however, lead to a destabilisation of soils and land forms within the Affected Ecosystems. While this is unlikely to directly impact any identified beneficiaries, if there are periods of heavy and prolonged rains during construction, the measures taken to reduce impacts on soil stability could fail. This could potentially contribute to the formation of mudslides that may lead to disruption of Project activities, loss of agricultural land, and damage to buildings.

The likelihood of any impacts on beneficiaries' well-being is likely to be low and any potential increase in risk of mud flows or slope instability would be felt periodically following heavy rains. Ecosystem functionality should be fully reversible following the construction period and any impacts in terms of increased instability would extend over several years as soil stability recovers through natural processes.

The impact magnitude is therefore considered to be low (refer to Appendix 17.3 for the scoring against each of the impact magnitude criteria).

Impact Significance

The overall significance of the impact of the Construction and Pre-Commissioning Phase on the well-being of people benefitting from hazard regulating services provided by Affected Ecosystems is assessed as being **Low**. Hazard regulation is therefore not considered to be a priority service during this Phase.

Air Quality Regulation

The service considered in this assessment is the capacity of Affected Ecosystems to regulate air quality. Due to the spatially diffuse nature of air and pollutant concentrations, the air quality regulation service cannot be directly linked to any particular ecosystem or area within it but rather is a cumulative service based on the interactions of multiple ecosystems.

While airborne pollutants can travel for long distances, those generated by Project activities are expected to disperse relatively quickly and to have a limited geographical extent. As such, the geographic scope of the service assessed within this section is the regulation of air quality within a 2 km radius of the Project Area, which is expected to be the greatest distance that any Project impacts could be felt (**Chapter 9 Air Quality**). The key beneficiaries include:

- Residential dwellings, a nursery, and school in Varvarovka;
- Residents and workers (particularly individuals with respiratory illnesses) in areas of Supsekh, Anapa, Rassvet and Gai Kodzor who benefit from clean air;
- The tourism industry (including the Shingari and Don resorts) which benefit from the influx of tourists seeking clean air; and
- People from across the region visiting the Local Area in order to benefit from the perceived health benefits of clean air (Ref. 17.24).

The Project activities which may impact provision of this service include:

- Clearance of vegetation;
- Emissions from offshore and nearshore vessels during pipeline installation;
- Emissions of pollutants from construction activities associated with the landfall section of the Project;
- Dust generation from construction traffic, land clearance, installation of the Project facilities, and installation of the Pipeline; and
- Emissions from road traffic during construction.

Receptor Sensitivity

Beneficiaries are highly dependent on the ability of ecosystems to regulate air quality as poor quality air, where pollutant thresholds are exceeded, is correlated with respiratory illness and death (Ref 17.56). The tourism industry is also dependent on good quality air for its marketing as a health resort. There are some activities which could feasibly be adopted to replace the air quality regulation service currently provided by Affected Ecosystems such as planting additional trees and green roofs (particularly in urban areas) to absorb more pollutants, or reducing pollutant emissions into the air quality regulatory system.

Based on the diffusion tube monitoring results, the ecosystem is considered to be of low vulnerability to changes in air quality, as vegetation cover is high and air quality thresholds within rural areas in the Local Area are not close to being exceeded. The vulnerability of receptors is considered to be moderate as there are significant resources within urban areas available for adapting to any changes in air quality, although there are some rural households and elderly or sick individuals who may be less able to adapt to a change in this service.

The overall receptor sensitivity is therefore considered to be moderate.

Impact Magnitude

Due to the relatively small amounts of pollutants released by the Project and the limited area of vegetation clearance required, the Project is not likely to significantly impact the ability of ecosystems to regulate air quality or lead to any negative impacts on the well-being of any beneficiaries of this service. The results of air quality modelling exercises found that there are unlikely to be any significant impacts on any identified beneficiaries (or any ecosystem functioning) in the area (**Chapter 9 Air Quality**).

The area of forest to be cleared (i.e. Shiblyak, Mesophilic forest, and Juniper woodland habitats) totals 7.6 ha (around 1.4% of the natural forested habitat in the Affected Ecosystems and a much lower percentage of the Local Area), which could lead to a reduction in the capacity of ecosystems to remove up to 114 tonnes of pollutants each year.

Due to the limited extent of this level of habitat clearance and the fact that the pollutant concentrations are generally significantly below threshold levels in rural areas, the magnitude of the impact on beneficiaries' well-being is likely to be negligible (refer to Appendix 17.3 for the scoring against each of the impact magnitude criteria).

Impact Significance

In combination, the total impact significance on the well-being of people benefitting from the air quality regulation service provided by the Affected Ecosystems is considered to be **Not Significant** and air quality regulation is not identified as a priority service.

Water Quality Regulation

The service considered in this section is the capacity of Affected Ecosystems to regulate and maintain marine and fresh water quality. This includes water in Affected Ecosystems in the marine environment and freshwater resources used throughout the Shingar catchment. The key beneficiaries include:

- Local households and private companies within the Shingar catchment who abstract groundwater for drinking and industrial purposes (e.g. MOD and households with wells on properties);
- Users of St. Barbara's Source for its spiritual / healing properties;
- Visitors, residents, and industry in Anapa SPNA dependent upon high water quality; and
- People working in the fishing industry who are in contact with marine water and those consuming the captured fish who benefit from the regulation of health risks.

Further beneficiaries of this service include tourists, recreational users, and the tourism industry who rely on good quality marine water for water sports, bathing, and scuba diving. In order to avoid double counting, impacts on these beneficiaries are assessed in Tourism and Recreation Values.

The specific Project activities that could affect the water quality regulating service include:

- An increase in pollution levels in surface and ground waters during construction activities due to soil disturbance, aerial deposition of dust generated by construction, leaks and spills from vehicles / plant, and waste generation;
- Clearance of terrestrial vegetation which absorbs pollutants and sediment from water resources;
- Disposal of contaminated water into the marine environment after use for hydro-testing, cleaning, and gauging the Pipeline;
- Seabed disturbance and release of sediments into the marine water column as a result of vessel movements, dredging, and Pipeline construction; and
- Reduction in the capacity of marine organisms to filter contaminants from the water due to loss of mussel beds and/or macrophyte strands.

Receptor Sensitivity

The dependence of beneficiaries on water quality is assessed as being high. Contamination of groundwater could have direct impacts on human health for those abstracting water from the environment, while contamination within the marine environment could also impact human health if marine water users come into direct contact with particular pollutants or if contaminants enter the food chain. Further, the Anapa Resort Town is a designated Sanitary Protection Area and the operation of the health industry and mineral water production is dependent on the continued supply of good quality water.

For both fresh and marine waters there are a number of alternatives to the water quality regulation service provided by the natural environment. These include planting new trees or creating wetlands in appropriate locations, chemically treating polluted waters, supporting the growth of biofiltering organisms within the marine environment, or reducing pollutant inputs from other sources. Since these activities are likely to incur relatively high costs, it is considered that there are some alternatives available.

Contaminant concentrations in fresh and saline resources in the Local Area exceed thresholds for a number of pollutants and marine sediments were found to have high concentrations of heavy metal contaminants (**Chapter 8 Soils, Groundwater and Surface Water** and **Chapter 12 Marine Ecology**). The capacity of these resources to assimilate any additional contamination is therefore likely to be limited. However, as noted in Section 17.6.6, actions by Black Sea States to restoring the ecological status of the Black Sea to a condition similar to that of the 1960s, has resulted in a decline in land-based sources of pollution and some improvements in ecological status. There are, nevertheless, still a number of external pressures which could impact the ability of ecosystems to regulate marine and fresh water quality such as climate change, rising water temperatures, and increasing development leading to habitat clearance and pollutant runoff. As such, fresh and saline water resources in the Affected Ecosystems are assessed as being of moderate sensitivity to change.

The sensitivity of beneficiaries of water quality regulating services provided by ecosystems within the Local Area is assessed as being moderate. While companies which abstract water directly (such as the Ministry of Defence) and the health industry within the Anapa Resort Town are likely to be able to access financial, technological, and legislative resources in order to adapt to any changes, groups such as individuals dependent on household wells (e.g. in Sukko) are less likely to be able to adapt to any change in this service.

The receptor sensitivity is therefore assessed as being moderate.

Impact Magnitude

Within the terrestrial environment, the Project could lead to contamination of surface and ground waters from leaks and spills during the construction period. The majority of leaks and spills are likely to be relatively small in volume and the construction drainage systems as outlined in **Chapter 5 Project Description** will collect and manage surface water runoff to reduce contamination risks. While ground and surface water quality could be locally affected, it is expected to recover through natural regulatory processes. Thus, the likely volumes of any spills are unlikely to significantly alter local pollutant concentrations or have significant lasting impacts on the ability of ecosystems to assimilate and regulate water quality.

Wastewater from domestic and industrial sources will be tankered off-site to an appropriate waste treatment facility and the risks associated with accidental release of oil, fuel, concrete and other pollutants will be controlled through appropriate storage, handling, and accident prevention procedures. Health complexes in Anapa Resort Town and St. Barbara's Source are located upstream of the Project Area and are therefore unlikely to be impacted by any possible leaks or spills. As such the impact on beneficiaries is not likely to be significant.

Land clearance including the removal of vegetation, topsoil, hardstanding or existing structures may increase the potential for infiltration of precipitation through the soil, increasing leaching of soil contaminants to groundwater. Increased sediment entering the surface watercourses could result from land clearance, excavation works and erosional processes (particularly on soil stockpiles and on access roads close to gullies until road drainage is established). The eroded sediment may also have a high nutrient or contaminant content which can contribute to the enrichment and contamination of downstream waters. Impacts on surface water quality will typically be of short duration (i.e. during and immediately after a storm event) and for low concentrations of contaminants this will be off-set by natural regulatory processes in the Affected Ecosystems.

Disposal of hydrotest water and leaks or spills could release contaminants into the marine environment and lead to localised changes in water temperature and quality, although this is unlikely to significantly impact the ability of ecosystems to regulate water quality. The principal impact on the capacity of the environment to regulate water quality is likely to come from dredging activities and the resultant dispersal of sediments in the water column. High levels of Total Suspended Solids (TSS) can cause, *inter alia*, reduction in light penetration (leading to reduced photosynthesis), reduction in visual awareness, irritation of sensitive organs (gills), clogging of delicate filter feeding mechanisms, and the potential release of contaminants from disturbance of marine sediments.

Contaminants within the marine environment, such as heavy metals, bind onto sediment and can remain locked up indefinitely. As a result of the dredging process, any contaminants locked in the sediments could be dispersed into the water column which could pose a risk to human health for those using the marine environment for swimming and recreation. These contaminants could also be ingested by benthic organisms which filter seawater for food particles. As this group provides a valuable food source for many commercially important fish species (as well as some species such as sea snails being harvested directly), the contamination released through dredging could lead to uptake by marine life with potential negative impacts on human health in the area. Surveys of marine sediments in the Affected Ecosystems suggest that there are contaminants present which could be disturbed by dredging activities although the extent of disturbance of the seabed is likely to be limited due to the small spatial and temporal scale of the dredging activities required. The limited extent of disturbance and the fact that fish are likely to avoid areas of dredging suggests that the impact on the well-being of any beneficiaries is likely to be low (**Chapter 15 Community Health, Safety and Security**).

The loss of mussel beds and macrophytes due to the laying of the pipelines on the seabed and disturbance during the dredging process could potentially have a permanent, negative impact on the ability of the marine environment to regulate water pollution. However, there is unlikely to be any significant impact on mussel beds or sea grasses as there are none present within the route of the Pipeline. Seaweed beds in shallow water within the Affected Ecosystems will be temporarily impacted by sediment plumes and more distant mussel beds could theoretically be impacted by plumes, although the duration and extent of plumes is limited. According to sediment modelling results, the deposition of sediment on the sea bed will not cause any long range impacts or smothering of such species (**Chapter 12 Marine Ecology**).

The impacts on well-being arising from changes in water quality regulation are therefore likely to be low. Spillages and sediment plumes may occur periodically throughout the construction period and any impacts on beneficiaries are likely to be limited to this period. Impacts are of short duration (e.g. during and immediately after storm events), and the environment would be able to recover relatively rapidly through natural processes.

The overall impact on water quality regulating services is therefore assessed as being of low magnitude (refer to Appendix 17.3 for the scoring against each of the impact magnitude criteria).

Impact Significance

The impacts of the Construction and Pre-Commissioning Phase on the well-being of beneficiaries of the water quality regulation services provided by the Affected Ecosystems are considered to be of **Low** significance and water quality is not considered a priority service.

Soil Quality Regulation

The service considered in this section is the capacity of Affected Ecosystems to regulate and maintain soil quality. The key beneficiaries include:

- Landowners and the agriculture / viticulture industry within and around Affected Ecosystems (including consumers); and
- Workers who interact with soils and benefit from the regulation of health risks.

Further beneficiaries of this service include local residents and businesses who benefit from the soil's capacity to store water and reduce flood risk, as well as people dependent on surface water quality which can be impacted by changes in soils. In order to avoid double counting, impacts on these beneficiaries are assessed under Hazard Regulation and Water Quality Regulation sections respectively.[14]

The Project activities which may impact provision of this service include:

- Increase in concentration of contaminants which could exceed the capacity of soils to regulate quality through leaks and spills and deposition of dust and atmospheric pollutants generated during construction activities;
- Exposure and disturbance of existing areas of contaminated soil which are currently unknown to the Project;
- Increased susceptibility of soil to erosion through clearance of vegetation and excavation works;
- Loss of soils as a natural resource due to hardstanding / development relating to Project;
- Loss of nutrients and soil carbon due to soil excavation and removal of vegetation which contributes to soil composition; and

[14] There is a significant degree of overlap with the soils service and other services such as crops, water quality, and hazard regulation. This is because soil regulation is part supporting service and part final service. In order to untangle the impacts and avoid double counting, any impacts on soils and soil productivity are considered in this section (not in the crops section) and any impacts on the ability of soils to regulate water flows or quality are discussed in the hazard regulation and water quality sections).

- Degradation of soil, physical damage, and compaction through stockpiling of soils during construction.

Receptor Sensitivity

Agrifirm Kavkaz is dependent on the regulation of soil quality for the production of crops and value of uncultivated land as highly degraded soil, which is unable to regulate contaminants through natural processes, is likely to be of lower productivity and of lower value as a potential asset for sale. Workers are also dependent on the soil quality regulation service as disturbance of contaminated soil can lead to adverse health impacts. Taken together, the dependence on this service is considered to be high.

The regulation of soil quality played by ecosystems could potentially be replaced through the treatment of soils to get rid of contaminants, use of fertilisers (which could replace loss of nutrients or organic carbon), import of good quality soils from other regions, or through the purchase of good quality agricultural land elsewhere, although the costs of some of these measures may be high. As such, there are some alternatives considered available for this service.

The baseline data suggests that while soils are typically of good quality there are areas of elevated concentrations of particular substances which could be due to natural or manmade causes. Growing use of agrochemicals, motor vehicles, and air borne particles could increase pressure on soil quality regulation in future. While soils used for agricultural purpose are resilient to disturbance, Phaoezem soils are structurally prone to compaction or erosion, and to contamination through surface spills. As such, the sensitivity of the ecosystem to change is considered to be moderate.

Agrifirm Kavkaz is considered to be of moderate vulnerability to a change in provision of this ecosystem service as reductions in soil quality and the on-going ability of soil ecosystems to regulate contaminants could reduce the potential use and potential value of their landholdings. Workers are also likely to be vulnerable to changes in soil quality regulation although they are likely to be able to mitigate such changes through the adoption of adequate health and safety procedures and protective clothing which should be provided by their employers. Overall, the sensitivity of human receptors to changes in this service is considered to be moderate.

The overall receptor sensitivity is therefore considered moderate.

Impact Magnitude

The potential impact of the Project on the well-being of beneficiaries is considered to be high since the potential for contamination of soils which exceeds the assimilative capacity of ecosystems present could have lasting impacts on the quality of soil with subsequent impacts on human health and livelihoods.

Contamination of the soil may result through accidental leaks or spills during construction (e.g. during refuelling or waste handling). Potential pollutants include fuels, lubricants, cement, concrete, grout and slurry additives, and metals. Further risks of contamination arise through the potential for leakage during hydro-testing. Hydro-test water may contain high concentrations of suspended sediment including metal particulates. Other contaminants such as hydrocarbons may also be present. Depending on the location of the leaks, this may permit test water to infiltrate through the soil, potentially influencing soil quality.

The Project could also disturb currently unidentified, localised pockets of soil contamination related to past land use or illegal dumping, although it is considered that the likelihood of encountering unidentified contamination is relatively low given the current land use.

Contaminated soil may affect workers through being inadvertently ingested or inhaled or through dermal contact and could have lasting impacts on the health of anyone exposed to soil contamination. Contamination of soil resources could also lead to reduced land values for Agrifirm Kavkaz if the long term productivity of soil is reduced. Further, if contamination from the Project impacts soil quality and the subsequent crops grown on that land are also contaminated, then there could potentially be human health risks due to the presence of contaminants in the food chain.

The removal of vegetation (which previously bound soil particles together and protected the soil surface from wind and rain exposure) will expose bare soils to erosion and/or compaction by the movement of heavy machinery and vehicles. The release of soil particles into surface watercourses and general migration down slopes could occur as a result of erosional processes. Earthworks and stockpiling of soils can lead to the mixing of different soil types, and also the changing of the soil structure. Such mixing can influence soil type and structure, which may influence ecosystems or agricultural usage. Similarly, mixing of excavated soil types can result in the contamination of previously clean soils by contaminated soils.

The impact of the Project on beneficiaries of the soil quality regulation service is long-term, with any contamination or impact on the structure of the soil occurring during the construction period likely to affect the current generation of users in terms of lower productivity, reduced ecosystem functioning, and increased health risk. Following the construction period, the ecosystem is expected to be able to recover from any impacts at natural recovery rates although for certain contaminants (such as heavy metals) or for significant structural damage, this could take significant periods of time. Impacts on soil quality are likely to be periodic, accidental events resulting from particular activities such as excavation works, vegetation clearance, and occasional spills or contamination events.

The overall impact magnitude is therefore considered moderate (refer to Appendix 17.3 for the scoring against each of the impact magnitude criteria).

Impact Significance

As such, the impact significance on the well-being of beneficiaries of the soil quality regulation service provided by Affected Ecosystems is therefore judged to be **Moderate** and soil quality regulation is identified as a priority service.

Tourism and Recreation Values

The service considered in this section is the enjoyment of natural features in the Affected Ecosystems and activities provided by the natural environment or any livelihoods derived from such services. The key beneficiaries include:

- Users of the Mountains of the Caucaus trail and horse riding trails;
- People using Sukko beach and the surrounding marine environment for activities such as sun bathing, swimming, yachting, scuba diving etc.;
- Visitors to the Shingari and Don holiday complexes; and
- Tourism operators and their employees operating in the Local Area who may depend on tourism for their livelihoods including dive operators, horse riding operations, and holiday complexes.

The specific Project activities that could affect these services during the Construction and Pre-Commissioning Phase include:

- Noise and visual disturbance during construction activities;
- Reduced access to sites used for recreation such as horse riding trails or areas of marine space used for yachting and swimming;
- Reductions in marine water quality which could impact on bathing activities, water sports, and scuba diving etc.;
- Impacts on marine ecology such as loss of mussels and other benthic species which contribute to beach formation or disturbance to species of importance for scuba diving; and
- Impacts on beach formation due to dredging activities and changes in coastal erosion and deposition rates (impacts on coastal processes are assessed under Hazard Regulation earlier in this section).

Receptor Sensitivity

Tourism makes an important contribution to the economy of the Local Area, with up to 4.5 million visitors travelling to ART each year. The designation of Anapa as a resort town recognises its national importance as a place for tourism. Further, a number of smaller scale tourist organisations are dependent on income from tourists visiting ecosystems in the area including the owners of the Shingari and Don complexes. As such, dependency on this service is considered to be high and, while there are alternative tourist destinations, few are considered to offer equivalent benefits as the ART area.

Many of the tourism and recreation opportunities provided within the Local Area are ecosystem based, including hiking along the Mountains of Caucasus trail, horse riding, bathing, beach-based recreation, water sports, and scuba diving. As such, it is considered that tourism is highly sensitive to changes in the quality of the natural environment in terms of both levels of enjoyment (by visitors and recreationalists) and income and employment generated by visitors to ART.

The receptor sensitivity for tourism and recreation services is therefore considered to be high.

Impact Magnitude

There are four potential Project impacts which could affect the ability of beneficiaries to enjoy recreation or derive livelihoods from this service: noise and visual disturbance; loss of access to recreational resources; declines in water quality; and impacts on marine ecology.

The presence of pipe laying vessels and other construction vessels may give rise to adverse visual and noise impacts on recreational users of beaches, hiking trails, and the sea. This could temporarily reduce the enjoyment of the Affected Ecosystems by visitors and could potentially reduce customer numbers for certain businesses leading to impacts on livelihoods.

The beneficiaries of most concern with respect to these impacts are visitors to, and owners of, the Shingari and Don holiday complexes, as well as visitors to the Sukko public beach. Consultation with owners of the Shingari resort revealed that they are particularly concerned about the impacts of construction activities on noise and sea water quality as swimming and other water based activities form a key component of the leisure opportunities offered at the resort.

As set out in **Chapter 10 Noise and Vibration**, noise modelling suggests there will be a residual impact of Low significance on the Shingari and Don resorts during Pre-Commissioning associated with cleaning, gauging, and drying of the pipelines. The impact is temporary and is expected to last for around 20 days. **Chapter 13 Landscape and Visual Assessment** identifies a moderate adverse residual visual impact on these beneficiaries during construction. The visual impact assessment states that the impact will be temporary and short term as the marine construction vessels, and in particular the pipe laying vessel, will only be highly visible to visitors at Shingari and Don holiday complexes for a few days (or a week at most) during the construction of each pipeline. The four pipelines are to be laid as quickly as possible over a period of approximately 15 months commencing in Q1 2015. Visual disturbance will be likely to occur on a single occasion during the main summer peak period when occupancy of the holiday complexes would be at its highest. Following construction the impact will cease. Disturbance from the Project will therefore be temporary and is unlikely to prevent anybody from undertaking recreational activities in the Affected Ecosystems. As such, it is considered that the magnitude of impact on the Shingari and Don holiday complexes will be low.

While the magnitude of any impact is considered likely to be low, visual impacts on beach users could potentially impact on the business revenues of the Shingari and Don Holiday complexes if guests are deterred from staying. This will depend on the timing of the construction work, particularly in the nearshore section closest to the holiday complexes, and the perceptions and reactions of guests. Impacts could therefore last beyond the Construction and Pre-Commissioning Phase of the Project if guests do not return or provide negative feedback to others.

For users of Sukko beach, marine construction vessels, and in particular the pipe laying vessel, will be highly visible for a few days (or a week at most) during the construction of each pipeline. The four pipelines are to be laid as quickly as possible over a period of approximately 15 months commencing in Q1 2015. As such, the impact will be likely to occur on a single occasion during the main summer peak period, when usage of the beach would be highest. Following construction, the impact will cease and beach users will not experience any impacts in relation to the operation of the Pipeline. As such, amenity-related visual impacts are temporary and unlikely to compromise beach users' ability to enjoy recreational activities such as swimming, playing, sunbathing etc. Therefore, any impacts on the well-being of beneficiaries are likely to be of low magnitude.

There is a potentially significant adverse visual impact on users of the Mountain of the Caucasus Trail which runs along the top of the cliff and affords users clear views out to sea. However, these impacts are likely to be temporary and aside from a changed visual outlook, there will be no other impact on users' enjoyment of, or access to, the trail. The extent of the impacts, in terms of the number of people affected, would be low given the relatively low usage of the trail.

In addition to noise and visual disturbance, the Project may restrict access to certain recreational activities in the marine and terrestrial Affected Ecosystems. In the marine environment, safety exclusion zones will be created in order to avoid impacts on recreational water users. While there could potentially be an adverse impact on sailing activities, it is considered that recreational sailors will not be impacted by the Project given their ability to easily navigate around the vessel spread during construction of the nearshore and offshore sections. There is one dive site (the Gordipiya barge, a sunken wooden shipwreck which has become an artificial reef) located close to the nearshore section of the Project although the site lies outside of the safety exclusion zone and access will not be restricted (Figure 17.13).

In the terrestrial environment, impacts on horse riding operations could be more significant as, in addition to visual disturbance, the operator may lose access to horse riding trails (or at least parts of them) during the Construction Phase which could impact on their business. While the exact details of the riding route have not yet been identified, if it crosses the Pipeline route, the business will not be able to use that route during the period of construction of the Pipeline and the owner will need to find a suitable replacement riding route. However, until the current route is confirmed, it is not possible to assess what impact the Project may have on this business.

A further potential impact is a decline in marine water quality due to sediment dispersal during the dredging process which could potentially impact on the Shingari and Don resorts, recreational water users, and scuba diving operations. The results of sediment modelling studies undertaken for the ESIA found that sediment is dispersed from each proposed dredging and disposal operation, a process that lasts 1.3 days per pipeline operation (Appendix 12.2 Sediment Dispersion Study).

Dredging activity could potentially affect the quality of the water at the beach in front of the Shingari complex for short periods of time under certain conditions depending on the prevailing currents and the level of sediment suspension in the water. However, modelling indicates that even in a worst case scenario, any sediment plume impact on the beach will be minor and concentrated in one area for 3 to 5 days per pipeline. Taking these factors into account, the magnitude of impact on visitors to and owners of the resort are likely to be low.

There is a potential risk to scuba dive operators if sediment dispersal reduces seawater quality and clarity at diving spots used by diving tour operator businesses off the coast from Sukko. However, the extent of sediment blooms are likely to be small and of short duration (a matter of days). Alternative dive sites are also available and, as such, the significance of any impacts on divers and dive operators are likely to be low and easily avoidable.

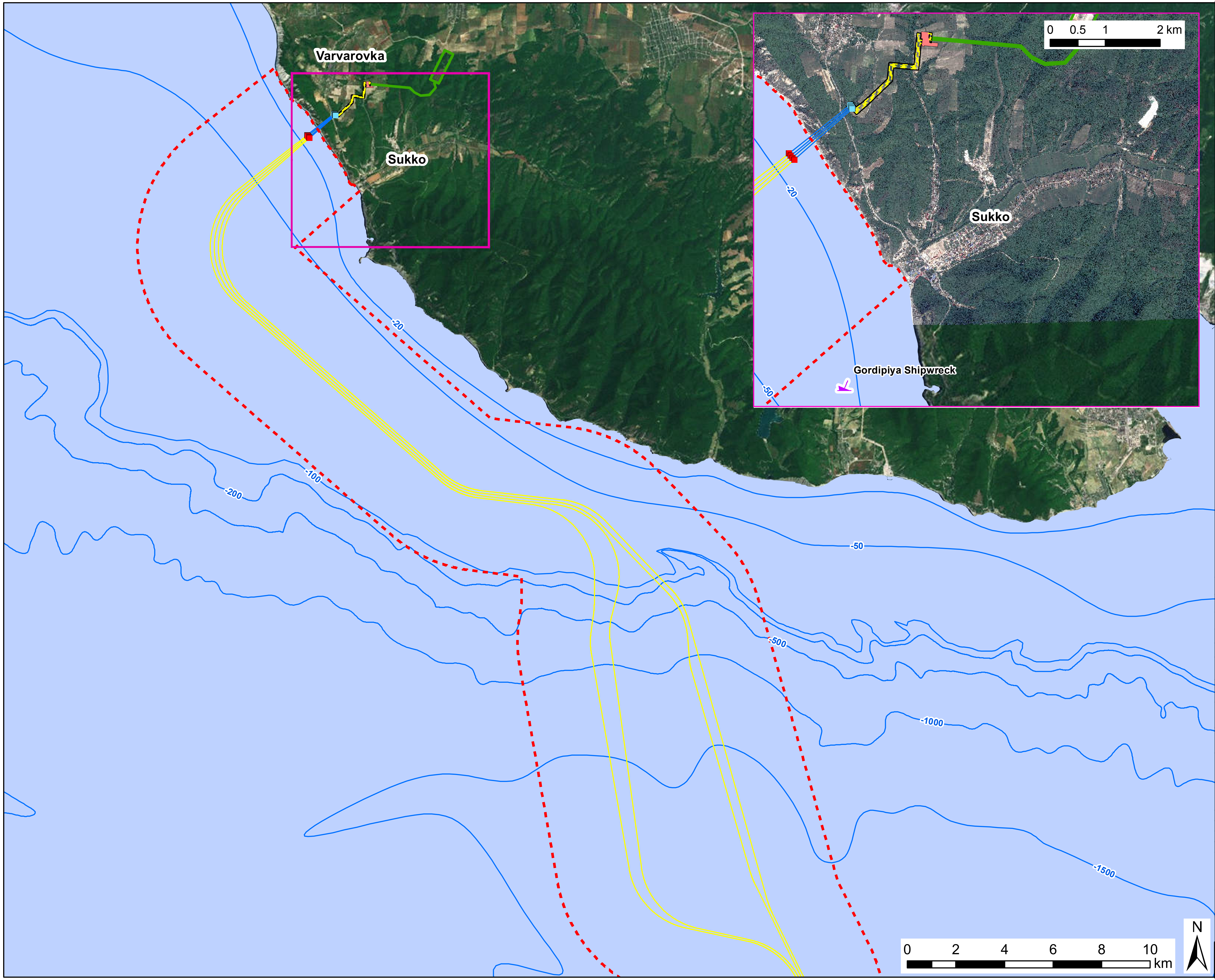
The quality of diving conditions is also dependent upon the range of marine species present although **Chapter 12 Marine Ecology** indicates the significance of Project impacts upon marine species is generally low and temporary. As such the impact on the well-being of divers is not likely to be significant. Impacts on mussel and other benthic species are likely to be limited and there is unlikely to be any resulting change in beach formation rates.

Taken together, the impacts of the Project on the well-being of beneficiaries of the tourism and recreation services are likely to be low, as it is unlikely that any activities or uses will be prevented. However, there is potential for some loss of well-being and livelihoods for visitors to and owners of the Shingari and Don holiday complexes, the horse riding operator in Varvarovka, visitors to Sukko beach, and users of the hiking trail. The impacts are expected to occur for short periods during the Construction and Pre-Commissioning Phase whereafter the Affected Ecosystems are expected to recover completely in a short period of time (as impacts are primarily visual disturbance and reduced access). The beneficiaries will be affected periodically by discrete activities during the Construction and Pre-Commissioning Phase.

The overall impact magnitude is therefore considered to be low (refer to Appendix 17.3 for the scoring against each of the impact magnitude criteria).

Impact Significance

The overall significance of the impact of the Construction and Pre-Commissioning Phase is considered to be **Moderate** and tourism and recreation services are identified as a priority service.



LEGEND

- Approximate 3km offshore construction safety exclusion zone
- Shipwreck diving site (plotted based on approximate location coordinates N 44°46 'E 37°22')

Russian Sector of South Stream Offshore Pipeline

- Proposed landfall section pipelines
- Landfall facilities
- Proposed microtunnels
- Right-of-Way
- Proposed offshore pipelines
- Microtunnel entry shaft
- Microtunnel exit pit

United Gas Supply System

- Russkaya compressor station
- United Gas Supply System pipelines
- Isobaths

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue
For Information

Client
South Stream Offshore Pipeline — ENERGISING EUROPE

Project Title
SOUTH STREAM OFFSHORE PIPELINE

Drawing Title
LOCATION OF DIVE SITE CLOSEST TO THE SAFETY EXCLUSION ZONE OF THE PROJECT

Drawn	Checked	Approved	Date
DH	RW	MW	05 Mar 2014

URS Internal Project No.	Scale @ A3
46369082	1:150,000

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Drawing Number
Figure 17.13

Rev

Plot Date: 05 Mar 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA\Chapter 15 Ecosystem Services\Figure 15.13 Location of Dive Site Closest to the Safety Exclusion Zone of the Project.mxd

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Cultural and Spiritual Values

The services considered in this section are the cultural and spiritual values provided by, or dependent upon, Affected Ecosystems. The key beneficiaries of this service are therefore:

- Local and regional visitors to the Varvarovka cemetery; and
- Local residents and visitors who benefit from the cultural and aesthetic qualities of the landscape, its history and identity as an area of agricultural production, and its situation adjacent to the Black Sea.

Additional beneficiaries of this service include visitors to memorials and religious sites such as St. Barbara's Source and the festival at the khachkar, although there are no identified Project activities which may impact on the ability of beneficiaries to access or use these services.

Wider beneficiaries could also include the national and global scientific community who may be interested in terrestrial and marine archaeological sites. **Chapter 16 Cultural Heritage** identified a number of archaeological resources which could be impacted by the Project, including: a burial mound, a submerged aircraft wing, a ceramic amphora, and a wooden shipwreck.

However, the sites do not presently have any strong or special significance for any particular community or cultural group for social, cultural, or spiritual reasons. The sites of cultural or archaeological heritage identified are not sacred sites and are not the focus of traditional beliefs and ceremonies, mainstream religious practices, secular pilgrimage, or cultural identity. As such, the value of the sites that may be disturbed is considered to be principally historic and scientific, rather than of aesthetic, community / social or spiritual value for present or future generations. A full discussion of the Project's impact on these sites is provided in **Chapter 16 Cultural Heritage**.

Therefore, the assessment focuses on potential impacts on visitors to the Varvarovka cemetery and residents of the Local Area who value the cultural and aesthetic nature of the landscape.

The Project activities which may impact provision of this service include:

- Damage to the environmental setting of the Local Area and particular sites through vegetation clearance, noise pollution, and visual disturbance; and
- Loss of tranquility and disturbance to cemetery visitors through increased construction related traffic and visual disturbance.

Receptor Sensitivity

While local and regional populations are not likely to be dependent on cultural services for their livelihoods or income, they may nevertheless value them and derive spiritual and cultural gratification. Within the area the agricultural and coastal landscape has an important aesthetic value and plays a role in the cultural identity of local communities. Further, relatives of those buried in the Varvarovka cemetery are likely to be highly dependent on this service in terms of their ability to remember and pay respects to the deceased.

The aesthetic and cultural identity of a landscape and the populations living within it cannot be replaced through construction or engineering. Likewise, there are no alternative sites for visitors to the Varvarovka cemetery where they can visit their deceased relatives and, while it may be possible to relocate the cemetery, it would entail significant social and economic costs. As such, it is considered that there are no alternatives to this service.

The environmental setting of cultural sites is considered of low sensitivity to change since habitat is well replicated in the area and, although ecosystems may be vulnerable to direct impacts such as land and vegetation clearance, they are not likely to be particularly vulnerable to more indirect changes such as climate change, population growth, changing water availability or temperature etc.

Local populations are likely to be sensitive to significant changes in the nature of the landscape although will be less sensitive to small changes due to the extent of natural habitat and its ability to absorb visual impacts. Visitors to the cemetery, on the other hand are likely to be highly sensitive to change spiritual services are strongly linked to the nature of the environmental setting.

In sum, the receptor sensitivity for cultural and spiritual services is considered to be high.

Impact Magnitude

Any development which requires vegetation clearance within a landscape with cultural and aesthetic value to local populations will have an impact on the aesthetics and identity of the area. However, the relatively small extent of natural habitat loss and productive agricultural land which will be cleared by the Project (Table 17.13 and Table 17.14), together with the use of microtunneling which means that most of the cleared land can be replanted following construction, mean that it is unlikely the Project will significantly change the character of the landscape or the nature of the Local Area as a productive agricultural region (**Chapter 13 Landscape and Visual Assessment**). As such, the Project is unlikely to have a significant impact on the cultural value of the landscape and is unlikely to lead to a significant change in the well-being of any beneficiaries of this service.

In addition to general landscape impacts, there may be a localised increase in noise and visual intrusion to the environment surrounding the Russian Orthodox and Armenian cemetery at Varvarovka. Visitors to the cemetery are likely to value and also place importance on the surrounding environment, and any disturbance of tranquillity to users could have an impact on well-being during construction activities.

Chapter 10 Noise and Vibration finds the impacts in terms of noise and vibration on the cemetery to be negligible, however, **Chapter 13 Landscape and Visual Assessment** finds an impact of moderate magnitude due to views of the construction activities and use of the access road along the northern and eastern boundaries of the cemetery. While there is likely to be a degree of visual intrusion into the environment surrounding the cemetery it will be temporary and the extent of disturbance is not likely to prevent visitors from using the site or being able to pay their respects.

Impacts on the well-being of beneficiaries of cultural services are therefore likely to be low and any disturbance is likely to be felt periodically throughout the duration of the Construction period. The ecosystems themselves are likely to be able recover naturally within the short term from such disturbance.

In sum, the impact magnitude for cultural and spiritual services is considered to be low (refer to Appendix 17.3 for the scoring against each of the impact magnitude criteria).

Impact Significance

In combination, the total impact significance on the cultural and spiritual values ecosystem service is therefore judged to be **Moderate** and cultural and spiritual services are identified as a priority service.

Wild Species Diversity

The service considered in this section is the diversity of locally, regionally, nationally, or globally important species which live within, or are dependent upon, Affected Ecosystems. The beneficiaries include:

- Any communities within the Local Area, wider region, nation, or global area who value and appreciate the existence and diversity of species living within or dependent upon Affected Ecosystems.

The Project activities which may impact provision of this service include:

- Loss and fragmentation of terrestrial habitat resulting from vegetation clearance during soil stripping and land clearance;
- Killing, injury, and disturbance of individual terrestrial species during site preparation and construction as well as noise and vibration emissions from vehicles, plant, and construction activities;
- Introduction of non-native species to the terrestrial environment;
- Impacts on aquatic life through vessel and welding wastes, cooling water discharge, proximity of vessels, and use of lighting;
- Impacts on benthic communities from seabed disturbing activities including surveys and inspections, obstacle removal ("*pre-sweeping*"), dredging, pipe-laying, post-lay trenching, rock placement / seabed intervention, and anchoring;
- Disturbance to seabirds through vessel movements during mobilisation, surveying and pipe-laying activities, displacement or loss of prey in the nearshore area, and mortality due to bird strikes on highly illuminated offshore installations; and
- Disturbance to marine mammals through surveying and pipe-laying activities, cooling water discharges, displacement of food resources, noise and collisions from vessel movements and use of dynamic positioning.

Receptor Sensitivity

Beneficiaries of wild species diversity (i.e. those who value the existence of wild species) are considered to be of moderate dependence on the service. While there were no beneficiaries identified as being dependent on any species for livelihoods or income, the high level of concern about impacts on wild species raised during consultation, together with the presence of critically endangered species of global conservation significance, suggest that this is an important service to beneficiaries and one on which welfare depends to a moderate extent.

The ecological role of a particular species could potentially be replaced by others although the existence value of that species cannot. Therefore, there are no replacements available to individual species. If a species is lost from an area it could be reintroduced from other areas although there are significant costs associated with such processes and a successful reintroduction can be difficult to achieve.

Due to the identification of Critical Habitat within the Affected Ecosystems and presence of the critically endangered Nikolski's tortoise in the terrestrial environment the ecosystem sensitivity is considered to be high, although the receptor sensitivity is considered low due to the widespread national and international financial and legislative resources available to adapt to any changes.

In sum, the receptor sensitivity for the wild species diversity service is considered to be high.

Impact Magnitude

There are a total of ten habitat types falling within the terrestrial Affected Ecosystems, five of which will require an area of habitat loss. Table 17.14 lists these habitats and the area of each habitat falling within the Affected Ecosystems which will be cleared or which have already been cleared to facilitate the geotechnical surveys undertaken in 2012 (**Chapter 11 Terrestrial Ecology**).

Table 17.14 Habitat Clearance in the Terrestrial Affected Ecosystems

Habitat Type	Area of Habitat Within the Affected Ecosystems (ha)	Area of Habitat Within the Affected Ecosystems already lost (ha)	Area of Habitat Within the Affected Ecosystems subject to loss (ha)
Shiblyak	426	0.39 (0.09%)	3.6 (0.8%)
Mesophilic forest	63	0	1.4 (2.2%)
Juniper woodlands	56	0.32 (0.6%)	2.6 (4.6%)
Tomillyar	7	0.03 (0.4%)	0
Steppefied secondary meadow*	110	0	4.1 (3.7%)
Mesophilic meadow	10	0	0
Rocky outcrops	8	0	0
Coastal shingle	3	0	0

Continued…

Habitat Type	Area of Habitat Within the Affected Ecosystems (ha)	Area of Habitat Within the Affected Ecosystems already lost (ha)	Area of Habitat Within the Affected Ecosystems subject to loss (ha)
Urban and Agricultural habitats*	239	0	59 (24.7%)
Running water	2	0	0

*Modified habitats

Complete.

As set out in Table 17.14, the Project requires clearance of Critical Habitat (Mesophilic forest and Tomillyar) and habitat which has important local values (Juniper woodlands). However, the extent of habitat clearance relative to the surrounding area is relatively small scale and is unlikely to have long term impacts on the nature or population viability of the habitats to be cleared. As such, the impact on beneficiaries is likely to be low.

In the absence of appropriate design controls, there is the potential for the introduction of invasive fauna and flora during construction. Although of a relatively low probability, introduction of invasive species has the potential to significantly alter the ecology of natural habitats and affect their overall integrity in the long term.

With regards to fauna species, the greatest impacts within the terrestrial Affected Ecosystems are likely to occur due to the removal of mesophilic and shiblyak woodland which provide habitats for nesting birds and reptiles. Of particular concern are potential impacts on Nikolski's tortoise which is known to occur within the Affected Ecosystems.

These habitats, together with juniper woodland and secondary steppefied meadow, are of particular importance to the tortoise during the active period for foraging, shelter, breeding and hibernation and have the potential to support significant numbers of Nikolski's tortoise. Local populations of this species are of important conservation significance to this species and construction activities may lead to disturbance and direct mortality of the species. Further impacts on this species could occur through loss and fragmentation of habitat (due to road construction), soil excavation which may impact hibernating and reproduction, or direct mortality through construction activities and are likely to be of significance to the global conservation community.

The marine Affected Ecosystems lie within Tier 2 critical habitat, which was identified according to IFC criteria for endangered, migratory, and congregatory species for certain pelagic fish, seabirds, and cetaceans. While the Project is unlikely to have any significant impact on this habitat, there may be some disturbance to particular species during construction activities. In particular, vessel movements during mobilisation, surveying and pipe-laying activities have the potential to temporarily disturb marine mammals which are of value to people in the region. However, these are highly mobile animals with acute sensory perception and are generally able to avoid areas of disturbance and only a few individuals are likely to be affected, if any. As such, there are unlikely to be any threats to the population of cetacean species or any significant impacts on the well-being of beneficiaries who value these species.

There may also be some temporary disturbance to fish and bird species although they are likely to be of low significance. The tub gurnard, which may be of importance in the Local Area, faces some risk due to potential loss of food and habitat in excavated areas, however, there are unlikely to be any significant impacts on populations or their beneficiaries.

Taken together, the small extent of habitat required for the Project and the nature of the construction activities are unlikely to have a significant impact on the long term viability of populations of any of the species in the area. As such the impact on well-being is expected to be low. However, the length of impact on beneficiaries of the service (such as through clearance of valued habitat) is likely to extend across the current human generation who value species diversity in the affected area.

Populations are likely to recover from any noise, disturbance, or collision damage following the construction period, however, loss of terrestrial habitat or introduction of any species which become successfully established could have longer lasting impacts on the ability of species to feed and reproduce, which could have long term impacts on population structures. The risks and disturbance to species (and therefore the impact on beneficiaries) are likely to occur regularly throughout the construction period.

In sum, the impact magnitude on the wild species service is considered to be moderate (see Appendix 17.3 for the scoring against each of the impact magnitude criteria).

Impact Significance

In combination, the total impact significance on the wild species diversity ecosystem service is therefore judged to be **High** and is identified as a priority service.

17.7.2.3 Mitigation and Monitoring

Based on the results of the impact assessment (see Appendix 17.3 for a detailed summary of the scoring assigned to each ecosystem service), five ecosystem services were identified as priority services which are likely to be significantly impacted during the Construction and Pre-Commissioning Phases of the Project and which will require further mitigation:

- Crops;
- Soil quality regulation;
- Tourism and recreation values;
- Cultural and spiritual values; and
- Wild species diversity.

In accordance with Good International Industry Practice, the Project will strive to avoid and then to minimise impacts as far as possible through design before undertaking mitigation measures. Design controls aimed at achieving this goal are summarised in the description of relevant Project design controls set out in **Chapter 5 Project Description**.

Where impacts cannot be avoided through design, appropriate mitigation measures for each of the adverse environmental and social impacts identified are discussed in detail in the relevant technical chapters. For the priority services identified, the measures implemented by the Project have the additional goal of maintaining (or restoring where they have been damaged or degraded) the value and functionality of these services for beneficiaries over the short and long-term.

Due to the cross-cutting nature of ecosystem services, mitigation of impacts on these services will be captured under a range of Construction Management Plans (CMPs) in the Health, Safety, Security and Environmental Integrated Management System (**Chapter 22 Environmental and Social Management**).

General Mitigation Measures

A number of General Mitigation measures will be adopted by South Stream to address adverse impacts where appropriate. These include:

- A Grievance Procedure which will be implemented by South Stream Transport in partnership with its contractors and will ensure that grievances are brought to the attention of the appropriate Project staff and addressed in an appropriate and timely way, following a standard procedure of investigation, analysis, and resolution. It will also ensure that resolutions are documented and communicated to the appropriate stakeholders;
- A Compensation Management Framework to guide the evaluation and determination of compensation measures. The Compensation Management Framework will capture the process and requirements for assessing compensation claims and implementing compensation measures;
- A Livelihood Restoration Framework to provide for the possibility that livelihood impacts do occur. This Framework will define the process that will be undertaken to identify the need for specific livelihood restoration measures, and the development of these measures in consultation with affected stakeholders and relevant local agencies. The overall goal will be to ensure that affected livelihoods are restored, at minimum, to pre-impact levels;
- On-going Stakeholder Consultation throughout the Construction and Pre-Commissioning Phase. These engagement activities will be designed to facilitate dialogue with relevant stakeholders, including those potentially affected by the Project, or who are concerned about or interested in the Project. These activities will allow potential impacts, issues and concerns to be identified early on and addressed in an expedient manner. These activities will also inform stakeholders of upcoming construction activities, as well as Project Activities that have been completed, and provide advance warning of any anticipated changes; and
- A Community Investment Plan to guide community investment initiatives and opportunities for the Project.

Further details on these measures are set out in **Chapter 14 Socio-Economics**.

In addition to applying these General Mitigation measures where appropriate, a number of specific measures will be adopted to address impacts on ecosystem services and their beneficiaries where required. The full range of mitigation measures for each priority service is set out below.

Crops

The Project was identified as having an impact of moderate significance on provision and use of this service due to potential economic displacement of workers employed by Agrifirm Kavkaz.

Measures to avoid impacts on land use and vegetation clearance are set out in **Chapter 5 Project Description.** However, it is not possible to avoid all impacts on this service as an area of productive agricultural land will need to be cleared to allow construction of the Project.

While it is unlikely that the clearance of agricultural land will lead to any on-going displacement of workers, there could potentially be limited, temporary displacement during construction activities. As such, the General Measures at the start of this section, Section 17.7.2.3, will apply as appropriate.

In addition, after construction, all land that is not required for permanent above ground infrastructure in the Operational Phase will be reinstated to a state as near to the original condition as possible or to a form in keeping with the surrounding topography where this is not precluded by risk to integrity of the Pipeline or erosion considerations. All necessary actions will be applied to ensure that reinstated land can function, at minimum, as productively as that prior to land acquisition.

Residual Impact

While it is unlikely that there will be any displacement of workers, the Grievance Procedure, Livelihood Restoration Framework, Land Acquisition Policy, and Compensation Management Framework are in place to ensure that there are no lasting impacts on the wellbeing of any workers if displacement does occur. These policies will compensate for any impacts on livelihoods.

The small extent of agricultural land clearance together with the development and implementation of a LRF mean that there are unlikely to be any significant residual impacts on workers employed by Agrifirm Kavkaz, although it is not certain at this stage. As such, while the impact magnitude with mitigation in place is likely to be reduced to negligible, it is considered that the overall residual impact is of **Low** significance.

Soil Quality Regulation

The impact on soil quality was assessed as being of moderate significance. The primary impacts with respect to beneficiaries are likely to be in terms of potential contamination of soils or disturbance of existing areas of contamination which could lead to human health risks, and structural damage to soils which could lead to lower soil productivity and impairment of natural ecosystem functioning. Mitigation measures for these impacts are set out below.

Human Health Risk

The main risks of soil contamination can be avoided by adopting the mitigation measures set out in **Chapter 8 Soils, Groundwater and Surface Water**. While it is unlikely that contamination risks can be avoided completely, development of a Spill Prevention and Response Plan for early identification and disposal of contamination should minimise any remaining risk.

In addition, in order to reduce the risk of disturbing existing areas of contamination a contingency plan will be developed in the ESMP to deal with encountering soil contamination not identified during the pre-construction studies. In the event that previously unidentified contamination is observed during construction, the plan will set out that works in the affected area will cease and appropriate mitigation measures will be designed.

Following these mitigation measures there may be potential risks to workers on the Project who are in contact with soil if contamination is identified. Workers will therefore be given access to the necessary safety equipment as well as full health and safety training in accordance with the Health and Safety Plan.

Structural Damage to Soils

A number of measures are also set out in **Chapter 8 Soils, Groundwater and Surface Water** to minimise structural impacts on soils including careful management of the topsoil to be displaced during construction as well as replanting of native vegetation which will help to maintain the structural and ecological integrity of the soil.

Residual Impact

With the mitigation measures set out above, the risks to the health of workers and structural composition of the soil should be reduced to negligible. As such, the magnitude of impacts with mitigation is considered to be negligible and the overall residual impact is therefore **Not Significant**.

Tourism and Recreational Values

The impact significance of the Project on tourism and recreation values was assessed as moderate. The principal impacts on beneficiaries are likely to be in terms of disruption to users and owners of the Shingari and Don resorts due to visual impact; disruption to users of Sukko beach and the surrounding marine environment; and potential disruption of horse riding operations.

Design controls are set out in **Chapter 5 Project Description** to avoid impacts on this service although it is unlikely that adverse impacts on beneficiaries can be avoided altogether. Measures to minimise unavoidable impacts and compensate beneficiaries where necessary are set out below.

Disturbance to Shingari and Don Resorts

The General Measures at the start of this section, Section 17.7.2.3, will apply as appropriate. In addition:

- Plans indicating the Pipeline route and construction phase vessel spread along with timing of construction activities will be provided to the relevant authorities for distribution to local businesses as appropriate, including Shingari and Don holiday complexes;
- For visual impacts that have not been avoided through design controls, **Chapter 13 Landscape and Visual** has set out mitigation measures to mitigate visual impacts. Specifically, to mitigate impacts on recreational visitors to the seashore, including the public

beaches at Sukko and Anapa, and the private beach at the Shingari and Don holiday complexes, mitigation includes: phasing construction where practicable; avoidance of night-time construction activities as far as practicable; and directional shielding for lighting on vessels, other than navigational lights on vessels; and

- **Chapter 12 Marine Ecology** sets out measures to prevent sedimentation impacts on recreational water users along the coast line.

Disturbance to Users of Sukko Beach and the Surrounding Marine Environment

The General Measures at the start of this section, Section 17.7.2.3, will apply as appropriate. Specific to recreational beach users, the Project will provide regular updates to beach users regarding construction activities and schedule, both on land and at sea. Updates and information provided to beach users will also include information about how interested parties can contact South Stream Transport with questions, concerns or complaints.

As set out in respect to the potential for reduced business revenues on Shingari and Don holiday complexes and the Anapa Resort Town tourism sector, **Chapter 13 Landscape and Visual** has set out mitigation measures to mitigate visual impacts. Likewise, **Chapter 12 Marine Ecology** also sets out measures to prevent sedimentation impacts on recreational water users along the coast line.

Impacts on Horse Riding Operations

The General Measures at the start of this section, Section 17.7.2.3, will apply as appropriate. In addition:

- The Project will work with the Varvarovka Horse Riding Business to undertake further investigation to check the horse riding route prior to construction to understand whether or not there may be an impact on the horse riding business if the route is not usable during the construction period and, if so, whether mitigation is required; and
- If access to all or part of the horse riding route is restricted or severed by the Project, South Stream Transport will work with the business owner to identify a suitable alternative. Whether or not an alternative can be found, the Compensation Management Framework and Livelihood Restoration Framework will also apply in the event that impacts on business revenues are evident. South Stream Transport will also engage with the stakeholder prior to and throughout the Construction and Pre-Commissioning Phase to ensure that the stakeholder is informed of Project activities and restrictions, and to understand any concerns the stakeholder may have. The Grievance Procedure will also apply to any complaints related to horse riding and related business impacts.

Residual Impact

The mitigation measures set out above are expected to reduce the significance of any impacts on the Don and Shingari resorts to negligible as financial compensation will be provided if necessary to ensure there is no loss of livelihoods.

For users of Sukko beach and the surrounding marine environment the mitigation measures listed above are unlikely to entirely eliminate potential impacts on beneficiaries as there will be some level of temporary visual disruption. While they cannot be eliminated, the impacts are unlikely to have a significant lasting effect on the ability of any beneficiaries to enjoy recreational services in the area or impact on livelihoods derived or dependent on this service.

The measures set out to address impacts on the horse riding operation (including the Livelihood Restoration Framework) should reduce the magnitude of the impact.

As such, with the proposed mitigation measures in place the magnitude of impacts is expected to be negligible and the residual impact significance is expected to be **Low**.

Cultural and Spiritual Values

The impact on this service was assessed as moderate significance, primarily due to loss of tranquillity and disturbance to users of the Varvarovka cemetery.

The General Measures at the start of this section, Section 17.7.2.3, will apply as appropriate. Further mitigation measures to address this are set out in **Chapter 13 Landscape and Visual** and **Chapter 16 Cultural Heritage** including re-routing the proposed access road in proximity to the cemetery in order to minimise the impact on visual amenity and landscape character, and planting of vegetation to act as screening.

The implementation of this mitigation should reduce the impact on well-being to negligible and the impact significance to **Low**.

Wild Species Diversity

The impact significance of the Project on wild species diversity was assessed as high. The principal impacts on beneficiaries of terrestrial wild species are likely to be in terms of habitat clearance, in particular loss of Critical Habitat and juniper woodlands of important local value; the risk of introduction of alien invasive species which could disrupt populations of existing species and disrupt the balance of ecosystem functioning; and disturbance to an important population of the critically endangered Nikolski's tortoise. With regards to beneficiaries of marine wild species, the principal impact is likely to be disturbance to charismatic cetacean species in the marine environment.

Chapter 5 Project Description sets out a range of design control measures to avoid impacts on this service. Since some level of impact is unavoidable, additional measures are set out in **Chapter 11 Terrestrial Ecology** and **Chapter 12 Marine Ecology**. These chapters set out a detailed mitigation approach which comprises general mitigation measures for addressing impacts on the terrestrial environment, a herpetile mitigation strategy for addressing impacts on herpetile species including Nikolski's tortoise, a Biodiversity Action Plan (BAP) for ensuring net gain in critical habitat, and measures for addressing impacts on the marine environment.

Impacts on Terrestrial Species and their Beneficiaries

The general mitigation measures will include provision for an Ecological Clerk of Works (ECoW), training of construction personnel, and implementation of a CMP which will minimise the risk of introduction of invasive species.

The Herpetile Mitigation Strategy will cover the construction period and will detail the measures to be employed to protect key ecological receptors such as the Nikolski's tortoise, particularly during initial site clearance works. One of the main risks to this species is harvesting for use in the pet trade, for medicinal purposes, and for food (Ref 17.53). All such, all workers on site will receive education and training with regards to identification of this species and the importance of protecting individuals and avoiding any unnecessary disturbance.

While these measures should reduce the residual impacts on the species to low, given the sensitivity of the receptor, the conservation community may still be concerned about the impacts of the Project. Given this, the Project will further mitigate any potential impacts on the species and its beneficiaries through engaging with local stakeholders (e.g. the Utrish reserve and universities researching this species) and support research and conservation efforts directed at the species.

The Project's mitigation strategy will be described in a BAP and will be designed to achieve net gains of those biodiversity values for which the critical habitat was designated. Management and monitoring requirements for an appropriate length of time will also be specified.

Since particular habitats such as juniper woodlands have important local value and the habitat mosaic provides important ecosystem services in addition to its role in supporting wild species diversity (such as enabling soil, water, and air quality regulation; cultural / aesthetic values; hazard regulation; provision of wild foods etc.), the BAP will take such considerations into account when designing any habitat restoration measures.

Impacts on Marine Species and their Beneficiaries

Within the marine environment, measures are set out in **Chapter 12 Marine Ecology** to reduce disturbance to cetacean species. A monitoring programme, particularly for fish, birds and mammals, will be appropriately designed to meet research objectives that enhance knowledge to the point that conservation measures can be tangibly improved. The scope of such programmes will be developed in consultation with relevant parties to ensure the maximum benefit is delivered.

Residual Impact

Through the adoption of these mitigation measures the extent of habitat loss, risk of introduction of invasive species, and direct Project impacts on populations of Nikolski's tortoise and marine species should be minimised. The development via a BAP of a mitigation strategy that will be designed to achieve net gains of those biodiversity values for which the critical habitat was designated is expected to address some of the key pressures on this species and increase awareness of the value of this species amongst the local population. As such the magnitude of the residual impact on the well-being of beneficiaries with mitigation is considered to be negligible and the overall significance of the impact is **Not Significant.**

17.7.2.4 Residual Impacts: Construction and Pre-Commissioning

The residual Project impacts during the Construction and Pre-Commissioning Phase are discussed in the above sections and a summary is presented in Table 17.15 below.

Table 17.15 Assessment of Potential Impacts: Construction and Pre-Commissioning

Ecosystem Service	Activity	Potential Impact	Receptor(s)	Receptor Sensitivity	Impact Magnitude / Likelihood	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Crops	Vegetation clearance for Pipeline corridor	Loss of current production and future use, potential loss of jobs	Migrant workers	High	Low	Moderate	Land reinstatement On-going stakeholder consultation Grievance Procedure Compensation Management Framework Livelihood Restoration Framework	Low
Capture fisheries	Sedimentation, safety exclusion zones, noise and visual disturbance	Changes in fishery productivity, loss of access to fishing grounds, barrier to migration	Fishing industry	Moderate	Negligible	Not significant	n/a	Not significant

Continued…

Ecosystem Service	Activity	Potential Impact	Receptor(s)	Receptor Sensitivity	Impact Magnitude / Likelihood	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Water (supply)	Dewatering, abstraction, changes in surface water flows	Reduced accessibility of water resources	Downstream abstractors including Project, MoD and local households	Moderate	Negligible	Not significant	n/a	Not significant
Hazard regulation	Vegetation clearance, earthworks, soil excavation, dredging	Increases in flood / landslide risk, changes in coastal erosion rates	Households and businesses, recreational beach users, Project itself	Moderate	Low	Low	n/a	Low
Air quality regulation	Emissions, vegetation clearance, dust generation	Lower air quality, human health risk, impact on tourism	Local households, workers, visitors, tourism industry	Moderate	Negligible	Not significant	n/a	Not significant

Continued...

Ecosystem Service	Activity	Potential Impact	Receptor(s)	Receptor Sensitivity	Impact Magnitude / Likelihood	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Water quality regulation	Waste disposal, contamination, vegetation clearance, sediment plumes, impacts on marine environment	Risk to human health	Households, visitors to St. Barbara's Source, tourism and fishing industries	Moderate	Low	Low	n/a	Low
Soil quality regulation	Contamination, leaks and spills, structural damage, loss of vegetation, disturbance of unidentified contamination	Lower soil productivity, health risks to workers, reduced ecosystem functioning	Landowners, viticulture industry including food consumers, workers on site and in the area	Moderate	Moderate	Moderate	Measures set out in **Chapter 8 Soils, Groundwater and Surface Water** Early identification and removal of contamination, Spill Prevention and Response Plan Restoration of native vegetation Health and safety plan for workers	Not significant

Continued…

Ecosystem Service	Activity	Potential Impact	Receptor(s)	Receptor Sensitivity	Impact Magnitude / Likelihood	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Tourism and recreation values	Noise and visual disturbance, exclusion zones, water quality decline, marine ecology impacts	Reduced recreational use of area and corresponding impact on livelihoods	Resort owners and visitors, users of beaches and marine areas, walkers and horse riders	High	Low	Moderate	On-going stakeholder engagement Provision of construction plans to relevant authorities Grievance Procedure Compensation Management Framework Livelihood Restoration Framework Sediment prevention mitigation as detailed in **Chapter 12 Marine Ecology** Visual impact mitigation as detailed in **Chapter 13 Landscape and Visual**	Low

Continued…

Ecosystem Service	Activity	Potential Impact	Receptor(s)	Receptor Sensitivity	Impact Magnitude / Likelihood	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Cultural and spiritual values	Vegetation clearance, noise and visual disturbance	Loss of cultural and aesthetic values of landscape, disturbance to cemetery	Visitors to cemetery, local residents	High	Low	Moderate	On-going stakeholder consultation Grievance Procedure Re-routing proposed access road as set out in **Chapter 16 Cultural Heritage** Vegetation screening as set out in **Chapter 13 Landscape and Visual**	Low
Wild species diversity	Loss of critical habitat and disruption to critically endangered tortoise species, risk of invasive species introduction, disturbance to marine mammals	Increase vulnerability of threatened species, loss of valued habitat	Local communities, global conservation community	High	Moderate	High	Measures set out in **Chapter 11 Terrestrial Ecology** Measures set out in **Chapter 12 Marine Ecology** Worker education Stakeholder engagement BAP with ecosystem service considerations where possible	Not significant

Complete.

17.7.3 Assessment of Potential Impacts: Operational Phase

17.7.3.1 Introduction

In the following sections the key beneficiaries of each ecosystem service and the relevant Project impacts during the Operational Phase are discussed. For each of the ecosystem services the beneficiaries are grouped together and the Project impact is assessed in terms of the total impacts on that service across all of its beneficiaries. A detailed breakdown of the scoring assigned to each ecosystem service is provided in Appendix 17.4 Impact Assessment – Operational.

17.7.3.2 Assessment of Potential Impacts (pre-mitigation)

Crops

The impacts on beneficiaries of crop services in terms of vegetation clearance during construction, loss of land, and corresponding impacts on employment opportunities are discussed in Section 17.7.2.2. While these impacts are on-going and are likely to be felt during the Operational Phase (as crops are re-established) they are assessed as part of the Construction and Pre-Commissioning Phase as that is when the activities leading to the impacts are undertaken.

In terms of activities undertaken during the Operational Phase, there are none identified which could significantly impact provision or use of crops within the Affected Ecosystems or the well-being of beneficiaries of this service.

The Operational Phase is therefore likely to have a negligible impact magnitude and the impact significance is assessed as **Not Significant**. Crop production is therefore not considered to be a priority ecosystem service during the Operational Phase

Capture Fisheries

The specific Project activities during the Operational Phase that could impact upon capture fisheries include restriction of access to fishing grounds due to an exclusion zone, and noise disturbance from Pipeline operation (Appendix 14.1).

With regards to the exclusion zone, beyond approximately 600 m from the shoreline the Pipeline will lie unburied on the seabed creating a potential hazard for fishing vessels which could make contact with their gear. To ensure that the Pipeline and fishing vessels are not damaged during the Operational Phase (e.g. dragged anchors, fishing gear, etc.), exclusion zones will be put in place along the Pipeline route to restrict activities that may cause damage (such as bottom trawling).

While the final design of the exclusion zones will be agreed in consultation with the appropriate authorities, it is anticipated that they will extend to 0.5 km (0.27 NM) either side of the outermost pipelines from the microtunnel exit pit until the Russian / Turkish EEZ boundary. The full width of the exclusion zone would therefore be a corridor of up to approximately 1.5 km, allowing for the spread of the four pipes.

While there may be some inconvenience due to access restrictions, the loss of fishing ground will only affect bottom trawling which is limited in the area. Further, the area of the shelf suitable for bottom fishing within the exclusion zone represents an insignificant amount (2.4%) of the total shelf area shallower than 100 m.

With regards to noise disturbance, the presence of a pipeline on the seabed should neither pose a physical barrier to fish movement nor act as a deterrent noise source; particularly since the main migratory species are pelagic species which live in the waters well above the pipeline. Evidence from monitoring of the fisheries within the vicinity of the North Stream pipeline in the Baltic (which includes several species related to those in the Black Sea and the same species of sprat) shows no discernible impacts on fish catches.

As such, the likelihood of the fishing industry experiencing any reductions in catches during the operational phase is considered to be minimal and there are unlikely to be any distinguishable differences from normal annual fluctuations.

The impact magnitude is therefore considered negligible and the overall significance of the Operational Phase of the Project on capture fisheries is assessed as being **Not Significant**.

Water (supply)

Due to the use of tunnelling, operation of the Pipeline could lead to on-going obstruction of groundwater flows within the Local Area although the extent of such changes are likely to be minimal and are not expected to lead to a measurable change in the well-being of any beneficiaries. As such the impact magnitude is assessed as negligible and the overall impact is considered **Not Significant**.

Hazard Regulation

There are no identified activities during the Operational Phase that are likely to have a significant impact on provision of this service or the well-being of any beneficiaries. As described in **Chapter 5 Project Description**, regular monitoring and inspection of the Pipeline will be undertaken throughout the Operational Phase. This will enable any changes to the local environment, particularly those relating to seismic and geomorphological processes, to be identified and managed.

As such the impact magnitude is assessed as negligible and the overall impact significance is assessed to be **Not Significant**.

Air Quality Regulation

There are no identified activities during the Operational Phase that are likely to have a significant impact on provision of this service or the well-being of any beneficiaries. As such the impact magnitude is negligible and the overall impact significance is assessed to be **Not Significant**.

Water Quality Regulation

There are no identified activities during the Operational Phase that are likely to have a significant impact on provision of this service or the well-being of any beneficiaries. As such the impact magnitude is negligible and the overall impact is assessed to be **Not Significant**.

Soil Quality Regulation

There are no identified activities during the Operational Phase that are likely to have a significant impact on provision of this service or the well-being of any beneficiaries. As such the impact magnitude is negligible and the overall impact is assessed to be **Not Significant**.

Tourism and Recreation Values

There are no identified activities during the Operational Phase that are likely to have a significant impact on provision of this service or the well-being of any beneficiaries. As such the impact magnitude is negligible and the overall impact is assessed to be **Not Significant**.

Cultural and Spiritual Values

Operation of the Pipeline could lead to further disturbance of sites of cultural value, in particular the Varvarovka Armenian and Russian cemetery, as well as a change in the cultural and aesthetic value of the Local Area as an agricultural landscape due to noise and visual disturbance from the operation of the landfall facilities. Potential impacts on archaeological sites are discussed in **Chapter 16 Cultural Heritage**.

In terms of landscape changes, the use of microtunneling effectively minimises the potential impacts on the landscape and visual amenity due to Pipeline operation. There will be further visual impact due to the presence the proposed landfall section facilities include a metering facility, pipeline inspection gauge (PIG) traps and electrical and instrumentation installations However, extensive woodland surrounding this area of the Project is effective at 'absorbing' development by screening much of the Project and the extent of any change is small relative to the total landscape (see **Chapter 13 Landscape and Visual**). Likewise, with regards to users of the cemetery, while there will be some visual impact it is unlikely to be of an extent which prohibits anyone from accessing the site or being able to derive spiritual value from the area due to the sensitive design of the microtunneling site access road.

As such, while there will be some visual change there are not expected to be any significant impacts on beneficiaries of cultural services and the impact magnitude is negligible. The overall impact significance is considered to be **Low**.

Wild Species Diversity

In the terrestrial Affected Ecosystems operational impacts resulting from the Project are limited given that all of the significant impacts on habitats as a result of habitat loss or fragmentation will have occurred at the Construction Phase. During the Commissioning and Operational Phase many of the mitigation measures for the impacts of construction (such as vegetation replanting) will occur. The overall impact of the Commissioning and Operational Phase will therefore be considerably lower than those during construction.

The overall impact on habitats during operation will be **Not Significant** due to the lack of any significant ground-works or other major works. The only activities that will be undertaken during this Project phase will be related to land remediation and maintenance of the RoW.

There is some potential for impacts on flora (including potentially red list species) as a result of maintenance to keep the RoW free of large trees and deep-rooted shrubs for the lifespan of the Project. However, considering that the worst case scenario of habitat and species loss for flora of conservation importance has been assessed for construction, the effect of operational activities is not likely to be significant.

There may be some disturbance to invertebrates, reptiles, birds, and mammals as a result of small-scale works, movement of vehicles and other machinery and vegetation clearance although there are unlikely to be any significant impacts on population viability or on the well-being of beneficiaries (see **Chapter 11 Terrestrial Ecology**).

The presence of the operational Pipeline within the marine environment is not expected to result in any significant impacts on benthic habitats, seabirds, marine mammals or fish. The movement of vessels (including noise) used for pipeline inspection and maintenance could periodically disturb some seabirds and marine mammals although the impacts on population viability and beneficiary well-being is unlikely to be significant (see **Chapter 12 Marine Ecology**).

Overall, the magnitude of impacts on beneficiary wellbeing are considered to be negligible and the impact **Not Significant**.

17.7.3.3 Mitigation and Monitoring

Based on the results of the impact assessment (see Appendix 17.4 for a detailed summary of the scoring assigned to each ecosystem service), there are no priority services likely to be significantly impacted during the Operational Phase of the Project and which will require further mitigation.

17.7.3.4 Residual Impacts: Operational Phase

Table 17.16 presents a summary of the residual effects of impacts on ecosystem services on their beneficiaries following mitigation.

Table 17.16 Assessment of Potential Impacts: Operational Phase

Ecosystem Service	Activity	Potential Impact	Receptor(s)	Receptor Sensitivity	Impact Magnitude / Likelihood	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Crops	Operation of the Pipeline	n/a	Migrant workers	Low	Negligible	Not significant	n/a	Not significant
Capture Fisheries	Noise and vibration from Pipeline operation, imposition of exclusion zones	Potential (or perceived) disturbance to fish communities, loss of access to fishing grounds, snagging of equipment	Fishing industry	Moderate	Negligible	Not significant	n/a	Not significant
Water (supply)	Obstruction of groundwater flows	Reduced accessibility of water to downstream beneficiaries	Downstream abstractors including MoD and local households	Moderate	Negligible	Not significant	n/a	Not significant
Hazard regulation	Operation of the Pipeline	n/a	Households and businesses, recreational beach users, Project itself	Moderate	Negligible	Not significant	n/a	Not significant

Continued…

Ecosystem Service	Activity	Potential Impact	Receptor(s)	Receptor Sensitivity	Impact Magnitude / Likelihood	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Air quality regulation	Operation of the Pipeline	n/a	Local households, workers, visitors	Moderate	Negligible	Not significant	n/a	Not significant
Water quality regulation	Operation of the Pipeline	n/a	Fishers, consumers, water users	Moderate	Negligible	Not significant	n/a	Not significant
Soil quality regulation	Operation of the Pipeline	n/a	Farmers, food consumers, workers on site and in the area	Moderate	Negligible	Not significant	n/a	Not significant
Tourism and recreation values	Operation of the Pipeline and landfall facilities	n/a	Beach users, dive operators, Shingari and Don resort owners, walkers / horse riders	High	Negligible	Not significant	n/a	Not significant

Continued...

Ecosystem Service	Activity	Potential Impact	Receptor(s)	Receptor Sensitivity	Impact Magnitude / Likelihood	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Cultural and spiritual values	Visual disturbance	Change in cultural and aesthetic values of landscape, disturbance to cemetery	Visitors to cemetery, local residents	High	Negligible	Low	n/a	Low
Wild species diversity	Routine inspection and maintenance	Injury and death of wild species from vehicle and vessel collisions, disturbance from noise	Local communities, global conservation community	High	Negligible	Not significant	n/a	Not significant

Complete.

17.7.4 Assessment of Potential Impacts: Decommissioning Phase

17.7.4.1 Introduction

Decommissioning of the South Stream Pipeline will be carried out according to prevailing international and national legislation and regulations and GIIP regarding environmental and other potential impacts. An assessment will be undertaken to confirm that the planned decommissioning activities are the most appropriate to the prevailing circumstances and future land use. The assessment of decommissioning impacts set out below is therefore provisional, based on current practices and technologies. It is not intended to be definitive, but may serve as a high level comparison between two alternative strategies:

- **Option 1 –** In situ decommissioning which involves cleaning the Pipeline and filling it with seawater. The receptors that might be impacted are thus the same as those for the Operational Phase; and
- **Option 2 –** Removal of the Pipeline which is essentially a similar operation to pipe-laying, but in reverse. The receptors and degree of impact will thus be similar to those identified for the Construction and Pre-Commissioning Phase.

17.7.4.2 Assessment of Potential Impacts (pre-mitigation)

Crops

Under Option 1 there are not likely to be any impacts on the provision or use of the crops service. As such the impact significance is **Not Significant.**

Under Option 2, the removal of the Pipeline will require clearance of an area of land similar to that required in the Construction and Pre-Commissioning Phase. This land may be used for productive agricultural uses depending on whether or not the area has been replanted following the vegetation clearance undertaken in the Construction and Pre-Commissioning Phase.

The receptor sensitivity in this Phase is likely to be high if the area of land currently fallow is planted at some point during the Operational Phase. Further, the projected changes in climate may make wine production more vulnerable to Project impacts and could increase the vulnerability of production if, for example, viticulture in the Local Area becomes increasingly challenging under a future climate thereby reducing the profitability of the enterprise.

Any loss of productive agricultural land would have an impact on the livelihoods of those employed on the land. Therefore, assuming that viticulture in the Local Area is still viable in 2065 and that at least the area currently in agricultural production is replanted following the Construction and Pre-Commissioning Phase, the Project could have an impact of **Moderate** significance.

Capture Fisheries

Under Option 1, there are not likely to be any significant impacts on fisheries productivity or on access to fishing grounds beyond the restrictions that exist during the Operational Phase. As such the significance of impacts is deemed **Not Significant**.

The removal of the Pipeline (Option 2) may result in disturbance from additional vessel movements and potentially the re-instatement of a wider exclusion zone around the vessels involved in decommissioning. This is unlikely to have a significant impact on fisheries productivity as the affected area is small relative to the total fishing area and fish are able to avoid the area of disturbance. As such, the significance of impacts is assessed as being **Not Significant**.

Water (supply)

Under Option 1 there are not likely to be any impacts on the provision or use of water (supply). As such the impact significance is **Not Significant**.

Under Option 2, the removal of the Pipeline could impact water supply for downstream users through the potential abstraction from aquifers for use in decommissioning activities leading to decreasing groundwater levels, and alterations to surface water flows during construction due to crossing of surface waters and alterations to vegetation cover.

Due to the on-going abstraction of water from groundwater aquifers throughout the Project's life, groundwater levels are likely to be lower in 50 years' time than at present. Further, factors such as the changing climate, projected decreases in water availability, potential population increases, new downstream water users, as well as growing demands for water in irrigated agriculture, could increase the sensitivity of water resources and their users to any changes in supply.

As such, the receptor sensitivity for this service is likely to be higher in this Phase than in the Construction and Pre-Commissioning Phase. However, the Project is unlikely to significantly alter water flows or the ability of any beneficiaries to access water. As such, the impact on well-being is likely to be negligible and the impact significance is assessed as **Low** significance.

Hazard Regulation

Under Option 1 there are not likely to be any impacts on the provision or use of hazard regulation services. As such the impact significance is **Not Significant**.

Under Option 2, the removal of the Pipeline could impact hazard regulation through site clearance and earthworks, particularly where these result in loss of vegetation; preparation of foundations which may induce tremors that trigger mass movement of soils; impacts on the structural composition of Phaeozem soils which play an important role in water storage and flow regulation; and any dredging activities which could impact upon coastal processes and the effects of sea surges.

Climate change projections are likely to increase the frequency of hazards in the region although it is not possible to accurately predict changes in the Local Area at this stage. Any growth in populations in the Local Area could increase the amount of people vulnerable to hazards.

While the likelihood of any impact on beneficiaries well-being is likely to be low the receptor sensitivity is likely to be higher due to the impacts of climate change and, as such, the impact significance is assessed as **Moderate** significance.

Air Quality Regulation

Under Option 1 there are not likely to be any impacts on the provision or use of air quality regulation services. As such the impact significance is **Not Significant**.

Under Option 2, vegetation clearance and emissions during decommissioning activities could reduce the ability of the Affected Ecosystems to regulate air quality. However, as in the Construction and Pre-Commissioning Phase, due to the limited extent of emissions and vegetation loss relative to the surrounding ecosystem cover the impact on air quality and the well-being of beneficiaries of this service is not likely to be significant.

Warming of the climate could reduce the uptake of pollutants by vegetation in the Local Area and further development which requires vegetation clearance could reduce the extent of natural habitat which can play this role. As such the ecosystem receptors are likely to be higher sensitivity to any Project impacts.

While the receptor sensitivity is likely to be higher, the likelihood of any impact on beneficiaries well-being is likely to be negligible. As such, the impact significance is assessed as **Not Significant**.

Water Quality Regulation

Under Option 1 there are not likely to be any impacts on the provision or use of water quality regulation services. As such the impact significance is **Not Significant**.

Under Option 2, the Project could lead to higher pollution levels in surface and ground waters due to decommissioning activities and removal of vegetation; accidental leaks and spills; impacts on mussels and other marine organisms capable of biofiltration if present in 50 years' time; and seabed disturbance and release of sediments into the marine water column as a result of dredging and pipeline removal.

Assuming that the regulatory frameworks for improving water quality in the Local Area are implemented successfully, inputs of pollution into the marine and freshwater ecosystems should be lower by 2065. As such, receptor sensitivity would be lower and the impact significance is assessed as **Low** significance.

Soil Quality Regulation

Under Option 1 there are not likely to be any impacts on the provision or use of soil quality regulation services. As such the impact significance is **Not Significant**.

Under Option 2, the Project could reduce the ability of ecosystems to regulate soil quality through an increase in concentration of contaminants through leaks, spills, and emissions;

increased susceptibility of soil to erosion through clearance of vegetation and excavation works; loss of nutrients and soil carbon due to soil excavation and removal of vegetation which contributes to soil composition; degradation of soil, physical damage, and compaction through stockpiling of soils during decommissioning; and displacement of soils through effects on the river channel.

While pressures on soil resources and the ability of ecosystems to regulate soil quality may increase over the life of the Project due to increased levels of development in the Local Area, vegetation clearance, growing air borne emissions, and greater pollutant from surface runoff, there is unlikely to be a significant change in the sensitivity of the receptors or the potential Project impacts. As such, the impact significance is assessed as **Moderate** significance.

Tourism and Recreation Values

Under Option 1 there are not likely to be any impacts on the provision or use of tourism and recreation services. As such the impact significance is **Not Significant**.

Under Option 2, the Project could reduce the ability of ecosystems to provide opportunities for tourism and recreation primarily through visual disturbance to beach users and visitors to nearby resort complexes. The receptor sensitivity and impact magnitude are likely to be similar to the Construction and Pre-Commissioning Phase and, as such, the impact significance is assessed as **Moderate** significance.

Cultural and Spiritual Values

Under Option 1 there are not likely to be any impacts on the provision or use of cultural and spiritual services. As such the impact significance is **Low** significance.

Under Option 2, the Project could damage the aesthetics and agricultural nature of the landscape as well as causing damage to sites of cultural importance and their environmental setting. The receptor sensitivity and impact magnitude are likely to be similar to the Construction and Pre-Commissioning Phase and, as such, the impact significance is assessed as **Moderate** significance.

Wild Species Diversity

Under Option 1 there are not likely to be any impacts on wild species diversity. As such the impact is assessed as being **Not Significant**.

Under Option 2, the Project could impact on wild species diversity through habitat loss, disturbance during decommissioning activities, pollution incidents, and introduction of invasive species. The receptor sensitivity and impact magnitude are likely to be similar to the Construction and Pre-Commissioning Phase and, as such, the impact significance is assessed as **High** significance.

17.7.4.3 Mitigation and Monitoring

Based on the results of the impact assessment there are no priority services identified for Option 1 and six priority ecosystem services identified for Option 2:

- Crops;
- Hazard regulation;
- Soil quality regulation;
- Tourism and recreation values;
- Cultural and spiritual values; and
- Wild species diversity.

Due to the similar nature of the impacts the mitigation requirements for the second options of the Decommissioning Phase are likely to mirror those required for the Construction and Pre-Commissioning Phase. As such, the mitigation requirements will be similar to those set out in Section 17.7.2.3, although a full EIA will need to be undertaken prior to decommissioning to ensure that the impact assessment and mitigation recommendations are still appropriate.

Hazard regulation is the only service which was not identified as a priority service in the Construction and Pre-Commissioning Phase. The increase in significance is due to the likely increase in hazard risk due to climate change within the Local Area. While the nature of such risks are difficult to predict at present, there could be increases in surface water flooding, coastal erosion, coastal flooding, and mudflows (as a result of more intense rainfall patterns).

In order to mitigate impacts on this service during the Decommissioning Phase, a detailed, quantitative study of hazard risk in the Local Area should be undertaken prior to decommissioning and used to inform appropriate mitigation measures.

17.7.4.4 Residual Impacts: Decommissioning Phase

Table 17.17 presents a summary of the residual effects of impacts on ecosystem services on their beneficiaries following mitigation.

Table 17.17 Assessment of Potential Impacts: Decommissioning (under Option 2)

Ecosystem Service	Activity	Potential Impact	Receptor(s)	Receptor Sensitivity	Impact Magnitude / Likelihood	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Crops	Vegetation clearance for Pipeline corridor	Loss of current production and future use, potential loss of jobs	Migrant workers	High	Low	High	Land reinstatement On-going stakeholder consultation Grievance Procedure Compensation Management Framework Livelihood Restoration Framework	Low
Capture fisheries	Sedimentation, safety exclusion zones, noise and visual disturbance	Changes in fishery productivity, loss of access to fishing grounds, barrier to migration	Fishing industry	Moderate	Negligible	Not significant	n/a	Not significant

Continued...

Ecosystem Service	Activity	Potential Impact	Receptor(s)	Receptor Sensitivity	Impact Magnitude / Likelihood	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Water (supply)	Dewatering, abstraction, changes in surface water flows	Reduced accessibility of water resources	Downstream abstractors including Project, MoD and local households	High	Negligible	Low	n/a	Low
Hazard regulation	Vegetation clearance, earthworks, soil excavation, dredging	Increases in flood/landslide risk, changes in coastal erosion rates	Households and businesses, recreational beach users, Project itself	Moderate	Low	Moderate	Detailed quantitative study of hazard risk and appropriate mitigation based on results	Low
Air quality regulation	Emissions, vegetation clearance, dust generation	Lower air quality, human health risk, impact on tourism	Local households, workers, visitors, tourism industry	High	Negligible	Not significant	n/a	Not significant

Continued...

Ecosystem Service	Activity	Potential Impact	Receptor(s)	Receptor Sensitivity	Impact Magnitude / Likelihood	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Water quality regulation	Waste disposal, contamination, vegetation clearance, sediment plumes, impacts on marine environment	Risk to human health	Households, visitors to St. Barbara's Source, tourism and fishing industries	Low	Low	Low	n/a	Low
Soil quality regulation	Contamination, leaks and spills, structural damage, loss of vegetation, disturbance of unidentified contamination	Lower soil productivity, health risks to workers, reduced ecosystem functioning	Landowners, viticulture industry including food consumers, workers on site and in the area	Moderate	Moderate	Moderate	Measures set out in **Chapter 8 Soils, Groundwater and Surface Water** Early identification and removal of contamination, Spill Prevention and Response Plan Restoration of native vegetation Health and safety plan for workers	Not significant

Continued…

Ecosystem Service	Activity	Potential Impact	Receptor(s)	Receptor Sensitivity	Impact Magnitude / Likelihood	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Tourism and recreation values	Noise and visual disturbance, exclusion zones, water quality decline, marine ecology impacts	Reduced recreational use of area and corresponding impact on livelihoods	Resort owners and visitors, users of beaches and marine areas, walkers and horse riders	High	Low	Moderate	On-going stakeholder engagement Provision of construction plans to relevant authorities Grievance Procedure Compensation Management Framework Livelihood Restoration Framework Sediment prevention mitigation as detailed in **Chapter 12 Marine Ecology** Visual impact mitigation as detailed in **Chapter 13 Landscape and Visual**	Low

Continued...

Ecosystem Service	Activity	Potential Impact	Receptor(s)	Receptor Sensitivity	Impact Magnitude / Likelihood	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Cultural and spiritual values	Vegetation clearance, noise and visual disturbance	Loss of cultural and aesthetic values of landscape, disturbance to cemetery	Visitors to cemetery, local residents	High	Low	Moderate	On-going stakeholder consultation Grievance Procedure Re-routing proposed access road as set out in **Chapter 16 Cultural Heritage** Vegetation screening as set out in **Chapter 13 Landscape and Visual Assessment**	Low

Continued…

Ecosystem Service	Activity	Potential Impact	Receptor(s)	Receptor Sensitivity	Impact Magnitude / Likelihood	Pre-Mitigation Impact Significance	Mitigation Measures	Residual Impact Significance
Wild species diversity	Loss of critical habitat and disruption to critically endangered tortoise species, risk of invasive species introduction, disturbance to marine mammals	Increase vulnerability of threatened species, loss of valued habitat	Local communities, global conservation community	High	Moderate	High	Measures set out in **Chapter 11 Terrestrial Ecology and Biodiversity** Measures set out in **Chapter 12 Marine Ecology**, Worker education Stakeholder engagement BAP with ecosystem service considerations where possible	Not significant

Complete…

17.8 Unplanned Events

Unplanned events are considered separately from planned activities as they only arise as a result of a technical failure, human error, or as a result of natural phenomena such as a seismic event. As such, unplanned events are assessed and relevant mitigation measures are presented in **Chapter 19 Unplanned Events.** Those relevant to the provision or use of ecosystem services include fuel and oil spillages; fire risk; introduction of invasive non-native species into the marine environment; and large scale release of natural gas.

Spillages of fuel and oil during construction activities could potentially have widespread impacts on a range of services provided by both terrestrial and marine ecosystems including crops, fisheries, and tourism and recreation. However, through adherence with the Spill Prevention and Response Plan, it is concluded that the actions taken will prevent any long term significant adverse impacts on the environment as a result of such events.

Fire risks during construction will be minimised through the definition and enforcement of strict control measures, which will include the adoption of a *"permit to work"* system for hot works and a smoking ban for all construction personnel whilst undertaking construction activities. Additional measures will include the development of an Emergency Response Plan, inclusive of fire prevention and suppression measures which will be developed and maintained by each construction contractor. The Emergency Response Plan will include specific measures to prevent the spread of any fires to the natural habitats within the Project Area.

Vessel operations during construction also have the potential to inadvertently introduce invasive alien species, either in ballast water, on the biofilm inside ballast tanks, or carried as fouling organisms on the hull. Despite its low probability of occurrence, the possibility of population or community-wide effects on the entire ecology of the sea makes this a potentially highly significant impact with potential impacts on a range of services including fisheries, water quality, and wild species diversity. In order minimise the risk of accidental introductions, appropriate mitigation measures will be implemented as set out in **Chapter 19 Unplanned Events**.

During the Operational Phase, unplanned events are similar to those listed above for the Construction and Pre-Commissioning Phase however there is also a risk of large scale releases of un-ignited natural gas from the pipelines. The majority of failures would be small, e.g. pin-hole releases from valve stems and flanges, and the frequency of catastrophic events that may cause a long-term shutdown is extremely low. Further detail is contained in **Chapter 19 Unplanned Events.**

17.9 Cumulative Impacts Assessment

Cumulative impacts associated with the Project are assessed in **Chapter 20 Cumulative Impact Assessment**.

17.10 Conclusions

A total of ten ecosystem services were scoped into the assessment in this chapter. For these ten services, the significance of the Project's impacts during the Construction and Pre-Commissioning Phase before mitigation was assessed as follows:

- **Not Significant:** Capture fisheries, water supply, and air quality regulation;
- **Low:** Hazard regulation and water quality regulation;
- **Moderate:** Crops, soil quality regulation, tourism and recreation values, and cultural and spiritual values; and
- **High:** Wild species diversity.

During the Operational Phase, the impacts on cultural and spiritual values were found to be of **Low** significance and impacts on all other services were found to be **Not Significant**.

The assessment therefore identifies five priority services on which the Project would likely have a significant impact (pre-mitigation) during the Construction and Pre-Commissioning Phase. No priority services are expected to be impacted during the Operational Phase. A summary of the priority services, the likely impacts, the proposed mitigation measures, and residual impacts is provided in Table 17.18.

Table 17.18 Assessment Summary of Priority Services identified during Construction and Pre-Commissioning

Priority Service	Potential Impact	Impact Significance	Mitigation Measures	Residual Impact
Crops	Loss of current production and future use, loss of jobs	Moderate	Land reinstatement On-going stakeholder consultation Grievance Procedure Compensation Management Framework Livelihood Restoration Framework	Low

Continued…

Priority Service	Potential Impact	Impact Significance	Mitigation Measures	Residual Impact
Soil quality regulation	Contamination from Project could lower soil productivity, introduce contaminants into the food chain, and present health risks to workers, structural damage could impact on soil productivity and ecosystem functioning	Moderate	Measures set out in **Chapter 8 Soils, Groundwater and Surface Water** Early identification and removal of contamination Spill Prevention and Response Plan Restoration of native vegetation Health and safety plan for workers	Not significant
Tourism and recreation values	Reduced recreational use of area and corresponding impact on livelihoods	Moderate	On-going stakeholder engagement Provision of construction plans to relevant authorities Grievance Procedure Compensation Management Framework Livelihood Restoration Framework Sediment prevention mitigation as detailed in **Chapter 12 Marine Ecology** Visual impact mitigation as detailed in **Chapter 13 Landscape and Visual**	Low

Continued...

Priority Service	Potential Impact	Impact Significance	Mitigation Measures	Residual Impact
Cultural and spiritual values	Vegetation clearance and disturbance to visitors of the Varvarovka cemetery	Moderate	On-going stakeholder consultation Grievance Procedure Re-routing proposed access road as set out in **Chapter 16 Cultural Heritage** Vegetation screening as set out in **Chapter 13 Landscape and Visual Assessment**	Low
Wild species diversity	Loss of critical habitat and disruption to critically endangered tortoise species, risk of invasive species introduction, disturbance to marine mammals	High	Measures set out in **Chapter 11 Terrestrial Ecology and Biodiversity** Measures set out in **Chapter 12 Marine Ecology**, Worker education Stakeholder engagement BAP with ecosystem service considerations where possible	Not significant

Complete.

The mitigation measures identified are intended to anticipate and avoid, or where avoidance is not possible, minimize, and, where significant residual impacts remain, compensate / offset impacts on receptors. Assuming that the mitigation measures suggested in this assessment are successfully implemented, it will be possible for the Project to mitigate all adverse effects associated with the Project to the degree that most impacts after mitigation would be low or not significant.

Hazard regulation was identified as an additional priority service during the Decommissioning Phase if the option to remove the Pipeline is selected. However, as the approach has not yet been decided and due to the large degree of uncertainty of assessing impacts over this timeframe, appropriate mitigation should be determined based on a survey of the risks nearer the time of decommissioning.

The combined effects of the Project and other developments are not expected to result in any significant cumulative impacts on ecosystem service beneficiaries.

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Chapter 18: Waste Management

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Tables

18 Waste Management

18.1 Introduction

This chapter presents an assessment of the potential waste arising from the Project. It relates to solid waste, non-aqueous liquid waste, and wastewater generated from treatment of sewage.

The methodology used to assess potential waste impacts differs slightly from that detailed in **Chapter 3 Impact Assessment Methodology** due to the unique nature of waste when considered as a Project impact. Unlike many other impact categories, waste is a product of the Project and impacts from waste will depend on the ability of facilities and management systems to store, transport, treat and dispose of waste in a safe and environmentally sound manner. There are a number of applicable legislative requirements and standards that exist which must be adhered to, as well as a range of potential waste management mitigations and practices that can be applied.

This chapter describes the legal and regulatory framework applicable to the Project based on wastes anticipated to be generated by Project activities (see **Chapter 5 Project Description**). In light of this, available waste facilities capable of receiving anticipated Project wastes are identified (Section 18.2).

The waste impact assessment section (Section 18.4) identifies the type and volume of wastes anticipated and describes the potential impacts arising from the management of wastes (e.g. impacts on human health and the environment from releases of waste to air, water or land; potential nuisance to humans and fauna). It is recognised that impacts can arise throughout the waste management process and therefore the generation, storage, collection and transport, reuse, recycling, recovery, treatment and disposal of waste are considered. In contrast to other chapters, pre-mitigation significance of impacts is not assessed in this chapter because it is not realistic to consider any situation in which management or mitigation would not be carried out; legislation dictates requirements for waste storage, management and disposal, and these are therefore considered part of the Project design.

The legal requirements for waste management and mitigation measures for the Project (e.g. waste minimisation) are described and the residual impacts are then assessed (Section 18.5). Mitigation measures that will be adopted to manage anticipated wastes so as to minimise their environmental impact and ensure compliance with relevant local, national and international regulations are provided. These approaches represent standard Good International Industry Practice (GIIP) for the various waste streams under consideration and make use of existing local facilities as far as practicable. The assessed significance of the residual impacts for each waste stream takes into account the identified mitigation measures.

The Project Environmental and Social Management Plan (ESMP) (described in **Chapter 22 Environmental and Social Management**) describes how the mitigation measures detailed within this chapter shall be practically applied to the construction and operation of the Project.

18.1.1 Applicable Legislation, Standards, and Guidelines

Chapter 2 Policy, Regulatory and Administrative Framework describes the framework of legislation, standards and guidelines relevant to the ESIA; those of particular relevance to waste management are summarised below.

18.1.1.1 International Legislation

There are four international conventions associated with waste management that are relevant in the context of this ESIA Report. Table 18.1 highlights the most relevant parts of these conventions in relation to waste management aspects of the Project.

Table 18.1 Summary of International Waste Management Requirements

Name	Relevance
Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention), 1972 (Ref. 18.1). (Russia is a Party to the London Convention)	The objective of the London Convention is to control pollution of the sea caused by dumping activities and to encourage supplementary regional agreements. As such, it covers the deliberate disposal at sea of wastes or other matter from vessels, aircraft and platforms. Under these requirements, Parties are to establish authorities responsible for issuing permits, keeping records and monitoring the condition of the seas. Furthermore, Parties are to promote measures which prevent pollution from hydrocarbons, additional matter transported other than for dumping, wastes generated during operation of ships, etc. and matter originating from exploration of the sea bed. Annexes I and II of the London Convention list matter which is defined as prohibited or restricted with regards to dumping.
Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (Basel Convention), 1992 (Ref. 18.2). (Russia is a Party to the Basel Convention)	The Basel Convention regulates transboundary movements of hazardous wastes and provides obligations upon its Parties to ensure that such wastes are managed and disposed of in an environmentally sound manner. The main principles of the Convention are as follows: • Transboundary movements of hazardous wastes should be reduced to a minimum, which is consistent with their environmentally sound management; • Hazardous wastes should be treated and disposed of as close as possible to their source of origin; and • Hazardous waste generation should be reduced and minimised at source. Annexes I–VIII of the Basel Convention provide lists of waste categories requiring special consideration or controls, including disposal operations. Annex I outlines a list of waste categories to be controlled, Annex II details waste categories requiring special consideration and Annex III provides a list of important hazardous characteristics.

Continued…

Name	Relevance
Convention on Persistent Organic Pollutants (Stockholm Convention) (Ref. 18.3) (Russia has signed and ratified the Stockholm Convention)	The Convention seeks to ensure the limitation of pollution by persistent organic pollutants (POPs). It defines the substances in question, whilst leaving open the possibility of adding new ones, and also defines the rules governing the production, importing and exporting of those substances.
International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 (MARPOL 73/78 Convention) Annex I – VI (Ref. 18.4). (Russia has acceded to Annexes I to VI of the MARPOL Convention)	The Convention covers the prevention of pollution of the marine environment by ships from operational or accidental causes. With regards to waste management, the Convention defines conditions for waste disposal in the marine environment by ship, particularly in determined "special areas" such as the Black Sea. Annex I includes regulations for the Prevention of Pollution by Oil and is mandatory. Annex II includes regulations for the Control of Pollution by Noxious Liquid Substances in Bulk. Annex III includes regulations for the Prevention of Pollution by Harmful Substances Carried by Sea in Packed Form. Of particular relevance to waste management aspects of the Project are Annex IV and Annex V. Annex IV includes regulations for the Prevention of Pollution by Sewage from Ships. Annex V includes regulations for the Prevention of Pollution by Garbage from Ships. Annex VI includes regulations for the Prevention of Air Pollution from Ships.
Convention on the Protection of the Black Sea Against Pollution (Bucharest Convention), 1992 (Russia has signed and ratified the Bucharest Convention)	The Convention provides a basic framework of agreement and three specific Protocols, which are: (1) the control of land-based sources of pollution; (2) control of dumping of waste; and (3) joint action in the case of accidents (such as oil spills). Discharges from ships are managed accordance with MARPOL and are as such compliant with the Bucharest Convention. The "Protocol on the Protection of the Black Sea Marine Environment Against Pollution by Dumping" does not apply to any of the wastes generated by the project in the Russian EEZ since the project activities in these waters do not comprise dumping as defined in the Convention.

Complete.

Of these international conventions, the most relevant to the Project is MARPOL 73/78 Convention, which governs management of waste on board vessels. The Black Sea is a Special Area under MARPOL Annexes I and V. Amendments to Annex V entered into force on 1 January 2013, and the revised Annex V prohibits the discharge of all garbage into the sea, except as provided otherwise. An overview of the revised MARPOL Annex V discharge provisions (as relevant to the Project) is presented in Table 18.2 below.

Under MARPOL Annex I, any discharge of oil from a ship exceeding 400 gross registered tonnage (GRT) is prohibited within any Special Area, as defined by the Annex, except when:

- The ship is proceeding en route;
- The oily mixture is processed through an oil filtering equipment meeting the relevant MARPOL requirements;

- The oil content of the effluent without dilution does not exceed 15 parts per million;
- The oily mixture does not originate from cargo pump room bilges on oil tankers; and
- The oily mixture, in case of oil tankers, is not mixed with oil cargo residue.

The Black Sea is a Special Area under MARPOL Annex I. This effectively prohibits the discharge of oily sludge and slops, and requires oily bilge water to be treated through an oily water separator (OWS) prior to discharge.

Annex IV of the MARPOL 73/78 Convention provides regulations for the prevention of pollution by sewage from ships. MARPOL Annex IV defines "sewage" as:

- Drainage and other wastes from any form of toilets and urinals;
- Drainage from medical premises (dispensary, sick bay, etc.) via wash basins, wash tubs and scuppers located in such premises;
- Drainage from spaces containing living animals; or
- Other waste waters when mixed with the drainages defined above.

The discharge of sewage into the sea is prohibited, except when:

- The ship is discharging comminuted and disinfected sewage at a distance of more than 3 nautical miles from the nearest land, or sewage which is not comminuted or disinfected at a distance of more than 12 nautical miles from the nearest land, provided that in any case, the sewage that has been stored in holding tanks shall not be discharged instantaneously but at a moderate rate when the ship is en route and proceeding at not less than 4 knots; or
- The ship has in operation an approved sewage treatment and (additionally) the effluent shall not produce visible floating solids nor cause discoloration of the surrounding water.

Annex V of the MARPOL 73/78 Convention provides regulations for the prevention of pollution by garbage from ships and limits the disposal, be it continuous or periodic, of food, domestic and operational waste into the sea. Annex V completely prohibits the disposal of plastics anywhere into the sea and places strict restrictions upon discharges into designated Special Areas. The Black Sea is a Special Area under Annex V.

Table 18.2 Relevant Requirements for Disposal of Garbage under MARPOL Annex V

Type of Waste	Ships within Special Areas
Food waste comminuted or ground	Discharge permitted provided vessel is ≥12 nautical miles (NM) from the nearest land and en route
Food waste not comminuted or ground	Discharge prohibited
Cargo residues a not contained in wash water	Discharge prohibited

Continued…

Type of Waste	Ships within Special Areas
Cargo residues[a] contained in wash water	Discharge only permitted in specific circumstances[b] and ≥12 NM from the nearest land and en route
Cleaning agents and additives contained in cargo hold wash water	Discharge only permitted in specific circumstances[b] and ≥12 NM from the nearest land and en route
Cleaning agents and additives contained in deck and external surface wash water	Discharge permitted
All other garbage including plastics, domestic waste, cooking oil, incinerator ashes, operational wastes and fishing gear	Discharge prohibited
Mixed garbage	When garbage is mixed with or contaminated by other substances prohibited from discharging or having different discharge requirements, the more stringent requirements shall apply

[a] These substances must not be harmful to the marine environment.

[b] According to regulation 6.1.2 of MARPOL Convention Annex V, the discharge shall only be allowed if: (a) both the port of departure and the next port of destination are within the special area and the ship will not transit outside the special area between these ports (regulation 6.1.2.2); and (b) if no adequate reception facilities are available at those ports (regulation 6.1.2.3).

Complete.

18.1.1.2 International Standards and Guidelines

In addition to the international legislation outlined above, the Project is aligned with the IFC EHS Guidelines and Performance Standards (PS). Table 18.3 summarises the IFC EHS Guidelines and PS that require consideration in relation to waste management aspects of the Project.

Table 18.3 IFC Guidelines and Performance Standards Relevant to Waste Management

Name	Relevance
IFC (2007) General EHS Guidelines: Environmental (Ref. 18.5).	The IFC EHS Guidelines are technical reference documents that provide general and industry-specific examples of Good International Industry Practice (GIIP). The Guidelines cover a wide range of technical subjects, including hazardous and non-hazardous waste management. Section 1.5 Hazardous Waste Management states that: *"Projects which manufacture, handle, use, or store hazardous materials should establish management programs that are commensurate with the potential risks present. The main objectives of projects involving hazardous materials should be the protection of the workforce and the prevention and control of releases and accidents. These objectives should be addressed by integrating prevention and control measures, management actions, and procedures into day-to-day business activities."* Section 1.6 Waste Management states that: *"Facilities that generate and store wastes should practice the following:* *establishing waste management priorities at the outset of activities based on an understanding of potential Environmental, Health, and Safety (EHS) risks and impacts and considering waste generation and its consequences;* *establishing a waste management hierarchy that considers prevention, reduction, reuse, recovery, recycling, removal and finally disposal of wastes;* *avoiding or minimizing the generation waste materials, as far as practicable;* *where waste generation cannot be avoided but has been minimized, recovering and reusing waste;* *where waste cannot be recovered or reused, treating, destroying, and disposing of it in an environmentally sound manner."*

Continued…

Name	Relevance
IFC PS3: Resource Efficiency and Pollution Prevention (1 Jan 12) (Ref. 18.6).	The IFC provides eight Performance Standards that offer guidance regarding the identification of risks and impacts associated with projects, and which aim to reduce, avoid or mitigate these risks and impacts. Of relevance to waste management is Performance Standard 3: Resource Efficiency and Pollution Prevention. The aim of this standard is to minimise or avoid adverse impacts on human health and the environment, promote sustainable use of resources and reduce greenhouse gas emissions. Performance Standard 3 states that the client will avoid generation of hazardous and non-hazardous materials, but where waste cannot be avoided, waste arisings will be reduced, recovered or reused before subjecting the materials to treatment and disposal in an environmental sound manner. Waste disposal should be at sites operating to acceptable standards and, where this is not the case, consideration should be given to alternative disposal options, including the development of facilities on site. The use and production of hazardous waste should be avoided as far as is possible and, where this is not practicable, material will be controlled and minimised.
IFC PS3 Guidance Note: Resource Efficiency and Pollution Prevention (01 Jan 2012) (Ref. 18.7).	To aid in the interpretation of IFC Performance Standards, Guidance Notes relevant to each standard are also provided. Guidance Note 3 corresponds to Performance Standard 3 and outlines further details regarding the management of hazardous and non-hazardous wastes. With regard to hazardous waste, Guidance Note 3 lists International Conventions the client should refer to when reviewing components of materials and hazardous waste; these conventions are listed in the Bibliography of Guidance Note 3.

Complete.

18.1.1.3 National Waste Management Legislation

In addition to international legislation and standards, the Project will also be undertaken in accordance with relevant national waste management legislation and requirements. A list of national legislation relevant to waste management aspects of the Project is provided in Table 18.4.

As part of the Russian regulatory approvals process, the Project proponent is required to estimate the types and quantities of waste to be produced by the Project. Following initial approvals, it is necessary to prepare a list of waste types and limits which is submitted to the regulatory authorities, and following their approval a certificate will then be issued which specifies the Waste Generation Standards and Waste Disposal Limits for the Project.

Waste producers are obligated to keep proper records of the wastes generated, treated, and handed over to other parties, fill out government statistical reports, and pay an Adverse Environmental Impact Fee based on the approved waste types and quantities. Penalty fees are payable in the event that waste quantities exceed those approved prior to project commencement.

Table 18.4 Summary of National Waste Management Legislation

Legislation	Date / Reference Number	Relevance to the Project
Federal Law 'On Production and Domestic Wastes' (Ref. 18.8).	24 Mar 1998, No. 89-FZ	Federal Law No. 89-FZ outlines the legal basis for the management of production and consumption wastes for the purpose of preventing negative impacts upon human health and the environment. The law establishes environmental requirements and monitoring of waste management activities, economic regulations related to waste and discusses issues regarding waste ownership (i.e. the proprietor of waste). In addition, the law is supported by various secondary laws regarding the implementation of waste management requirements. The main principles of Federal Law No. 89-FZ include the following: Specifically designated federal executive authorities for waste management; Identification of the proprietor of waste; Licensing of hazardous waste management activities; Determining categories of hazardous waste; Certification procedures for hazardous waste; and Determining the basis for state inventory of hazardous waste. The law also discusses the distribution of waste management roles between federal executive bodies and corresponding bodies at the regional and municipal level.
Federal Law 'On Licensing Activities' (Ref. 18.9).	8 Aug 2001, No. 128-FZ	Federal Law No. 128-FZ determines the types of waste activities that are subject to licensing. It includes general provisions concerning issue of licenses, validity of licenses, etc.

Continued…

Legislation	Date / Reference Number	Relevance to the Project
Federal Law 'On the Protection of the Environment' (Ref. 18.10).	30 Dec 2008, No. 309-FZ	Federal Law No. 309-FZ includes a list of features used to categorise industrial facilities as hazardous industrial facilities. This list outlines properties of hazardous substances that may be received, used, processed, produced, stored, transported or destroyed by a hazardous industrial facility, as well as toxic substances and environmentally hazardous substances. Operational conditions of equipment employed at hazardous industrial facilities in relation to pressure and water-heating temperatures are also discussed. The list further summarises transport mechanisms (i.e. stationary lifting mechanisms, escalators, cableways or funicular railways), production of molten ferrous and non-ferrous metals and alloys and conduction of mining, mineral-enrichment and underground operations used by hazardous industrial facilities.
Government Enactment 'On the adoption of procedure for development and adoption of environmental standards for emission and discharge of polluting substances into the environment, limits for natural resources' use and waste disposal' (Ref. 18.11).	3 Aug 1992, No. 545	Environmental standards for emission and discharge of polluting substances into the natural environment, the maximum use of natural resources and waste disposal limits are set for specific enterprises, institutions, organisations and the Ministry of Natural Resources and Environment of the Russian Federation by the Health and Welfare supervisory authorities, in accordance with their competence. Documents specifying the normative values are developed by specific enterprises, institutions and organisations. The adopted procedure therein lost force to the extent it is applicable to development and adoption of limits for waste disposal.

Continued…

Legislation	Date / Reference Number	Relevance to the Project
Government Enactment 'On adoption of procedure for defining payment and its limits for environmental pollution, waste disposal and other harmful impacts' (Ref. 18.12).	28 Aug 1992, No. 632	The adopted procedure applies to enterprises, institutions, organisations, foreign legal and physical entities that perform any kinds of activities in the territory of the Russian Federation related to the nature of use. It stipulates charging for emission and discharge of pollutants into the atmosphere and surface or subsurface water bodies, waste disposal and other harmful impacts. Basic standard fee rates are set for impacts within permissible or tentatively agreed norms. They are specific to every type of pollutant, waste or harmful impact and are related to the degree of their hazard for the natural environment and human health.
Government Enactment 'On the state registration of potentially hazardous chemical and biological substances' (Ref. 18.13).	12 Nov 1992, No. 869	The State Registration of Potentially Hazardous Chemical and Biological Substances applies to potentially hazardous chemical and biological substances of natural and artificial origin produced in the territory of the Russian Federation and purchased abroad for national economy and household use. The purpose of the State Registration is to protect human health and the environment from harmful impacts associated with these substances. In addition, it discusses the prevention of adverse consequences resulting from their application.

Continued…

Legislation	Date / Reference Number	Relevance to the Project
Government Enactment 'On amendments to administrative regulations by the federal service for environmental, technological and nuclear supervision for execution of the state function of issuing permits for emissions, discharges of polluting substances into the environment adopted by Order of the Ministry of Natural Resources and Environment of the Russian Federation' (Ref. 18.14).	25 Feb 2010, No. 173	The adopted procedure establishes requirements for the preparation and submission of documents regarding maximum permissible disposal levels for specific kinds of wastes in line with the environmental situation of the territory where these sites are located.
Ministerial Order 'On the adoption of criteria for waste identification by class of environmental hazard' (Ref. 18.15).	15 Jun 2001, No. 511	Criteria for waste identification by class of environmental hazard are intended for individual project owners and legal entities and define which activities cause the generation of environmentally hazardous wastes. In addition, the Criteria also confirm identification of these wastes as a certain class of environmental hazard. Class hazard are determined by the degree of potential adverse environmental impact (direct or indirect) in accordance with the Criteria presented within this documentation.
Ministerial Order 'On the adoption of hazardous waste passport or datasheet' (Ref. 18.16).	2 Dec 2002, No. 785	This order denotes hazardous waste documentation and instruction on completion of waste management forms.

Continued…

Legislation	Date / Reference Number	Relevance to the Project
Ministerial Order 'On the adoption of the Federal Classificatory Catalogue of Wastes' (Ref. 18.17).	2 Dec 2002, No. 786	The Order approves the Federal Waste Classification Catalogue, including waste hazard class. Waste is classified using a 13-digit code, with each digit relating to a specific property of the waste; the last digit is used for coding waste hazard classes.
Ministerial Order 'Supplements to the Federal Waste Classificatory Catalogue' (Ref. 18.18).	30 Jul 2003, No.663	Updates Ministerial Order No. 786 dated 2 Dec 2002 on the adoption of the Federal Classificatory Catalogue of Wastes.
Ministerial Order 'On the procedures for development and adoption of standards for waste generation and limits of their disposal' (Ref. 18.19).	25 Feb 2010, No. 50	This Order establishes requirements for preparation and submission of documents for the adoption of the maximum permissible levels of a specific kind of wastes.
Ministerial Order 'On the adoption of statistical instruments for organising the monitoring of domestic waste production' (Ref. 18.20)	28 Jan 2011, No. 17	The Order comprises of the adoption of the annual State Statistical Monitoring Form No. 2 – TP (Wastes) "Information on generation, use, neutralisation, transportation and disposal of production and domestic wastes". The Ministry of Natural Resources and Environment requires waste data collection, data aggregating and storage, which is collected in accordance with this form.
Ministerial Order 'On the adoption of accounting procedures in relation to waste management' (Ref. 18.21)	1 Sep 2011, No. 721	The accounting procedure in relation to waste management establishes requirements to be carried out by legal entities and individual company owners in relation to generated, used, neutralised, transferred from third parties or received from third parties and disposed wastes. The procedure does not apply to accounting in relation to radioactive, biological, medicinal wastes, harmful emissions to harmful discharge into water bodies.

Continued...

Legislation	Date / Reference Number	Relevance to the Project
Order 'On the adoption of methodological instructive regulations for development of projects for waste generation and disposal limits' (Ref. 18.22)	19 Oct 2007, No. 703	These methodical instructive regulations are intended for individual project owners and legal entities that perform activities related to waste management. They are also relevant for territorial branches of the Federal service for environmental, technological and nuclear supervision that make a decision on adoption of waste generation and disposal limits. The regulations determine a unified approach to development and general requirements to the contents and execution of projects for waste generation and disposal limits but do not apply to radioactive waste.
Book of per-unit indicators of production and consumption wastes' generation (Ref. 18.23)	21 Jun 1999	The Book of per-unit indicators of production and domestic wastes' generation includes statistical-average and industry-average values of per-unit indicators of the main production wastes' generation and per-unit indicators of the most common production and domestic wastes' generation. The Book is intended for use by the federal, regional, and local authorities as a reference guide for execution of environmental control, checking reliability of data presented in documents prepared by enterprises for establishing waste generation and disposal limits. The Book may be used by any legal entities for control over internal production wastes' generation, and justification of limits for wastes' disposal. Data on per-unit indicators presented therein are recommended to be applied as standards, because many of the values are defined as statistical-average and industry-average with neutralisation of differences between production facilities by the management level and the quality of raw materials processed.
Methodological recommendations for assessment of volumes of domestic and production wastes' generation (NITsPURO) (Ref. 18.24).	25 Jun 2003	The Methodological recommendations set forth possible methods for assessment of volumes of domestic and production wastes' generation, a formula of evaluation of the most common wastes and the main reference data for such evaluation. The Methodological recommendations may be used as a reference guide by commercial entities during preparation of waste generation and disposal limits. The presented recommendations do not exclude a possibility to use other methods and other information sources for these purposes.

Continued…

Legislation	Date / Reference Number	Relevance to the Project
Guidelines and procedures for charging environmental pollution payment (Ref. 18.25)	26 Jan 1993	The Guidelines and procedures specify application of the basic norms of payment for emissions, discharges of polluting substances into the natural environment, waste disposal, coefficients with regard to environmental factors and payment indexation rates in connection with price level changes and setting the maximum size of payment for environmental pollution, waste disposal and other adverse impacts. Adopted as per Resolution by the Government of the Russian Federation of August 28, 1992 No. 632 and put into effect since January 1, 1993. Payment for pollution of the natural environment is charged from users (production facilities, institutions, organisations and other legal entities regardless of their business legal structures and forms of incorporation), which exercise the right to perform production-commercial activities in the territory of the Russian Federation.

Complete.

18.1.1.4 Russian Federal Waste Classification Catalogue

In accordance with Federal Law, Russia classifies waste based on its origin, physical state, hazardous properties and class of environmental hazard, in accordance with criteria established by the Federal Executive Authority responsible for regulating environmental protection.

In Russia, the Ministry of Natural Resources and Environment (MNRE) is responsible for monitoring and enforcing waste classification, as well as managing waste management activities including data collection and reporting. The MNRE has developed and approved criteria for classifying waste according to the Federal Waste Classification Catalogue (FWCC), approved by Decree Order No. 786 and No.663 (see Table 18.4).

The FWCC provides each class of waste with a thirteen digit code. The thirteenth digit in the code indicates the class of hazard to the environment. There are five hazard classes, whereby Hazard Class I wastes are deemed the most hazardous and Hazard Class V wastes are considered to be practically non-hazardous. Hazard Class 0 relates to wastes for which the class of hazard has not been established.

Wastes categorised as Hazard Classes I to IV require a license to be granted by the MNRE for the proposed waste management activity. Table 18.5 provides example waste streams for each of the five Hazard Classes, in accordance with the FWCC.

Table 18.5 Russian Hazardous Waste Classification System

Hazard Class	Hazard Description	Waste Stream Examples	International Definition
0	Hazard Class not identified	N/A	N/A
I	Extremely hazardous	Exhausted and waste mercury-vapour lamps, luminescent mercury-containing tubes, activated carbon contaminated with mercury sulphide, etc.	Hazardous
II	High hazard	Sulphuric battery acid, intact lead batteries with undrained battery acid, halogenated solvents, concentrated acids and alkalines, etc.	Hazardous
III	Medium hazard	Unsorted lead batteries with drained battery acid, ethylene glycol wastes, ethylene glycol residues, wastewater treatment sediments, filter and absorption waste mass, waste industrial oils, pipeline slurry, bilge water, waste filters (transmission and motor), non-halogenated solvents, etc.	Hazardous

Continued...

Hazard Class	Hazard Description	Waste Stream Examples	International Definition
IV	Low hazard	Cleaning material contaminated with oil, sand contaminated with oil, bitumen coating waste, solid asphalt, construction debris, welding slag, paint materials, medical wastes, ashes and slag from heat waste treatment, drilling waste, operational ship waste (domestic trash), etc.	Hazardous or Non-hazardous (depending on composition)
V	Practically non-hazardous	Unsorted ferrous steel scrap, unsorted aluminium scrap, unsorted kitchen and catering food waste, concrete products (grit), building grit, uncontaminated packaging waste (i.e. paper, cardboard and plastic), glass cullet waste (excluding cathode ray tubes and luminescent lamps), non-treated wood waste, uncontaminated soil, construction debris etc.	Hazardous or Non-hazardous (depending on composition)

Complete.

If wastes are generated that are classed according to the FWCC as Hazard Class "0" (i.e. Hazard Class not identified) then identification of the Hazard Class is based on the document 'Criteria for Classifying Hazardous Waste as Hazardous to the Environment', approved by Order of the MNRE of Russia No.11. The Hazard Classes for such wastes are determined by the 'Calculation of the Class of Hazard 2.1' (c) INTEGRAL 2001-2003 software.

18.1.1.5 Regional and Local Waste Management Legislation

There are no regional or local waste management regulations which are relevant to this assessment.

18.2 Baseline Conditions

The Strategic Action Plan (SAP) for the Environmental Protection and Rehabilitation of the Black Sea (adopted in Sofia, Bulgaria, 17 April 2009) (Ref. 18.26) includes a number of provisions related to waste management.

Waste management itself is not one of the priority transboundary problems identified in the SAP, although oil pollution is recognised as an aspect of chemical pollution, which is one of the four priority problems.

The SAP presents Ecosystem Quality Objectives (EcoQOs), which are statements that reflect how stakeholders would like the state of the Black Sea to be over the long term, based on a resolution of priority problems identified in the Transboundary Diagnostic Analysis. Each EcoQO is assigned a number of management targets that address the immediate, underlying and root causes of the concern areas. For regional level interventions, the Black Sea coastal states and the international partners shall work collectively to take the required steps to fulfil those interventions. National level supporting interventions will be the responsibility of individual states.

Several of these management targets relates to waste management:

- Target (18): Amend national waste strategies and/or national coastal zone management plans with the aim of coastal and marine litter minimisation;
- Target (19): Develop regional and national marine litter monitoring and assessment methodologies on the basis of common research approaches, evaluation criteria and reporting requirements;
- Target 20: Promote / develop investment projects within national strategies / local plans to engineer, construct and install new solid waste recycling facilities, landfill sites and incineration plants, complying with BAT regulations;
- Target (60): Provide adequate port reception facilities for ship-generated wastes according to MARPOL 73/78, Annex I, IV, V;
- Target (61): Establish a harmonised fee / cost recovery system on ship-generated waste;
- Target (62): Develop systems for the identification of illegal pollution sources from vessels and off-shore installations; and
- Target (63): Develop / establish a harmonised enforcement system in cases of illegal discharges from vessels and off-shore installations, including technical means and fines.

The SAP presents indicators for each target, although a status update has not been published by the Black Sea Commission.

18.2.1.1 Existing Waste Management Arrangements

Table 18.6 outlines some of the existing waste management facilities in the vicinity of the Project (including waste types and capacity). The EPC contractor carrying out the works for the Project will be likely to use one or more of these facilities.

Site visits to two key waste facilities were undertaken in 2013 by South Stream Transport. Representatives visited the ECOBIO Waste Treatment Facility, near Krymsk, and the Alfa Landfill Facility, near Anapa, on the 18 April 2013, to evaluate these facilities for their suitability to manage Project wastes. South Stream Transport's observations are summarised in Table 18.6 below and have been used as part of the assessment in Section 18.4.

Table 18.6 Waste Management Facilities in the Vicinity of the Project

Name	Location	Types of Waste which the Facility is Licensed to Accept	Licenced capacity	Site Observations
Alfa Landfill Facility	Anapa, Krasnodar	Class IV and V: Non-hazardous soils, welding electrodes, crushed stone, used sands, plastic containers, cardboard, tree stumps	140,000 tonnes per year.	The landfill does not appear to be an engineered landfill and has no obvious means of leachate or gas management, or any effective lining or capping systems. The landfill is planned to close in 2016 (a closure plan is reported to be in place) by which time a new engineered landfill is planned to be in operation: the location for this new landfill has yet to be confirmed.
Research & Production Enterprise EcoBio LLC	Nizhnebakansky, Krasnodar	Class III: Oily sludges, used oils, oily rags, sand contaminated with oils, oily residues from separators Class IV: Waste drilling sludge, waste drilling fluid, slurry from treatment plants, oily spent carbon filters	Facility has confirmed capacity to accept up to 100,000 tonnes of waste drilling sludge as well as smaller quantities of other oil-contaminated wastes.	The site is located in a former quarry and is licenced to backfill the quarry with bioremediated class III waste – drilling cuttings or polluted soil. The site has 3 main treatment cells, and a number of disposal areas. The treatment cells are concrete lined, and are sequentially filled with contaminated material which undergoes bioremediation prior to final disposal. The site is securely fenced, internal access roads are in good condition, and an environmental monitoring regime is in place. Site observations indicate that the facility is likely to be operating in accordance with good international industry practice.

Continued…

Name	Location	Types of Waste which the Facility is Licensed to Accept	Licenced capacity	Site Observations
ACh Enppi SIRIUS	Temryuk, Krasnodar	Class I: mercury lamps, fluorescent tubes containing mercury waste and marriage Class II hazards: Lead-acid accumulators waste, intact with no drained electrolyte Class III: Oily sludges, used oils, oily filters, oily rags, sand contaminated with oils, oily residues from separators Class IV: Waste drilling sludge, waste drilling fluid, slurry from treatment plants, oily spent carbon filters	Licence does not specify capacity – facility has confirmed capacity to accept up to 100,000 tonnes of waste drilling sludge.	Facility not visited.
Mercury Safety Agency LLC	Abinskiy District, Krasnodar	Class I: Mercury containing lamps and tubes Class III: Oily sludges, used oils, oily filters, oily rags, sand contaminated with oils, oily residues from separators Class IV: Contaminated textiles (waste protective clothing), leather work footwear, waste drilling sludge, waste drilling fluid, waste paint resources Class V: Non-hazardous soils, plastic containers	Licence does not specify capacity.	Facility not visited.

Complete.

Existing Port Waste Management Facilities

Existing waste management facilities at Temryuk and Novorossiysk Ports will be used for the management of wastes generated by the Project's offshore activities.

The Ports of Temryuk and Novorossiysk have arrangements in place with port waste management companies to provide waste reception facilities for vessels using the port, and these contractors include:

- Marine Consulting LLC;
- Mortrans-Service NHB LLC;
- SPC Crocus LLC; and
- Krymskvtorsyryo LLC.

The contractor managing the vessels used for the Project will arrange with one or more of these port waste management companies to receive vessel waste, depending on which port is used, and the port waste management company will be responsible for the onward transportation and management of the vessel waste, using the existing regional disposal and treatment facilities as described in Table 18.3. Further inspection of the waste management facilities will be undertaken prior to completion of waste management contracts, i.e. to confirm that sufficient capacities are available to manage Project wastes legally and safely, in accordance with the requirements set out in Section 18.5 and the suite of Construction and Operational Phase Management Plans (refer to **Chapter 22 Environmental and Social Management**).

18.3 Methodology and Assessment Criteria

In contrast to other environmental and social technical disciplines in this ESIA Report, this chapter describes the estimated waste arisings, but does not assess the significance of these impacts in the absence of mitigation, since waste storage, management and disposal is considered part of the Project design, and as such it is not realistic to consider any situation in which no mitigation would be carried out. The mitigation section therefore describes the measures that will be adopted to manage the wastes generated by the project (including identifying potentially suitable facilities), and the significance of residual impacts following mitigation is then assessed.

Impact magnitudes for the residual impacts following mitigation are assessed based on:

- The hazardous properties (physical, chemical and biological) of the relevant waste stream; and
- The availability of suitable waste management facilities, taking into consideration: (a) the volume of waste produced, (b) the capacity of the identified waste management facilities for managing the waste in compliance with relevant guidelines, and (c) the degree of certainty in the availability of these facilities.

Table 18.7 presents a matrix that compares waste type and the availability of suitable waste management facilities, to determine impact magnitude (negligible, low, moderate, and high).

Table 18.7 Magnitude of Waste Impacts

Waste Management Option	Type of Waste		
	Inert	Non-hazardous	Hazardous
Suitable facilities or outlets available with sufficient capacity to manage the quantities of wastes generated	Negligible	Negligible	Low
Suitable facilities or outlets available but capacity to accept waste from project may be constrained due to size of facility or distance from site	Low	Moderate	Moderate
Facilities are unavailable or unsuitable; or means of management is uncertain.	Moderate	Moderate	High

Since receptor sensitivity was assumed to be constant, the rankings (negligible, low, moderate, and high) delivered by the impact magnitude matrix in Table 18.7 also reflect "impact significance"; the definitions of significance detailed in **Chapter 3 Impact Assessment Methodology** are therefore applicable.

The definition of hazardous waste includes any wastes specifically designated as hazardous within applicable legislative requirements (e.g. hazardous wastes listed under the Russian Federal Waste Classification Catalogue (FWCC)). For the purposes of this ESIA Report, hazardous wastes are also defined in terms of the International Finance Corporation (IFC) General Environmental, Health and Safety (EHS) Guidelines for Waste Management (Ref. 18.7), i.e. wastes that share the properties of a hazardous material (e.g. ignitability, corrosivity, reactivity, or toxicity), or other physical, chemical, or biological characteristics that may pose a potential risk to human health or the environment if improperly managed. Inert waste is not defined in the FWCC but is recognised in IFC guidelines and is defined in the EU Landfill Directive such that *"waste is considered inert if:*

1. *It does not undergo any significant physical, chemical or biological transformations;*
2. *It does not dissolve, burn or otherwise physically or chemically react, biodegrade or adversely affect other matter with which it comes into contact in a way likely to give rise to environmental pollution or harm to human health; and*
3. *Its total leachability and pollutant content and the ecotoxicity of its leachate are insignificant and, in particular, do not endanger the quality of any surface water or groundwater."*

In practice, inert waste typically comprises surplus excavated soil and rock, and waste construction materials such as brick and concrete.

Table 18.8 below presents a comparison of the FWCC hazardous waste classifications against IFC and EU classifications of hazardous, non-hazardous and inert waste.

Table 18.8 Comparison of FWCC Hazard Codes with IFC and EU Classifications

FWCC Hazard Class	Example of Waste Types	Equivalent IFC or EU category
Hazard Class I (extremely hazardous)	Exhausted and waste mercury-vapour lamps, luminescent mercury-containing tubes, activated carbon contaminated with mercury sulphide, etc.	Hazardous
Hazard Class II (highly hazardous)	Sulphuric battery acid, intact lead batteries with undrained battery acid, halogenated solvents, concentrated acids and alkalines, etc.	Hazardous
Hazard Class III (moderately hazardous)	Unsorted lead batteries with drained battery acid, ethylene glycol wastes, ethylene glycol residues, wastewater treatment sediments, filter and absorption waste mass, waste industrial oils, pipeline slurry, bilge water, waste filters (transmission and motor), non-halogenated solvents, etc.	Hazardous (but includes some non-hazardous categories, e.g. many wastewater sludges)
Hazard Class IV (low hazard)	Cleaning material contaminated with oil, sand contaminated with oil, bitumen coating waste, solid asphalt, construction debris, welding slag, paint materials, medical wastes, ashes and slag from heat waste treatment, drilling waste, operational ship waste (domestic trash), etc.	Non-hazardous (but includes some hazardous categories, e.g. medical wastes)
Hazard Class V (slight hazard)	Unsorted ferrous steel scrap, unsorted aluminium scrap, unsorted kitchen and catering food waste, concrete products (grit), building grit, uncontaminated packaging waste (i.e. paper, cardboard and plastic of lost useful quality), glass cullet waste (excluding cathode ray tubes and luminescent lamps), non-treated wood waste, uncontaminated soil, construction debris of lost useful quality, etc.	Non-hazardous or inert

Suitable facilities are those which are licensed by the relevant regulatory authorities and (in the case of hazardous waste sites) are operating in accordance with GIIP[1]. The operational capabilities and licensing status of these facilities will be confirmed.

No specific waste study area was defined for the purpose of this chapter. Rather the assessment considered waste arising within the established Project Area boundaries and Associated Activities defined in **Chapter 1 Introduction** of this ESIA Report.

18.4 Project Wastes

The Project has the potential to give rise to a number of wastes during the Construction and Pre-Commissioning, Operational and Decommissioning phases.

The potential impacts arising from the management of wastes include:

- Impacts on human health and on ecological receptors from releases of waste to air, water or land; and
- Nuisance, including litter, odour, dust and vermin.

Impacts can arise throughout the waste management supply chain and therefore the generation, storage, collection and transport, reuse, recycling, recovery, treatment and disposal of waste are all taken into account when assessing impacts.

The impacts of wastes associated with the decommissioning phase of the Project have not been assessed in detail as the available waste facilities and disposal technologies are likely to change significantly over the 50 year life of the Project. For the decommissioning phase, the assessment is limited to identifying the types and approximate quantity of waste generated.

18.4.1 Wastes Arising from the Project

Generally, wastes can be categorised into three main types in terms of their basic properties:

- Inert waste - e.g. surplus excavated soil and rock, rubble and bricks;
- Non-hazardous waste - e.g. food waste, packaging waste and other general wastes from construction, businesses, industry and households; and
- Hazardous waste - e.g. oils, certain types of healthcare waste, batteries and other waste exhibiting hazardous properties.

Waste is considered to be inert if it does not undergo any significant physical, chemical or biological transformations; and does not dissolve, burn or otherwise physically or chemically react, biodegrade or adversely affect other matter with which it comes into contact in a way

[1] In these cases, it is assumed that residual impacts due to releases from these facilities are addressed as part of the facilities pre-existing licensing regime and are therefore not assessed within this ESIA.

likely to give rise to environmental pollution or harm to human health[2]. Certain categories of municipal, industrial and construction waste (e.g. brick rubble) may be considered inert.

Individual jurisdictions typically have more detailed waste classification schemes. Table 18.8 above provides more specific details on the classification of waste based on the Russian FWCC.

The main types of waste expected to arise from the Construction and Pre-Commissioning Phase and Operational Phase of the Project are described below.

18.4.1.1 Construction and Pre-Commissioning

Onshore

The main landfall or onshore Pipeline Construction and Pre-Commissioning Phase works to be undertaken as part of the Project will comprise:

- Clearance and bulk earthworks associated with establishment of the Pipeline construction corridor;
- Trenching and installation of the Pipeline;
- Establishment of the microtunnels;
- Construction and installation of temporary construction sites;
- Construction of the landfall facilities; and
- Types and quantities of waste likely to be produced have been calculated and are presented (using the Russian FWCC codes) in Table 18.9. Further details are provided in the following paragraphs.

Waste from Workforce

Municipal waste will be primarily generated by construction workers operating across all of the identified activities and will be a function of the size of workforce. It will be generated from office operations and site welfare facilities (e.g. canteens, etc.). It is assumed that there will be no accommodation camps, and hence waste will only be generated by the workforce during the course of the working day.

This waste will comprise the following:

- Paper and cardboard;
- Glass;
- Biodegradable kitchen and canteen waste;
- Plastics;
- Metals (e.g. drinks cans); and

[2] Article 2(e) of the EU Landfill Directive (1999/31/EC)

- General mixed waste.

In addition to the above, the Russian National EIA has calculated figures for the amount of waste textiles (i.e. protective clothing) and worn footwear that is anticipated to be produced during the onshore Construction and Pre-Commissioning Phase.

Waste from Construction Activities

Non-hazardous construction waste is likely to consist primarily of:

- Waste from vegetation clearance along the Pipeline construction corridor and landfill facility;
- Surplus excavated spoil from the Pipeline construction corridor and landfill facility;
- Material excavated from the microtunnelling operations;
- Packaging (paper, plastic, metal and wood) from construction materials received at the construction sites;
- Welding waste and metal swarf resulting from jointing of pipeline sections;
- Surplus, damaged and out-of-specification construction materials, including concrete and other inert materials; and
- Empty gas bottles and canisters.

During ground preparation works, excavated spoil will be generated by a number of construction activities. The preparation of the site for the construction of the landfall facilities, for example, will require extensive earthworks. A portion of excavated material will be reused (e.g. to prepare the development platform) and therefore will not be considered waste requiring disposal. Approximately 250,000 m3 (or 375,000 tonnes) of spoil is considered unusable and will be exported from the site.

A number of onshore temporary facilities will be required (e.g. for storage of pipe, equipment and materials; spoil storage areas; parking space; mess and welfare facilities, etc.). It is estimated that approximately 59 ha of land will be required for these facilities. The establishment of these temporary construction areas will involve the stripping of topsoil. Some areas of the construction corridor may also be benched or graded to eliminate irregularities, large stones, tree stumps and other features. The majority of this material will be temporarily stored and re-used for reinstatement.

The landfall section of the Project will use a combination of open-cut and trenchless techniques (i.e. microtunnelling) for pipeline construction. It will not be possible to return all the originally excavated trench spoil (due to the volume of space taken up by the installed pipelines and removal of rock or other unsuitable backfill material) and the surplus will either be disposed of or incorporated into landscaping activities.

The surplus excavation spoil from construction of the microtunnels and entry shafts will require incorporation into the works or off-site disposal.

Other construction wastes will include waste metal (e.g. from damaged pipe sections or as swarf from preparation of joints) and welding stubs. Waste cardboard packaging will mainly be generated from the cardboard packaging used for delivering welding electrodes.

Following completion of pre-commissioning tests, temporary construction areas will be restored. This will include the removal of temporary roads and hardstanding (e.g. macadam base used in the temporary access roads) and a certain amount of uncontaminated waste sand and crushed stone will be produced.

Hazardous Waste

Hazardous wastes include those identified as either potentially harmful to human health or the environment, typically with the potential to lead to long term contamination. It is likely that the majority of these wastes will arise during the operation of construction vehicles, plant and equipment, and utilisation of potentially hazardous raw materials. The following hazardous wastes may be produced as a result of construction activities.

- Hazardous waste from maintenance of construction plant, including:
  - Oil filters;
  - Hydraulic oil;
  - Anti-freeze; and
  - Batteries.
- Sludge from cleaning out refuelling tanks;
- Packaging with residues of hazardous substances (e.g. paints, solvents or coatings);
- Fluorescent tubes;
- Oily residues or spent filters from surface water treatment system; and
- Clinical wastes from first aid facilities or on-site clinics.

A number of onshore temporary facilities will be required throughout the Construction and Pre-Commissioning Phase. These areas will be lit using various types of lighting and will most likely include the use of fluorescent tubes. Fluorescent tubes are categorised as extremely hazardous (Class I) by the FWCC.

The treatment of surface water runoff from the construction sites will give rise to a number of wastes (e.g. sludge or spent filters) potentially contaminated with oil that will require disposal.

Table 18.9 Estimated Types and Volumes of Waste during Onshore Construction and Pre-Commissioning Activities

Description of Waste Type	Source	FWCC code	FWCC Hazard Class	Equivalent EWC Code (* = hazardous)	Quantity (tonnes)
Fluorescent tubes and other mercury-containing lamps	Lighting of construction sites and industrial premises	353 301 00 13 01 1	1	20 01 21*	<1
Oily wastes, including: - waste oils, filters, oily rags, spill response waste, etc.	Maintenance of mobile plant, cleaning of diesel tanks, spill cleaning material, etc.	546 015 01 04 03 3 541 002 05 02 03 3 920 000 00 00 00 0 549 027 01 01 03 3 314 023 03 04 03 3 546 002 00 06 03 3	3	13 02 05* 13 01 10* 16 01 07*	1 – 10
Waste protective clothing and worn work footwear	Staff clothing and footwear replacement	582 000 00 00 00 0 147 006 01 13 00 4	4	20 03 01	1 - 10
Waste drilling sludge	Microtunnelling operations	314 000 00 00 00 0	4	17 05 04 (inert)	98,000
Waste paint resources	Onshore pipeline	555 000 00 00 00 0	4	15 01 10*	<1
Sludge from wastewater treatment	Solids from treatment of surface water run-off and settlement of wash waters	943 000 00 00 00 0	4	13 05 01*	100 - 1000
Mixed municipal waste	Mixed waste from welfare, mess and office facilities	912 004 00 01 00 4	4	20 03 01	1 - 10

Continued…

Description of Waste Type	Source	FWCC code	FWCC Hazard Class	Equivalent EWC Code (* = hazardous)	Quantity (tonnes)
Scrap metal	Cutting of pipelines, etc.	351 301 00 01 99 5	5	17 04 07	10 - 100
Uncontaminated soil	Surplus excavated material	314 011 00 08 99 5	5	17 05 04 (inert)	375,000
Welding waste	Waste from pipe welding	351 216 01 01 99 5	5	12 01 13	<1
Crushed stone	Earthworks, removal of temporary construction areas and hardstanding etc.	314 009 02 01 99 5	5	17 05 04 (inert)	30,400
Uncontaminated sand	Earthworks, removal of temporary construction areas and hardstanding	314 023 01 01 99 5	5	17 05 04 (inert)	26,600
Plastic	Waste from mess and office facilities	571 018 00 13 00 5	5	15 01 02	1 - 10
Cardboard	Waste card packaging from construction materials	187 102 02 01 00 5	5	15 01 01	<1
Tree stumps	Preparatory works	173 001 02 01 00 5	5	02 01 07	10 - 100
Waste (slurry) from cesspools and domestic sewage	Chemical toilets and cess pits for workforce	951 000 00 00 00 0	4	19 08 05	100 - 1000

Complete.

Nearshore and Offshore Sections

The main activities which have the potential to generate waste within the nearshore and offshore sections during the Construction and Pre-Commissioning Phase are:

- Activities of pipe-lay vessels and regular deliveries of construction materials;
- Activities of dredging vessels and support craft;
- Assembly (mounting / joining / pulling) of the pipelines; and
- Activities of the crew involved in the operation of Project vessels and workers associated with the maintenance of the vessels.

Types and quantities of waste likely to be produced have been calculated and are summarised (using the Russian FWCC codes) in Table 18.10. Further details are provided in the following paragraphs.

Waste from Workforce

Municipal waste will be generated by construction workers and crew of all vessels and is categorised as 'garbage' under MARPOL Annex V. This type of waste will include general mixed waste, food waste and recyclable waste.

The workforce and crew aboard vessels will also generate sewage, which is regulated under MARPOL Annex IV.

Waste from Construction Activities

Dredging will generate a certain amount of dredged spoil. From the microtunnel exit point, the pipelines will be buried in trenches to a depth of approximately 2.5 to 3 m for a distance of approximately 170 m. The excavated material will be temporarily stored before being dredged back up and used as backfill following pipeline installation, and hence is not considered waste.

In addition to the above, there will be a requirement for some levelling and flattening of the seabed in the offshore section, prior to installation of the Pipeline. The resulting dredged material (estimated as 42,500 m^3) will require disposal at a designated offshore disposal area.

Pipeline assembling activities will generate wastes associated with the jointing and installation of pipeline sections including stubs of welding electrodes, spent polishing bodies and metal swarf.

The construction materials and equipment used may require the disposal of associated packaging elements, typically a mixture of paper and cardboard, wood and plastic waste. Due to the scale of equipment used in the pipe-laying, some packaging waste items may be relatively large in dimension.

Hazardous Waste

A number of hazardous wastes may potentially be generated as a result of the nearshore and offshore Construction and Pre-Commissioning works, including:

- Waste oils and batteries from maintenance of construction plant;
- Oily waste generated during normal operation of the vessels undertaking the works (e.g. oily sludges and bilge oil);
- Waste fluorescent tubes and other lamps containing mercury from construction vessels; and
- Packaging with residues of hazardous substances.

Clinical wastes may also be generated from medical facilities on-board the vessels.

Oily wastes will be generated by vessels as a result of fuel filtering, collection of oily slops from machinery spaces, and from oily bilge water. Oily wastes generated by vessels are controlled under MARPOL Annex I. The discharge of any oily sludge or slops is prohibited. Bilge water may be discharged following treatment by an oily water separation (OWS) system, provided such discharge is in compliance with the requirements of MARPOL Annex I and Russian regulations. In practice, the requirement under MARPOL Annex I for vessels to be "proceeding en route" when they discharge treated bilge water may preclude pipe lay vessels from treating and discharging any bilge water, since they will be almost stationary whilst pipe laying. The oily residue following treatment of bilge water through an OWS will be managed in the same waste as oily sludge or slops.

Order No.20 of the Russian Federal Fishery Agency (dated 18 January 2010) mandates that discharges into Russian territorial waters must not lead to the limit 0.05 mg/L oil content being exceeded at the control point (which is typically 500 m from the point of discharge). Vessel OWS are generally designed to meet the MARPOL discharge requirements of 15 parts per million of oil (approximately equivalent to 12 mg/L) and it is unlikely that the discharge from a vessel's OWS would result in non-compliance at the control point, due to the effect of dilution in the receiving water. There is therefore unlikely to be any constraints on the discharge of treated bilgewater over and above those outlined in MARPOL Annex I.

Discharge of hydro-testing and pipeline cleaning waters (during the Pre-Commissioning Phase) are discussed in **Chapter 8 Soils, Groundwater and Surface Water**. This process will require the use of monoethylene glycol (MEG) as a drying agent. Waste MEG will be collected and stored in tanks on support vessels prior to onshore disposal.

Table 18.10 Estimated Types and Volumes of Waste during Offshore Construction and Pre-Commissioning Activities

Description of Waste Type	Source	FWCC Code	Hazard Class	Equivalent EWC Code (* = hazardous)	Quantity (tonnes)
Fluorescent tubes and other mercury-containing lamps	Lighting on board vessels (MARPOL Annex V waste)	353 301 00 13 01 1	1	12 01 01	<1
MARPOL Annex I oily wastes	Vessel operation, bilge water separation, etc.	546 002 00 06 03 3 546 003 00 04 03 3	3	13 04 03* 13 07 01*	100 - 1000
Mixed municipal waste	Mixed waste from welfare, mess and office facilities (MARPOL Annex V waste)	912 004 00 01 00 4	4	20 03 01	100 - 1000
Ash, slag and dust from on-board incineration	Fuel or waste burning (MARPOL Annex V waste)	313 000 00 00 00 0	4	19 01 12	100 - 1000
Medical waste	Staff medical treatment (MARPOL Annex V waste)	971 000 00 00 00 0	4	18 01 03*	<1
Glass scrap (excluding fluorescent tubes)	Waste from mess and office facilities (MARPOL Annex V waste)	314 008 02 01 99 5	5	15 01 07	100 - 1000

Continued…

Description of Waste Type	Source	FWCC Code	Hazard Class	Equivalent EWC Code (* = hazardous)	Quantity (tonnes)
Uncontaminated soil	Surplus excavated material (offshore)	314 011 00 08 99 5	5	17 05 06	55,250 (based on volume of 42,500 m3 with density of 1.3 t/m3)
Plastic	Waste from mess and office facilities (MARPOL Annex V waste)	571 018 00 13 00 5	5	15 01 02	1 - 10
Scrap metal	Cutting of pipelines, etc. (MARPOL Annex V waste)	351 301 00 01 99 5	5	12 01 01	13,000
Waste textiles	Staff clothing and footwear, etc. (MARPOL Annex V waste)	581 011 08 01 99 5	5	20 03 01	10 - 100
Biodegradable kitchen waste	Source-separated waste from mess facilities (MARPOL Annex V waste)	912 010 01 00 00 5	5	20 01 08	100 - 1000
Waste MEG	Hydro-testing and drying of Pipeline	590 000 00 00 00 0	3	16 01 14*	134
Sewage	Sewage generated by vessel crews and offshore construction workers (MARPOL Annex IV waste)	951 000 00 00 00 0	4	Not applicable	5,000 – 10,000

Complete.

18.4.1.2 Operational Phase

In comparison to the Construction and Pre-Commissioning Phase, it is anticipated that the Operational Phase of the Project will generate much smaller volumes of waste. As the Pipeline will carry dry gas, there is not expected to be any accumulation of scale or need for frequent cleaning.

Types and quantities of waste likely to be produced have been calculated and are presented (using the Russian FWCC codes) in Table 18.11. Further details are provided below.

Onshore

No waste will be routinely produced at the Landfall Facilities during normal operating conditions; they will be unmanned.

A very small amount of waste will be produced by staff undertaking maintenance activities (inspections, surveys, etc.). The Pipeline Right of Way (RoW) will be kept clear of deep-rooting trees by periodic inspection and clearance. This is not anticipated to give rise to any wastes that would require off-site management or disposal.

A small number of fluorescent tubes will require replacing each year at the Landfall Facilities during the Operational Phase of the Project. The treatment of surface water runoff from the permanent Landfall Facilities will give rise to a number of wastes (e.g. sludge or spent filters) potentially contaminated with oil that will require disposal.

Waste filters and waste lubricating oil will also be produced as a result of the routine maintenance of plant and machinery (but very low volumes are expected).

Nearshore and Offshore Sections

Normal operation of the Pipeline will not generate waste in the nearshore and offshore sections. Surveys will be carried out of critical areas on an annual basis using Remotely Operated Vehicles (ROV), and of the whole Pipeline every five years. These surveys will be carried out from vessels and the survey duration is expected to be five days for annual surveys and up to 30 days for the five-year surveys. The survey vessels will generate relatively small quantities of MARPOL Annex V (garbage) and MARPOL Annex I (oily waste).

In the event of emergency pipeline repair, vessels will need to be mobilised and welding may be required. The types of waste would be similar to those generated during construction, but since the frequency and severity of pipeline repair cannot be estimated, there is no information on the quantities of waste arising. Since the probability of failure is expected to be low, the likelihood of significant quantities of repair waste being generated is also expected to be low.

Table 18.11 Estimated Types and Volumes of Waste during Operational Phase (Onshore and Offshore)

Description of Waste Type	Source	FWCC code	Hazard Class	Equivalent EWC Code (* = hazardous)	Quantity (tpa)
Fluorescent tubes and other mercury-containing lamps	Lighting of landfall facilities and onboard vessels	353 301 00 13 01 1	1	20 01 21*	< 1
Oily wastes, including: -waste oils, filters, oily rags, spill response waste, etc.	Maintenance of mobile plant, spill cleaning material, etc.	541 002 05 02 03 3 549 027 01 01 03 3 314 023 03 04 03 3 546 002 00 06 03 3	3	13 01 10* 13 02 05*	< 1
Mixed municipal waste	Mixed waste from welfare, mess and office facilities	912 004 00 01 00 4	4	20 03 01	10 - 100
Waste paint resources	Onshore pipeline	555 000 00 00 00 0	4	15 01 10*	< 1
Sludge from wastewater treatment	Solids from treatment of surface water run-off and settlement of wash waters	943 000 00 00 00 0	4	13 05 01*	10 - 100
MARPOL Annex I oily wastes	Vessel operation, bilge water separation, etc.	546 002 00 06 03 3 546 003 00 04 03 3	3	13 04 03* 13 07 01*	10 - 100
Medical waste	Staff medical treatment	971 000 00 00 00 0	4	18 01 03*	< 1

Continued…

Description of Waste Type	Source	FWCC code	Hazard Class	Equivalent EWC Code (* = hazardous)	Quantity (tpa)
Biodegradable kitchen waste	Source-separated waste from mess facilities	912 010 01 00 00 5	5	20 01 08	< 1
Plastic	Waste from mess and office facilities	571 018 00 13 00 5	5	15 01 02	< 1
Glass scrap (excluding fluorescent tubes)	Waste from mess and office facilities	314 008 02 01 99 5	5	15 01 07	1 - 10
Sewage	Sewage generated by vessel crews and offshore construction workers (MARPOL Annex IV waste)	951 000 00 00 00 0	4	Not applicable	10 – 100

Complete.

18.4.1.3 Decommissioning

The expected service lifetime of the South Stream Offshore Pipeline is 50 years. Decommissioning of the Pipeline will be undertaken in accordance with the legislation prevailing at that time, in liaison with the relevant regulatory authorities.

Within the South Stream Offshore Pipeline timeframe of 50 years there may be changes to statutory decommissioning requirements, as well as advances in technology and knowledge. South Stream Transport will therefore utilise GIIP during all decommissioning activities.

The actual method used for decommissioning will not be determined until closer to the time of decommissioning, and in particular, no decision has been made on whether the subsea pipelines will be removed, or whether they will be decommissioned in situ (i.e. flushed, filled with water, sealed and left in position).

The main waste materials generated by decommissioning will be inert crushed stone (from demolition of structures and removal of hardstanding) and metal (from pipes and ancillary equipment). Depending on the techniques used, small quantities of waste associated with maintenance of the plant used for decommissioning may also be generated.

Table 18.12 Estimated Types and Volumes of Waste during Decommissioning Activities

Description of Waste Type	Source	FWCC Code	Hazard Class	Equivalent EWC Code (* = hazardous)	Quantity (tonnes)
Scrap metal	Removal of pipelines and associated equipment	351 301 00 01 99 5	5	12 01 01	Approximately 670,000 tonnes
Crushed stone	Demolition rubble from removal and crushing of concrete structures	314 009 02 01 99 5	5	17 05 04 (inert)	Approximately 30,000 tonnes
Mixed municipal waste	Mixed waste from welfare, mess and office facilities	912 004 00 01 00 4	4	20 03 01	1 - 10
Oily wastes, including: - waste oils, filters, oily rags, spill response waste, etc.	Maintenance of mobile plant, cleaning of diesel tanks, spill cleaning material, etc.	546 015 01 04 03 3 541 002 05 02 03 3 920 000 00 00 00 0 549 027 01 01 03 3 314 023 03 04 03 3 546 002 00 06 03 3	3	13 02 05* 13 01 10* 16 01 07*	1 – 10

18.5 Mitigation Measures

18.5.1 General Approach to Waste Management

The general approach to managing solid waste will be described in the integrated Waste Management Plan (WMP) drawn up by contractors. This provides guidance on:

- Waste minimisation and prevention;
- Identification and segregation of waste materials at source;
- Recycling and reuse of suitable materials; and
- Treatment and disposal of specific waste streams.

The integrated WMP will refer to vessel-specific Waste Management Plans which will include provisions for segregating waste on board, having secure areas for storage of hazardous waste and recycling or reuse where practicable.

The structure of the waste management elements of integrated WMP should follow the outline provided in Table 18.13.

Table 18.13 Recommended Contents of the Integrated Waste Management Plan (WMP)

Section	Content
Introduction	Background
	Plan Objectives
	Limitations of the WMP
	Layout of the WMP
Project Description	Project Details
	Nature of Project
	Location
Management Arrangements	Roles and Responsibilities
	WMP Distribution
	Instruction and Training
	Performance Indicators

Continued…

Section	Content
Waste Management Arrangements	Forecast Waste Arisings
	Record of Decisions Taken Regarding Waste Management
	Opportunities for Increasing Recycled Content
	Opportunities for Waste Minimisation
	Waste Storage and Segregation Arrangements
	Waste Management Arrangements
	Monitoring Arrangements

Complete.

All wastes will be managed in accordance with the applicable regulations and statutory obligations.

18.5.2 General Mitigation Measures

The general approach to mitigating impacts will be to use existing licensed facilities which comply with Russian regulations and the requirements of the IFC EHS Guidelines and Performance Standards. Prior to the start of construction works, contracts will be arranged with licensed organisations for the transport, reuse, recycling, treatment and final disposal of waste.

Pursuant to Article 19 of Federal Law № 89-FZ of 24 June 1998 ("On Production and Consumption Wastes"), waste producers are obligated to keep proper records of the wastes generated, treated, and handed over to other parties.

Waste recordkeeping shall be conducted in the locations where the wastes are generated, used, and treated, and also when transferring the wastes for recovery during the construction period. A designated Waste Control Officer will be responsible for keeping records on the wastes generated. The Waste Control Officer shall record this information, in the manner required by Order № 721 of 01 September 2011 ("On Approval of the Waste Management Recordkeeping Procedure"), in specially created tables that are used as the primary means of tracking waste transfer. The results presented in the tables will be used to fill out government statistical reports (№2-TP Wastes), and must also be used in the Adverse Environmental Impact Fee Calculations.

All personnel will receive a briefing on the waste management rules and principles whilst working onsite.

Temporary waste storage sites will meet the following requirements:

- Ensure that impacts on the environment are avoided or minimised as far as practicable;
- Ensure that there is no risk to human health as a result of hazardous waste;

- Prevent the loss of properties of recycled waste as a result of improper collection and storage;
- Minimise the risk of fire from stored waste;
- Prevent littering;
- Undertake a waste inventory and monitor waste management; and
- Ensure ease of waste disposal.

Appropriate skips, containers, bags and storage areas will be provided including the separate storage of hazardous and non-hazardous wastes and for the segregation, where viable, of materials suitable for reuse or recycling such as metals and plastics.

Transportation of waste will be carried out in compliance with environmental safety regulations, ensuring protection of the environment when handling loading and unloading operations and transportation. The Project will comply with the following requirements regarding transportation of wastes:

- Transportation of hazard Class IV or V wastes to industrial waste landfill will be carried out by specialised transport vehicles;
- Operations associated with loading, transportation and unloading of waste are mechanised where practicable, in order to avoid possible losses en route and environmental pollution;
- Each type of waste is subject to separate transportation so that wastes will not be mixed during transportation;
- All vehicles delivering waste will be accompanied by a consignment note which will be signed by the responsible person; and
- Once the waste has been delivered, the transport vehicles and containers that were used will be cleaned in a specially designated location.

The frequency of waste collections destined for the permanent disposal facilities (landfill) or recycling facilities will be determined by the following factors:

- Frequency of waste accumulation;
- Availability and capacity of the vessel (container) on site for temporary storage of waste; and
- Type and hazard class of the waste stream and its compatibility with other waste streams during storage and transportation.

18.5.3 Specific Mitigation Measures

The specific mitigation measures that will be adopted to ensure responsible management of the wastes arising from the Project are described below and summarised in Table 18.14.

18.5.3.1 Onshore

Waste from Workforce

All wastes arising will be stored, collected and transported off site in appropriate bins and containers. Only appropriately licensed companies will be employed for the transportation, recycling and disposal of waste. All waste will be managed using existing local facilities which are suitably licensed under Russian regulations.

During operation, the small quantities of waste generated will typically be transported back to the base office of the staff involved, from where it will be managed using local waste collection and disposal companies.

Waste from Construction Activities

Construction waste will be segregated at source and collected by suitably licensed local waste management contractors for recycling or disposal using existing local facilities which are suitably licensed under Russian Federation regulations.

It is considered that a portion of the waste generated within the Construction Phase has an opportunity to be reused or recycled. Examples include:

- Recycling of inert wastes, excavated materials and surplus concrete and concrete products into aggregates for use within the development, such as in parking areas or access roads;
- Recycling of metal off-cuts, surplus and damaged parts, including pipework, re-bar, cabling etc.; and
- Reuse, recycling or recovery of packaging wastes including wood, cardboard, paper and some plastics.

Where possible, contractors will be encouraged to reduce waste arisings and identify opportunities for reuse and recycling.

The location of waste storage areas will consider the nature of the materials to be stored within, the likelihood of disturbance through accidents, and control actions available in case of emergency (e.g. fire, flood).

General construction wastes will be managed with a local waste management contractor as per the local waste management market. The waste management contractor will be approved by Russian regulatory authorities to transport, reuse, recycle, treat and/or dispose of waste types that are generated. Appropriate skips, containers, bags and storage areas will be provided including the separate storage of hazardous and non-hazardous wastes and for the segregation, where viable, of materials suitable for reuse or recycling such as metals, plastics and paper and card.

As far as possible, surplus excavated spoil will be used for landscaping purposes within the construction corridor or will be used for site engineering or restoration purposes at a local landfill site, or as inert backfill at identified quarries.

Hazardous Waste

Hazardous materials, such as waste oils and oily wastes, will be contained in appropriate closed containers and drums. Liquid wastes will be stored in an area of secondary containment, designed to capture any waste that may leak from the containers, with a volume equal to at least 110% of the volume of the largest storage container. Hazardous wastes will be collected for treatment by a suitably licensed waste collector and treated at a facility which complies with the relevant local regulations and GIIP.

Waste fluorescent tubes will be stored separately in a designated container which is resistant to chemical degradation and prohibits accumulation of water. Transportation of such waste will be undertaken in accordance with strict guidelines to ensure integrity and eliminate the possibility of contamination of the environment. Waste fluorescent tubes will not be stored outdoors, in cardboard boxes, or on the ground, and will be removed at least every three months regardless of the amount accumulated.

Any small quantities of medical waste generated will be temporarily stored in fit-for-purpose containers in a closed room with restricted access for the staff until transport off site by an approved and licensed contractor to a dedicated clinical waste management facility.

18.5.3.2 Offshore

Waste from Workforce and Construction Activities

Offshore waste during both construction and operation will be managed in accordance with the requirements of MARPOL 73/78.

With respect to MARPOL Annex V waste, there will be no discharge of any garbage within 12 nautical miles of the coast. Outside this 12 nautical mile limit, food waste may be comminuted or ground prior to discharge, providing vessels are en route. MARPOL Annex V does not give any minimum speed as part of the definition of "en route".

Garbage will be stored on vessels in suitable containers, clearly marked to indicate the type of waste within. Any garbage requiring transfer either to support vessels or for onshore disposal will be located in order to provide ease of access for loading and unloading. Once the waste has been transferred to shore, it will be collected by the port authorities or their nominated contractors using the existing port waste reception facilities.

Alternatively, if equipped, vessels may make use of on-board garbage incineration units, provided these are type approved in accordance with the IMO "Standard Specification for Shipboard Incinerators" and comply with the requirements of Regulation 16 of MARPOL Annex VI and the Standard Specification for On-board Ship Incinerators, adopted by the Marine Environment Protection Committee on 25 September 1997 (Ref. 18.27). On vessels capable of incineration the following solid wastes may be incinerated: domestic waste (excluding glass); operating wastes (e.g. oily sludges); textiles; and uncontaminated plastic containers. Solid wastes that will not be incinerated include mercury vapour lamps and mercury-containing fluorescent tubes, glass and scrap metal.

There will be no inappropriate mixing of waste types (e.g. domestic waste with hazard Class 1 or 2 waste) and containers will be not overfilled. Where feasible, recyclable garbage (e.g. glass and plastics) will be separated at source, separately stored and collected for recycling by the port waste reception contractors. Domestic waste containing a high biodegradable fraction will not be stored for more than one week (reduced to two days in the summer).

Where waste is transferred to other ships, specific procedures will govern methods employed for preparing material and ensuring accidental discharge, spillages or leaks do not occur. Consignment notes detailing the quantity and type of waste transferred between ships will be kept.

Project vessels shall carry a Garbage Management Plan which will include written procedures for collection, storage, processing and disposal of waste, including the use of any relevant equipment fitted onboard. The Garbage Management Plan will designate the person responsible for carrying out the Plan. Vessels over 400 gross tonnage or carrying more than 15 passengers shall also maintain a Garbage Book.

For the purposes of complying with MARPOL 73/78, construction waste arising on board the vessels will be managed as MARPOL Annex V waste, with discharge at sea strictly prohibited. All waste (predominantly welding and packaging waste) will be retained on board, source-separated where practicable, and collected by the port authorities or their nominated contractors using the existing port waste reception facilities. Any hazardous waste generated during offshore construction (other than MARPOL Annex I Oily Waste, described separately below) will be stored, collected and managed separately in accordance with Russian regulations.

The Project will generate dredged spoil from offshore trenching and profiling. Dredged spoil in the nearshore zone (i.e. from microtunnelling activities) will be temporarily stored in designated offshore storage areas. This material will be subsequently re-dredged and used for trench backfill following pipe installation. A certain amount of offshore dredged material (estimated volume of 42,500 m^3) will be disposed of at an existing underwater disposal site (no. 923, located on the Russian continental slope).

In the event that any dredge spoil is identified as contaminated or requires disposal on land, the spoil will be treated as construction waste and appropriately stored, transported and disposed of. However, baseline studies undertaken to date do not indicate that this is likely.

Sewage from vessels will be managed in accordance with MARPOL Annex IV. Discharge of sewage will only take place when:

- The ship is discharging comminuted and disinfected sewage at a distance of more than 3 nautical miles from the nearest land, or sewage which is not comminuted or disinfected at a distance of more than 12 nautical miles from the nearest land, provided that in any case, the sewage that has been stored in holding tanks shall not be discharged instantaneously but at a moderate rate when the ship is en route and proceeding at not less than 4 knots; or
- The ship has in operation an approved sewage treatment and the effluent does not produce visible floating solids nor cause discoloration of the surrounding water.

Hazardous Waste

Under MARPOL Annex I, vessels are permitted to discharge bilge water which has been treated using an Oily Water Separater (OWS) such that it has oil content below 15 ppm, provided the vessel is proceeding en route. "En route" for the purposes of MARPOL Annex I is defined as meaning *"… that the ship is underway at sea on a course or courses, including deviation from the shortest direct route, which as far as practicable for navigation purposes, will cause any discharge to be spread over as great an area of the sea as is reasonable and practicable".* Vessels which are stationary (i.e. not en route) will be required to retain bilge water on board for subsequent discharge to dedicated collection vessels; or treatment and discharge once they are proceeding en route; or discharge to port waste reception facilities.

Oily sludge will be collected and stored in dedicated sludge tanks. Oily sludge (and residues from bilge water OWS systems) will be treated by incineration in the case of those vessels having MARPOL-compliant incinerators. In all other cases, oily wastes will be retained on board for subsequent discharge to dedicated collection vessels or port waste reception facilities.

Vessels will maintain an Oil Record Book and Oil Pollution Emergency Plan in accordance with MARPOL Annex I.

MEG from the hydrotest and dewatering operation of the nearshore section will be collected and stored on board vessels and transported to a suitable facility onshore for recycling. Depending on whether MEG will be transported on board the vessel in packaged form or in bulk (i.e. whether it will be stored in demountable tanks on a regular vessel, or in internal tanks in chemical tanker), it may be regulated by either MARPOL Annex III (Regulations for the Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form) or Annex II (Regulations for the Prevention of Pollution by Noxious Liquid Substances in Bulk), and the vessel will comply with the relevant provisions.

MEG is categorised as a potential marine pollutant under the International Maritime Organisation's International Maritime Dangerous Goods (IMDG) Code and as such must be suitably packaged and labeled in accordance with MARPOL Annex III. Under MARPOL Annex II, MEG is classified as a Category Y pollutant.

18.5.3.3 Summary

Table 18.14 summarises the management measures proposed for the various waste types anticipated to be generated by the Project and facilities which may be used for the intermediate storage, treatment and/or disposal of the wastes.

Due to the long period of time before decommissioning is programmed to start, it is not possible to identify specific management routes and facilities for decommissioning waste. However, the great majority of decommissioning waste will be inert rubble or metal.

Table 18.14 Mitigation and Management Measures

Description of Waste Type	FWCC code	Potential Management Route	Potential Facilities
Construction and Pre-Commissioning Phase			
Onshore			
Fluorescent tubes and other mercury-containing lamps	353 301 00 13 01 1	Disposal at hazardous waste facility	Mercury Safety Agency and Ach Enppi Sirius
Oily wastes, including: - waste oils, filters, oily rags, spill response waste, etc.	546 015 01 04 03 3 541 002 05 02 03 3 920 000 00 00 00 0 549 027 01 01 03 3 314 023 03 04 03 3 546 002 00 06 03 3	Reuse where possible (e.g. waste oil) or disposal at suitable waste facility	EkoBio, Mercury Safety Agency and Ach Enppi Sirius
Waste protective clothing and worn work footwear	582 000 00 00 00 0 147 006 01 13 00 4	Disposal at suitable waste facility	Mercury Safety Agency and Promehkologiya
Waste drilling sludge	314 000 00 00 00 0	Disposal at suitable waste facility; Research & Production	EkoBio, Mercury Safety Agency and Ach Enppi Sirius
Waste paint resources	555 000 00 00 00 0	Disposal at suitable waste facility	Mercury Safety Agency
Sludge from wastewater treatment	943 000 00 00 00 0	Disposal at suitable waste facility	EkoBio and ACh Enppi Sirius
Mixed municipal waste	912 004 00 01 00 4	Disposal at suitable waste facility	Alfa Landfill
Scrap metal	351 301 00 01 99 5	Reuse	Krymskvtorsyryo and Novorossiisk-metal

Continued…

Description of Waste Type	FWCC code	Potential Management Route	Potential Facilities
Uncontaminated soil	314 011 00 08 99 5	Reuse on site for landscaping, etc. where possible; potential reuse off site as inert backfill or restoration cover	Alfa Landfill or quarry
Welding waste	351 216 01 01 99 5	Disposal at suitable waste facility	Alfa Landfill
Crushed stone	314 009 02 01 99 5	Reuse off site as inert backfill or restoration cover	Alfa Landfill or quarry
Uncontaminated sand	314 023 01 01 99 5	Reuse off site as inert backfill or restoration cover	Alfa Landfill or quarry
Plastic	571 018 00 13 00 5	Recycled or reused where practicable, otherwise disposal at suitable waste management facility	Mercury Safety Agency and Alfa Landfill
Cardboard	187 102 02 01 00 5	Disposal at suitable waste facility	Mercury Safety Agency and Alfa Landfill
Tree stumps	173 001 02 01 00 5	Disposal at suitable waste facility	Mercury Safety Agency and Alfa Landfill
Waste (slurry) from cesspools and domestic sewage	951 000 00 00 00 0	Treatment by licenced contractor	ACh Enppi Sirius
Offshore			
Fluorescent tubes and other mercury-containing lamps	353 301 00 13 01 1	Transferred to vessel waste reception facilities for disposal at hazardous waste facility	Marine Consulting LLC
MARPOL Annex I oily wastes	546 002 00 06 03 3 546 003 00 04 03 3	Incinerated onboard or transferred to vessel waste reception facilities for disposal at suitable waste facility	Mortrans-Service NHB LLC, SPC Crocus LLC and ACh Enppi SIRIUS

Continued...

Description of Waste Type	FWCC code	Potential Management Route	Potential Facilities
Mixed municipal waste	912 004 00 01 00 4	Incinerated onboard or transferred to vessel waste reception facilities for disposal at suitable waste facility	Marine Consulting LLC and Mortrans-Service NHB LLC
Ash, slag and dust from on-board incineration	313 000 00 00 00 0	Transferred to vessel waste reception facilities for disposal at suitable waste facility	Marine Consulting LLC and Mortrans-Service NHB LLC
Medical waste	971 000 00 00 00 0	Incinerated onboard or transferred to vessel waste reception facilities for disposal at suitable waste facility	Mercury Safety Agency LLC
Glass scrap (excluding fluorescent tubes)	314 008 02 01 99 5	Transferred to vessel waste reception facilities for disposal at suitable waste facility	Marine Consulting LLC and Mortrans-Service NHB LLC
Uncontaminated sediment	314 011 00 08 99 5	Transferred to existing permitted underwater disposal sites	Disposal Site 933
Plastic	571 018 00 13 00 5	Incinerated onboard or transferred to vessel waste reception facilities for disposal at suitable waste facility	Marine Consulting LLC and Mortrans-Service NHB LLC
Scrap metal	351 301 00 01 99 5	Source segregated for reuse where possible and transferred to vessel waste reception facilities	Novorosmetall LLC and Krymskvtorsyryo LLC
Waste textiles	581 011 08 01 99 5	Incinerated onboard or transferred to vessel waste reception facilities for disposal at suitable waste facility	Marine Consulting LLC and Mortrans-Service-NHB LLC

Continued...

Description of Waste Type	FWCC code	Potential Management Route	Potential Facilities
Biodegradable kitchen waste	912 010 01 00 00 5	Incinerated onboard or macerated and discharged at sea where this can be done in compliance with MARPOL regulations, otherwise transferred to vessel waste reception facilities for disposal at suitable waste facility	Marine Consulting LLC and Mortrans-Service NHB LLC
Waste MEG	590 000 00 00 00 0	Transferred to vessel waste reception facilities for disposal at suitable hazardous waste facility	Kubanekoprodukt LLC
Sewage	951 000 00 00 00 0	Discharged to sea following treatment or transferred to port reception facilities, in accordance with MARPOL Annex IV	n/a
Operational Phase (Onshore and Offshore)			
Fluorescent tubes and other mercury-containing lamps	353 301 00 13 01 1	Disposal at hazardous waste facility	Mercury Safety Agency LLC / Marine Consulting LLC
Oily wastes, including: - waste oils, filters, oily rags, spill response waste, etc.	541 002 05 02 03 3 549 027 01 01 03 3 314 023 03 04 03 3 546 002 00 06 03 3	Reuse where possible (e.g. waste oil) or disposal at suitable waste facility	EkoBio, Mercury Safety Agency and Ach Enppi Sirius
Mixed municipal waste	912 004 00 01 00 4	Onshore: disposal at suitable waste facility	Alfa Landfill
		Offshore: incinerated onboard or transferred to vessel waste reception facilities for disposal at suitable waste facility	Marine Consulting LLC and Mortrans-Service NHB LLC
Waste paint resources	555 000 00 00 00 0	Disposal at suitable waste facility	Mercury Safety Agency

Continued...

Description of Waste Type	FWCC code	Potential Management Route	Potential Facilities
Sludge from wastewater treatment	943 000 00 00 00 0	Disposal at suitable waste facility	Research & Production Enterprise EcoBio LLC
MARPOL Annex I oily wastes	546 002 00 06 03 3 546 003 00 04 03 3	Incinerated onboard or transferred to vessel waste reception facilities for disposal at suitable waste facility	Mortrans-Service NHB LLC, SPC Crocus LLC and ACh Enppi SIRIUS
Medical waste	971 000 00 00 00 0	Incinerated onboard or transferred to vessel waste reception facilities for disposal at suitable waste facility	
Biodegradable kitchen waste	912 010 01 00 00 5	Incinerated onboard or macerated and discharged at sea where this can be done in compliance with MARPOL regulations, otherwise transferred to vessel waste reception facilities for disposal at suitable waste facility	Marine Consulting LLC and Mortrans-Service NHB LLC
Plastic	571 018 00 13 00 5	Incinerated onboard or transferred to vessel waste reception facilities for disposal at suitable waste facility	Marine Consulting LLC and Mortrans-Service NHB LLC
Glass scrap (excluding fluorescent tubes)	314 008 02 01 99 5	Transferred to vessel waste reception facilities for disposal at suitable waste facility	Marine Consulting LLC and Mortrans-Service NHB LLC

Complete.

18.5.4 Monitoring

South Stream Transport will develop a detailed overarching Environmental and Social Monitoring Programme that will detail the monitoring requirements. As part of this ESMP, the quantities of waste generated by the project and the means of management of these wastes will be monitored on a regular basis. Monitoring will also be carried out to ensure compliance with Russian regulations, as described in Section 18.5.2 above, and MARPOL requirements for maintenance of Oil and Garbage Record Books as required under MARPOL Annex I and V respectively.

Monitoring records will be maintained which will include, as a minimum, the following information:

- Types and quantities of waste generated;
- Types and quantities of waste leaving Project sites or vessels for recycling, recovery or disposal;
- Details of vehicles or vessels transporting waste from the sites;
- Location of treatment or disposal facilities to which the waste is transported; and
- Records of any spillages or unplanned releases, or any enforcement actions.

18.5.5 Assessment of Residual Impact Significance

Table 18.15 indicates the assessed residual impact significance of each waste stream assuming management measures as described are implemented.

The main regional landfill site (Alfa landfill) is not designed or operated as an engineered landfill in accordance with GIIP, and hence this has been identified as being a potentially unsuitable facility. However, the wastes that require landfill disposal are non-hazardous and relatively small in quantity (typically less than 1000 tonnes per waste stream). Alfa landfill is due to be replaced once it ceases operation in 2016, and thereafter the replacement landfill would be used by the Project, which is expected to be an engineered facility (although its location is yet to be confirmed by the local government). In the event that any Project wastes are deposited at Alfa landfill, the impacts are not expected to be significant since the wastes are non-hazardous, and those wastes arising from the Project would form only a very small proportion of the overall waste disposed of at Alfa, such that they would not significantly increase any existing environmental impacts associated with the site.

The overall quantities of waste requiring management are relatively small in comparison with the capacity of the receiving facilities. Any impacts from accidental release during temporary storage or transport of hazardous wastes will be minimised by implementing an integrated WMP.

Table 18.15 Evaluation of Mitigation Measures

Description of Waste Type	Potential Facilities	Waste Category	Facility Assessment	Residual Impact
Construction and Pre-Commissioning Phase				
Onshore				
Fluorescent tubes and other mercury-containing lamps	Mercury Safety Agency and Ach Enppi Sirius	Hazardous	Suitable facilities with sufficient capacity	Low
Oily wastes, including: - waste oils, filters, oily rags, spill response waste, etc.	EkoBio and Mercury Safety Agency and Ach Enppi Sirius	Hazardous	Suitable facilities with sufficient capacity	Low
Waste protective clothing and worn work footwear	Mercury Safety Agency and Promehkologiya	Non-hazardous	Suitable facilities with sufficient capacity	Negligible
Waste drilling sludge	EkoBio and Mercury Safety Agency and Ach Enppi Sirius	Inert	Suitable facilities with sufficient capacity	Negligible
Waste paint resources	Mercury Safety Agency	Hazardous	Suitable facilities with sufficient capacity	Low
Sludge from wastewater treatment	EkoBio and ACh Enppi Sirius	Hazardous	Suitable facilities with sufficient capacity	Low
Mixed municipal waste	Alfa Landfill	Non-hazardous	Facilities are potentially unsuitable.	Moderate*
Scrap metal	Krymskvtorsyryo and Novorossiisk-metal	Non-hazardous	Suitable facilities with sufficient capacity	Negligible
Uncontaminated soil	Alfa Landfill or quarry	Inert	Suitable facilities but capacity may be constrained	Low
Welding waste	Alfa Landfill	Non-hazardous	Facilities are potentially unsuitable.	Moderate*

Continued...

Description of Waste Type	**Potential Facilities**	**Waste Category**	**Facility Assessment**	**Residual Impact**
Crushed stone	Alfa Landfill or quarry	Inert	Suitable facilities but capacity may be constrained	Low
Uncontaminated sand	Alfa Landfill or quarry	Inert	Suitable facilities but capacity may be constrained	Low
Plastic	Mercury Safety Agency and Alfa Landfill	Non-hazardous	Facilities are potentially unsuitable.	Moderate*
Cardboard	Mercury Safety Agency and Alfa Landfill	Non-hazardous	Facilities are potentially unsuitable.	Moderate*
Tree stumps	Mercury Safety Agency and Alfa Landfill	Non-hazardous	Facilities are potentially unsuitable.	Moderate*
Waste (slurry) from cesspools and domestic sewage	ACh Enppi Sirius	Non-hazardous	Suitable facilities with sufficient capacity	Negligible
Offshore				
Fluorescent tubes and other mercury-containing lamps	Marine Consulting LLC	Hazardous	Suitable facilities with sufficient capacity	Low
MARPOL Annex I oily wastes	Mortrans-Service NHB LLC and SPC Crocus LLC	Hazardous	Suitable facilities with sufficient capacity	Low
Mixed municipal waste	Marine Consulting LLC and Mortrans-Service NHB LLC	Non-hazardous	Suitable facilities with sufficient capacity	Negligible
Ash, slag and dust from on-board incineration	Marine Consulting LLC and Mortrans-Service NHB LLC	Non-hazardous	Suitable facilities with sufficient capacity	Negligible
Medical waste	Mercury Safety Agency LLC	Hazardous	Suitable facilities with sufficient capacity	Low

Continued...

Description of Waste Type	Potential Facilities	Waste Category	Facility Assessment	Residual Impact
Glass scrap (excluding fluorescent tubes)	Marine Consulting LLC and Mortrans-Service NHB LLC	Non-hazardous	Suitable facilities with sufficient capacity	Negligible
Uncontaminated sediment	Disposal Site 933	Inert	Suitable facilities with sufficient capacity	Negligible
Plastic	Marine Consulting LLC and Mortrans-Service NHB LLC	Non-hazardous	Suitable facilities with sufficient capacity	Negligible
Scrap metal	Novorosmetall LLC and Krymskvtorsyryo LLC	Non-hazardous	Suitable facilities with sufficient capacity	Negligible
Waste textiles	Marine Consulting LLC and Mortrans-Service-NHB LLC	Non-hazardous	Suitable facilities with sufficient capacity	Negligible
Biodegradable kitchen waste	Marine Consulting LLC and Mortrans-Service NHB LLC	Non-hazardous	Suitable facilities with sufficient capacity	Negligible
Waste MEG	Kubanekoprodukt LLC	Hazardous	Suitable facilities with sufficient capacity	Low
Sewage	n/a	Non-hazardous	Suitable facilities with sufficient capacity	Negligible
Operational Phase (Onshore and Offshore)				
Fluorescent tubes and other mercury-containing lamps	Mercury Safety Agency and Marine Consulting LLC	Hazardous	Suitable facilities with sufficient capacity	Low
Oily wastes, including: - waste oils, filters, oily rags, spill response waste, etc.	EkoBio, Mercury Safety Agency and Ach Enppi Sirius	Hazardous	Suitable facilities with sufficient capacity	Low

Continued...

Description of Waste Type	Potential Facilities	Waste Category	Facility Assessment	Residual Impact
Mixed municipal waste	Onshore: Alfa Landfill	Non-hazardous	Facilities are potentially unsuitable.	Moderate*
	Offshore: Marine Consulting LLC and Mortrans-Service NHB LLC	Non-hazardous	Suitable facilities with sufficient capacity	Negligible
Waste paint resources	Mercury Safety Agency	Hazardous	Suitable facilities with sufficient capacity	Low
Sludge from wastewater treatment	EkoBio	Non-hazardous	Suitable facilities with sufficient capacity	Negligible
MARPOL Annex I oily wastes	Mortrans-Service NHB LLC and SPC Crocus LLC	Hazardous	Suitable facilities with sufficient capacity	Low
Medical waste	Mercury Safety Agency LLC	Hazardous	Suitable facilities with sufficient capacity	Low
Biodegradable kitchen waste	Marine Consulting LLC and Mortrans-Service NHB LLC	Non-hazardous	Suitable facilities with sufficient capacity	Negligible
Plastic	Marine Consulting LLC and Mortrans-Service NHB LLC	Non-hazardous	Suitable facilities with sufficient capacity	Negligible
Glass scrap (excluding fluorescent tubes)	Marine Consulting LLC and Mortrans-Service NHB LLC	Non-hazardous	Suitable facilities with sufficient capacity	Negligible

* The current status of Alfa Landfill is discussed in Table 18.6 and the potential use of this facility for non-hazardous wastes is discussed in Section 18.8 below.

Complete.

18.6 Unplanned Events

Procedures for dealing with unplanned events will be set out in the Project Emergency Preparedness and Response Plan (see **Chapter 22 Environmental and Social Management**). The mitigation measures described in this chapter (including the procedures for temporary storage and transportation of waste) have been developed with the intention of mitigating the likelihood of any unplanned release of wastes; for example, releases due to inadequate storage arrangements at the site, or spillages during loading and unloading of wastes, and the Project Emergency Preparedness and Response Plan will include contingency arrangements in the unlikely event of releases (e.g. provision of spill kits).

18.7 Cumulative Impacts

There are four known developments in the region which are all onshore. The Russkaya compressor station (CS) is considered to be the most significant of these which may add pressure on waste storage and disposal facilities in the area. However, providing all wastes are disposed of in accordance with legislative requirements at waste facilities operating in accordance with permitted conditions and GIIP, the Project will not generate significant cumulative impacts. The quantities of hazardous and non-hazardous waste arisings from the Project are small when compared to total regional arisings and therefore no significant cumulative impact is expected. Although large quantities of uncontaminated soil and rock will be generated, this is not expected to give rise to significant cumulative impacts since it will be used for backfill or restoration purposes at quarry or landfill sites in the region; and since the material is inert, it is unlikely to give rise to significant environmental impacts.

Cumulative impacts are considered and assessed in **Chapter 20 Cumulative Impact Assessment**.

18.8 Conclusions

The assessment of waste management impacts arising from the Project has identified the waste streams that are anticipated to be produced during the Construction and Pre-Commissioning Phase and the Operational Phase and identified the availability and suitability of existing waste management facilities to manage those wastes. Mitigation measures have been recommended in order to minimise the impacts as far as possible, including the preparation and implementation of an integrated WMP by contractors.

Moderate impacts are estimated in the event that the existing Alfa landfill are to be used for disposal of non-hazardous wastes from the Project. It is expected that this landfill will be closed and a replacement engineered facility may be available by 2016. Even in the absence of such a facility, the relatively small amounts of non-hazardous waste requiring landfill means that the impacts of using Alfa Landfill would not be significant.

Provided that all of the mitigation measures described above are correctly implemented, the overall waste management impacts from the development are expected to be **Not Significant**.

References

Number	Reference
Ref. 18.1	Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention), 1972.
Ref. 18.2	Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (Basel Convention), 1992.
Ref. 18.3	Convention on Persistent Organic Pollutants (Stockholm Convention).
Ref. 18.4	International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 (MARPOL 73/78 Convention) Annex I – VI.
Ref. 18.5	IFC (2007): General EHS Guidelines: Environmental.
Ref. 18.6	IFC PS3: Resource Efficiency and Pollution Prevention, 1 Jan 2012.
Ref. 18.7	IFC PS3 Guidance Note: Resource Efficiency and Pollution Prevention, 1 Jan 2012.
Ref. 18.8	Federal Law 'On Production and Domestic Wastes'. 24 June 1998, No. 89-FZ.
Ref. 18.9	Federal Law 'On Licensing Activities'. 08 Aug 2001, No. 128-FZ
Ref. 18.10	Federal Law 'On the Protection of the Environment'. 30 Dec 2008, No. 309-FZ
Ref. 18.11	Government Enactment 'On the adoption of procedure for development and adoption of environmental standards for emission and discharge of polluting substances into the environment, limits for natural resources' use and waste disposal'. 03 Aug 1992, No. 545
Ref. 18.12	Government Enactment 'On adoption of procedure for defining payment and its limits for environmental pollution, waste disposal and other harmful impacts'. 28 Aug 1992, No. 632
Ref. 18.13	Government Enactment 'On the state registration of potentially hazardous chemical and biological substances'. 12 Nov 1992, No. 869
Ref. 18.14	Government Enactment 'On amendments to administrative regulations by the federal service for environmental, technological and nuclear supervision for execution of the state function of issuing permits for emissions, discharges of polluting substances into the environment adopted by Order of the Ministry of Natural Resources and Environment of the Russian Federation'. 25 Feb 2010, No. 173
Ref. 18.15	Ministerial Order 'On the adoption of criteria for waste identification by class of environmental hazard'. 15 June 2001, No. 511
Ref. 18.16	Ministerial Order 'On the adoption of hazardous waste passport/datasheet'. 02 Dec 2002, No. 785

Number	Reference
Ref. 18.17	Ministerial Order 'On the adoption of the Federal Classificatory Catalogue of Wastes'. 02 Dec 2002, No. 786
Ref. 18.18	Ministerial Order 'Supplements to the Federal Waste Classificatory Catalogue'. 30 July 2003, No.663
Ref. 18.19	Ministerial Order 'On the procedures for development and adoption of standards for waste generation and limits of their disposal'. 25 Feb 2010, No. 50
Ref. 18.20	Ministerial Order 'On the adoption of statistical instruments for organising the monitoring of domestic waste production'. 28 Jan 2011, No. 17
Ref. 18.21	Ministerial Order 'On the adoption of accounting procedures in relation to waste management'. 01 Sep 2011, No. 721
Ref. 18.22	Order 'On the adoption of methodical instructive regulations for development of projects for waste generation and disposal limits' 19 Oct 2007, No. 703
Ref. 18.23	Book of per-unit indicators of production and consumption wastes' generation.
Ref. 18.24	Methodological recommendations for assessment of volumes of domestic and production wastes' generation (NITsPURO)
Ref. 18.25	Guidelines and procedures for charging environmental pollution payment. 26 Jan 1993, No 632.
Ref. 18.26	Strategic Action Plan for the Environmental Protection and Rehabilitation of the Black Sea (2009). Accessed from http://www.blacksea-commission.org/_bssap2009.asp. Accessed on 14 March 2013.
Ref. 18.27	Resolution Marine Environment Protection Committee (MEPC) 76(40) adopted on 25 September 1997: Standard Specification for On-board Ship Incinerators.

Chapter 19: Unplanned Events

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19 Unplanned Events

19.1 Introduction

Unplanned events are episodes that are not expected to occur during the Project's normal Construction and Operational Phase activities, such as accidents. The Project follows safety and engineering design criteria that aim to avoid unplanned events that could lead to adverse environmental, socio-economic or health and safety impacts.

This chapter provides an assessment of the potential environmental and socio-economic risks and impacts from onshore and offshore unplanned events, that could occur during the Construction and Pre-Commissioning, Operational (including Commissioning) Phases of the Project so that design controls and mitigation measures can be put in place. The approach to unplanned event management during the Decommissioning Phase is also presented herein. Project risks and impacts associated with worker occupational health and safety (OH&S) are considered in Appendix 15.1: Occupational Health and Safety.

The assessment considers both the likelihood of unplanned event occurrence as well as the potential consequences of such events.

19.2 Scope and Approach

The overall Project Area (the geographical area within which all proposed Project Activities will occur as defined in **Chapter 1 Introduction**) has been split into three main areas of activity for the purpose of the assessment of unplanned events, namely:

- Onshore Landfall: Area covers all Project onshore landfall facilities and activities (from the landfall facilities of the Project to the shoreline); and
- Offshore: Area includes the nearshore and offshore sections as defined in the previous chapters of this ESIA Report. This area commences at the shoreline and extends out to the border of the Russian and Turkish Exclusive Economic Zones (EEZ) in the Black Sea.

Locations in the wider surrounding area and/or between these main areas of activity that could be affected by unplanned events are also considered. For example, onshore access roads / routes and shipping routes.

This chapter focuses on those unplanned events considered to be of most relevance to the Project given the nature of the construction activities, the operational requirements of the pipelines and the geographic location of the Project. In order to assist the unplanned event identification process, South Stream Transport has undertaken an Emergency Threat Analysis[1] for the Project that determines the risks posed by potential emergencies and the need for an Emergency Preparedness and Response Plan and related procedures as a contingency for

[1] Involves use of an emergency risk analysis spreadsheet that assigns risk ratings against potential unplanned events taking account of event likelihood and consequences. In August 2013 South Stream Transport undertook an internal Emergency Threat Analysis workshop involving relevant specialists.

emergency events. The unplanned events considered within this chapter have been identified via the Emergency Threat Analysis.

Where available, information on the likelihood of occurrence of unplanned events has been drawn from statistics from industry organisations. Data on the frequency of shipping incidents has been taken from statistics published by recognised industry bodies, including the International Association of Oil & Gas Producers and the European Maritime Safety Agency.

Given the inherent uncertain nature of potential unplanned events, the potential variability of such events in terms of geographic location and coverage, and limitations of directly relevant event statistics, a qualitative assessment methodology has been adopted herein. This methodology has entailed the following tasks:

- Screening of unplanned events to identify those which are carried forward for further consideration;
- Identifying the range of activities that could lead to the occurrence of a potential unplanned event during Construction and Pre-Commissioning and the Operational (including Commissioning) Phases of the Project;
- If possible, determining the likelihood of occurrence of such events;
- Defining and describing the geographic range of occurrence of potential unplanned events;
- For each unplanned event, definition of the potential resultant impacts in relation to potentially affected receptors; and
- Definition of appropriate risk management measures to reduce the likelihood of occurrence of each unplanned event and minimise the residual significance of any resulting impacts.

When determining the potential consequences of unplanned events, the resultant impacts have been assessed in relation to categories of receptors as follows:

- Environmental receptors; and
- Socio-economic receptors (including impacts upon community health).

OH & S impacts associated with unplanned events are not considered in this chapter. However, South Stream Transport will implement internationally recognised procedures to assure the OH&S of the workforce (including during unplanned events) along with the necessary equipment and training to make these effective. OH&S measures will be included in a Health, Safety, Security and Environmental Integrated Management System (HSSE-IMS) which will form an important part of the corporate management system (**Chapter 22 Environmental and Social Management**).

In order to support the unplanned events assessment as reported herein, the following additional assessments have been undertaken:

- Quantitative Risk Assessment (QRA) (Ref. 19.1 and Appendix 19.1: Quantitative Risk Assessment) which considers the risks to the public as associated with the operation and maintenance of the onshore pipeline and landfall infrastructure and facilities;

- Maritime Risk Assessment (Appendix 19.2: Maritime Risk Assessment and Oil Spill Modelling) which considers the risks of marine vessel accidents occurring and the potential for consequential oil spillages;
- Oil spill modelling (Appendix 19.2) to investigate the fate and behaviour of various oil spill scenarios that may occur following an unplanned marine event (as identified by the maritime risk assessment); and
- Terrestrial and marine geohazard evaluation (Appendix 19.3: Unplanned Events - Marine Geohazards) which highlights the potential geohazards present along the pipeline alignment, and the actions that have been undertaken to manage risks to pipeline integrity.

19.3 Legal Context

A range of legislation has been passed in Russia that requires plans and actions to be developed should unplanned events have the potential to impact on workers, the local community and the environment. Much of the legislation applies to private organisations as well as public authorities and local government bodies. This legislation reinforces the prevention and elimination of accidents and promulgates the need for emergency and management plans and thus the legislation needs to be taken into account as part of the Project's unplanned event risk minimisation and management process. A summary of the relevant legislation is outlined below:

- Russian Federation Law "On protection of population and territories from natural and man-made emergency situations", No. 68-FZ, 21 December 1994: The law sets forth institutional and legal provisions for the protection of people, land, water and air space from emergency situations. This Federal Law extends to public authorities, local government bodies, as well as to private companies and organizations;
- Russian Federation Law "On fire safety", No. 69-FZ, 21 December 1994: The law determines legal, economic and social basis for provision of fire safety in the Russian Federation, regulates relations between the state authorities, self-government bodies, institutions, private organizations, other legal entities and also between public organisations, officials, citizens of the Russian Federation, foreign citizens, and stateless persons;
- Russian Federation Government Enactment "On procedure for organising measures for emergency oil spills' prevention and response in the territory of the Russian Federation", No. 240, 21 August 2000: The resolution determines the main requirements for developing plans for emergency oil spill prevention and response. The requirements define the principles for formulation of the plans for emergency oil spill prevention and response, which apply to emergency situations of onsite, local, territorial, regional and federal importance, and coordination of response measures;
- Russian Federation Government Enactment "On urgent measures for emergency oil spills' prevention and response", No. 643, 15 April 2002: The related rules establish requirements for organising measures for emergency oil spill prevention and response aimed at reducing adverse impacts on humans and the natural environment. The measures are organised by the federal bodies of executive power of the Russian Federation, self-government bodies and companies who carry out field exploration, oil production, refining, transportation and storage of oil and related products; and

- Russian Federation Requirements "On adoption of requirements for prevention of emergency situations at potentially hazardous facilities and vital infrastructure", No. 105, 28 February 2003: The requirements provide a set of measures on reduction of risk of emergency situations of technogenic character at potentially hazardous facilities, which use, produce, process, store and transport fire-explosion-hazardous substances, hazardous chemical and biological substances, including the provision of publicly vital activities (water supply and wastewater discharge, waste water treatment, heat and power supply utilities, hydro-engineering facilities). The specified requirements are as follows:
    - Identification of emergency situations for population and territories, coordination and planning for monitoring, forecasting and modelling, zoning of Russian territories by location of hazardous production facilities;
    - Classification of potentially hazardous facilities and vital infrastructure by risk of emergency situation occurrence at these facilities;
    - Design, construction, operation and decommissioning of facilities, which are hazardous to the population and Russian territories;
    - Management of actions for emergency situation prevention and protection of population and territories from hazardous impacts; and
    - Assessment of potentially hazardous facilities preparedness to emergency situation prevention and sufficiency of measures for protection of population and territories.

19.4 IFC Requirements and Guidance

International Finance Corporation (IFC) Performance Standard (PS) 1 Assessment and Management of Environmental and Social Risks and Impacts (January 1, 2012) (Ref. 19.11) states that:

"The client, in coordination with other responsible government agencies and third parties as appropriate will conduct a process of environmental and social assessment, and establish and maintain an ESMS appropriate to the nature and scale of the project and commensurate with the level of its environmental and social risks and impacts. The ESMS will incorporate the following elements: (i) policy; (ii) identification of risks and impacts; (iii) management programs; (iv) organizational capacity and competency; (v) emergency preparedness and response; (vi) stakeholder engagement; and (vii) monitoring and review."

PS1 goes on to highlight the need for the Environmental and Social Management System (ESMS) to establish and maintain an emergency preparedness and response system:

"…so that the client, in collaboration with appropriate and relevant third parties, will be prepared to respond to accidental and emergency situations associated with the project in a manner appropriate to prevent and mitigate any harm to people and/or the environment. This preparation will include the identification of areas where accidents and emergency situations may occur, communities and individuals that may be impacted, response procedures, provision of equipment and resources, designation of responsibilities, communication, including that with potentially Affected Communities and periodic training to ensure effective response. The emergency preparedness and response activities will be periodically reviewed and revised, as necessary, to reflect changing conditions".

Guidance on the content and coverage of Emergency Preparedness and Response Plans is provided in the IFC Environmental, Health and Safety (EHS) Guidelines (IFC, 2012) (Ref. 19.12). Also of relevance is PS4 Community Health, Safety, and Security (Ref. 19.15) which addresses the client's responsibility to avoid or minimise the risks and impacts to community health, safety, and security that may arise from project related-activities, with particular attention to vulnerable groups. PS4 states that:

"In addition to the emergency preparedness and response requirements described in Performance Standard 1, the client will also assist and collaborate with the Affected Communities, local government agencies, and other relevant parties, in their preparations to respond effectively to emergency situations, especially when their participation and collaboration are necessary to respond to such emergency situations. If local government agencies have little or no capacity to respond effectively, the client will play an active role in preparing for and responding to emergencies associated with the project. The client will document its emergency preparedness and response activities, resources, and responsibilities, and will disclose appropriate information to Affected Communities, relevant government agencies, or other relevant parties."

19.5 Emergency Preparedness and Response Plan

Chapter 22 Environmental and Social Management highlights that South Stream Transport will prepare an over-arching Emergency Preparedness and Response Plan for the overall project (covering Russian, Turkish and Bulgarian sectors) in line with IFC EHS Guidelines. The plan will be part of the HSSE-IMS as defined in **Chapter 22 Environmental and Social Management**.

This plan will define response actions for material unplanned events / risks that have been identified by the Emergency Threat Analysis. The overarching plan will cover all project phases and will include details as suggested by the IFC EHS Guidelines as follows:

- Purpose and scope;
- Emergency response management strategy;
- Emergency risk analysis, Emergency Preparedness and Response Plan and definition of the relationships with Contractors' Emergency Response Plans;
- Roles and responsibilities;
- Communication requirements;
- Emergency drill requirements (including examinations, inspections and testing); and
- Review processes.

South Stream Transport's Construction Contractors will be responsible for preparing their own Emergency Response Plans for their work activities, and specifically those events identified by the Emergency Threat Analysis. Contractors are expected to apply Good International Industry Practices (GIIP) and applicable recognized industry standards when preparing their Emergency Response Plans.

The preparation of contractors' Emergency Response Plans will be a requirement of the applicable works Contract, and will be available prior to the start of construction activities and will be subject to South Stream Transport review and acceptance. South Stream Transport will ensure that Contractors' plans are integrated with other Project response plans, including South Stream Transport 's overarching Emergency Preparedness and Response Plan.

Similarly, South Stream Transport will ensure that contractor Emergency Response Plans appropriately integrate with the Emergency Prevention and Response Plan for Anapa municipality and the National Disaster Management Plan with regard to command and control systems, points of first contact during emergencies, local capabilities and capacity.

South Stream Transport will also prepare a Security Plan which will include the following:

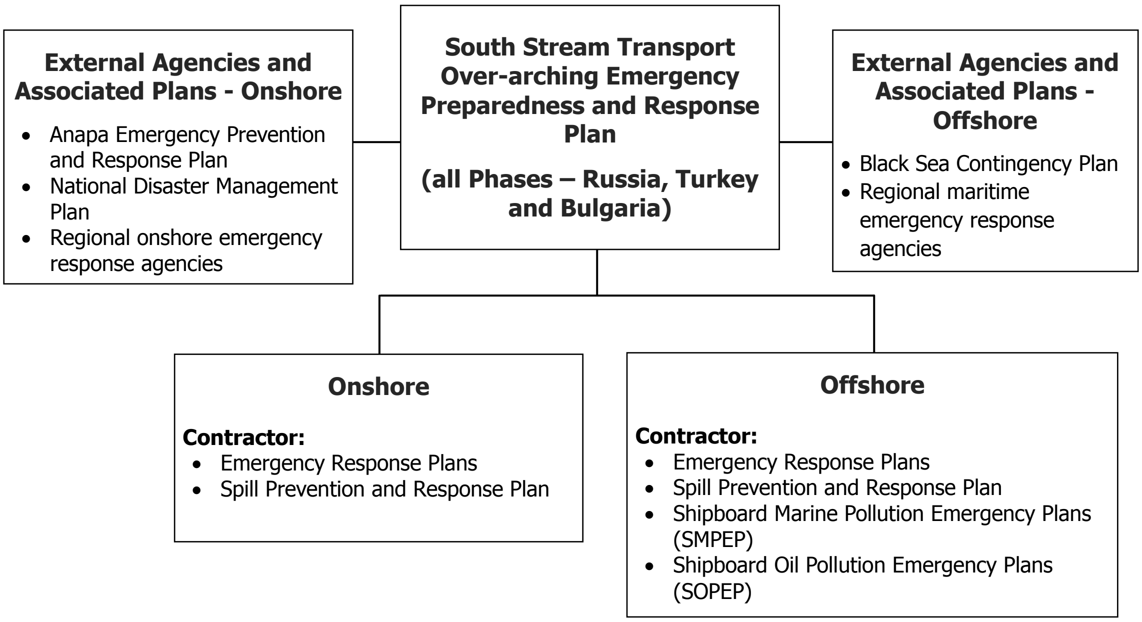
- Systematic identification of security threats;
- Monitoring of social and other conditions related to security threats;
- Security screening of employees and other persons, as appropriate;
- Security measures to protect the property, assets, employees and intellectual capital of South Stream Transport;
- Information, instruction and training on security practices and requirements;
- Promotion of personal and corporate security;
- Security surveillance, including CCTV, security guards etc.;
- Emergency response plan and crisis management plan in case of serious security incidents; and
- Analysis of security incidents to facilitate lessons learned.

The Security Plan will be coordinated with the contractors who will be required to demonstrate how they will ensure compliance with the plan through the development of their own contract-specific Security Plan and procedures.

As detailed in Section 14.8.6 Security Provision (**Chapter 14 Socio-Economics**), in order to ensure there are no risks of human rights abuses against local communities by security forces, whether these be directly employed by the Project, contractors or state security forces, South Stream Transport will ensure training for security forces on escalation of force and protection of human rights. Furthermore, South Stream Transport will use its contractual process to ensure that provisions are in place for the conducting of background checks on security staff, as well as monitoring of performance.

The security provisions for the Project will follow the guidance as set forth in the Voluntary Principles on Security and Human Rights (Ref. 19.14). Policies, plans and procedures to protect the safety and security of the workforce, community and other Project stakeholders will be documented in the HSSE-IMS (**Chapter 22 Environmental and Social Management**). Figure 19.1 illustrates the relationship between South Stream Transport's over-arching Emergency Preparedness and Response Plan and the contractor Emergency Response Plans for the onshore and offshore areas, as well as external agencies and associated emergency plans.

Figure 19.1 Relationship between South Stream Transport's Over-arching Emergency Preparedness and Response Plan and the Contractor Emergency Response Plans (Onshore and Offshore)



19.6 Onshore Landfall Section

19.6.1 Construction and Pre-Commissioning Phase – Landfall Section

19.6.1.1 Events Identification

During the Construction and Pre-Commissioning Phase of the Project, unplanned events in the onshore landfall section may occur as a result of the use of construction plant, power generation equipment and from vehicular traffic in conjunction with equipment malfunction or human error.

Table 19.1 lists the activities that could result in an unplanned event, a description of the unplanned event, and the receptors which could be affected.

Table 19.1 Landfall Activities Potentially Resulting in an Unplanned Event (Construction and Pre-Commissioning Phase)

Activity	Event	Receptors	
		Environmental	Socio-Economic and Community Health
Use of construction equipment and power generation equipment	Fuel and oil spillages	✓	
	Damage to third party property or utilities		✓
	Fires	✓	✓
Vehicular traffic	Traffic accidents		✓
	Fuel and oil spillages	✓	
	Damage to third party property or utilities		✓
Third party activity	Major forest fire during construction caused either by public or nature e.g. lightning strike requiring evacuation of the site	✓	✓
	Protests and communal violence		✓

The design controls that will be put in place to reduce the likelihood of occurrence of the above potential unplanned events, as well as the mitigation / response measures that will be enforced to minimise the consequences associated with these events, are discussed below.

19.6.1.2 Potential Impacts to Environmental Receptors

Fuel and Oil Spillages

Construction activities will require many large mobile plant items (e.g. excavators, dozers), power generation equipment and vehicles that will be powered by diesel oil and which will contain relatively small reservoirs of lubricant oil and hydraulic oil. There is the potential for environmental damage if such materials are spilled depending on the volume and location of the spill / loss of containment.

Oil spilled to unpaved areas could potentially seep into the soil if the spill is not responded to immediately. Small oil spillages to paved and contained areas can generally be responded to in a manner that does not impact upon environmental receptors (unless spillages to paved areas subsequently discharge onto unpaved areas). In the case of a relatively large spillage of fuel, associated for example with a fuel tank rupture as a result of vehicular accidents, the spilled fuel could also discharge directly into any nearby drainage ditches or watercourses.

Such a spill of diesel fuel, lubricants or hydraulic oil impacting upon surface water could be harmful to aquatic organisms and may cause long-term adverse effects in the aquatic environment. Spillages to soil could also result in localised soil contamination.

Most onshore construction related oil spillage incidents are likely to be relatively small (e.g. less than 100 litres) given the nature of the vehicles / mobile plant being used. The control measures to be adopted by the Project will be defined within a Spill Prevention and Response Plan which will be developed and maintained by each Project contractor. The Spill Prevention and Response Plan will include aspects such as the following:

- Introduction and objectives;
- Roles and responsibilities;
- Oil spillage risk analysis;
- Response equipment details;
- Response actions;
- Communication requirements;
- Drill and training requirements; and
- Review processes.

The application of the Spill Prevention and Response Plan will reduce the risks of any long-term significant adverse impacts on the aquatic environment as a result of such events. In the case of soil contamination from a small scale spillage, in accordance with the Spill Prevention and Response Plan, any contaminated soil would be promptly removed and disposed of at an appropriately licenced waste management facility. Such actions taken will reduce the risks of any long-term significant adverse impacts on soil quality. Given the small quantity of any accidental hydrocarbon spillages and implementation of the Spill Prevention and Response Plan, the potential for adverse impacts upon groundwater resources will also be reduced. Any residual groundwater contamination will only be locally affected and is expected to gradually recover through natural attenuation (Section 8.6.2).

Accidents during the bulk transportation of fuel to the landfall section and spillages from bulk fuel storage tanks (e.g. tank rupture or as a result of human error or equipment malfunction during tank loading and unloading operations) could result in a large spillage of hydrocarbon (greater than 100 litres) into the environment. The design controls that will be implemented to minimise the risks of such events occurring and to prevent adverse environmental impacts will be included in the Spill Prevention and Response Plan. Measures include:

- Appropriate driver training;
- The use of designated routes for transporting fuel to the landfall site (avoiding where possible environmental sensitive areas and built up areas);
- Definition of spillage containment equipment and clean-up actions following such events; and

- Provision of on-site secondary containment facilities for all hydrocarbon storage tanks (including loading and unloading bays) to enable any spillages of hydrocarbons to be contained, thus preventing significant environmental impacts.

Fires

Fires during construction could occur, for example, as a result of the accidental ignition of dry vegetation during certain operations that involve the use of gas torches (hot works), such as heat wrapping of the coating that is applied to the pipe welds or during torch welding of mechanical components. Fires could also be caused by inappropriate human behaviour, such as construction worker smoking, as well as actions by third party activities and via lightning strikes.

Fires could spread to the forest environment that surrounds the landfall section and cause significant environmental impacts. **Chapter 11 Terrestrial Ecology** describes the habitats that occur within the Project Area that could be adversely affected by fire. In view of the sensitivity of some of the habitats and their protection status, it is important that stringent measures are enforced to minimise fire risks and the associated potential significant adverse impacts.

Fire risks will be minimised through the definition and enforcement of strict control measures, which will include the adoption of a "permit to work" system for hot works and a smoking ban for all construction personnel whilst undertaking construction activities. Other ignition sources, such as open fires along the pipeline Right of Way (RoW) will also be prohibited, whilst dry vegetation will be removed from the RoW and from areas of hot works.

Section 19.5 indicates that South Stream Transport will prepare an overarching Emergency Preparedness and Response Plan – this plan will include details of fire prevention, fire detection and fire-fighting systems which will be developed and maintained by each construction contractor. Contractors' Emergency Response Plans will be tailored to work to be carried out under their contracts. These Emergency Response Plans will include specific measures to prevent ignition and subsequent spread of any fires to natural habitats and well as fire-fighting procedures (including interactions with local competent fire-fighting authorities). Contractor Emergency Response Plans will thus make reference to, and be aligned with, South Stream Transport's overarching Emergency Preparedness and Response Plan.

19.6.1.3 Potential Impacts to Socio-Economic Receptors and Community Health

Damage to Third Party Properties or Utilities

Large mobile construction plant items, such as excavators, dozers and construction vehicles etc. have the potential to cause damage to third party property, whilst the excavation of pipeline trenches could result in damage to buried utilities.

Existing third-party services will be located, marked, and either safeguarded or diverted in accordance with owners agreements, and as further described in **Chapter 5 Project Description**.

As noted in **Chapter 5 Project Description,** Section 5.3 Construction Phase Description, two existing third-party utility infrastructure installations crossing the landfall section of the Project Area have been identified, namely:

- An existing underground communication cable; and
- A 10 kV overhead power line suspended on poles located approximately 850 m downstream from the landfall facilities.

If utilities such as the communication cable or overhead power line were damaged, in addition to causing damage to the relevant utility operator's assets, it could also lead to economic impacts on local businesses e.g. potential interruption to communication services and energy supply, as well as potential lost production time. Householders could also experience inconvenience and could potentially make alternative provisions, at personal expense, to cope with a loss of communication services or electricity.

For buried services, at the time of setting out the works, each contractor will locate such services and record depth, type and size through the use of hand excavation. All services will be adequately protected from damage by the laying of excavator mats, or geotextile membrane and hard-core and by maintaining an appropriate safe distance between the pipeline and existing services. Alternatively, in agreement with the service owners (including the underground communication cable), it may be decided to cut and reroute service lines. The final decision will be subject to consultation with the utility owner and detailed design studies.

Due to the height of the overhead power line which is suspended over the access road and construction corridor, it is possible that it may restrict certain types of vehicles from accessing the route. In order to overcome this and to maintain a safe working environment, the power will need to be cut temporarily and either an alternative power system provided or the power lines rerouted so that the construction equipment can travel safely along the route. A decision on which option will be selected will be based on consultation and agreement with the power line owners, local authorities and any other effected parties. South Stream Transport will put in place measures to ensure that disruptions to power supply as a result of accidental damage to services are kept to a minimum.

It is considered that the risks of accidentally damaging either the communication cable or the overhead power line are low taking into account the aforementioned preventative measures.

All reasonable efforts have been made to ensure that all utilities crossing the landfall section of the Project Area have been identified. However, in the event that unknown services are encountered during construction, the potential for damage to that infrastructure will be minimised through the implementation of procedures to stop work in the immediate area until the nature of the services can be established. Project construction activities could restart following the definition of appropriate working methods which would avoid impacting upon the integrity of the subject services and/or the health and safety of the construction personnel. Ownership of the services will be established where possible, and the owners consulted if service diversions are deemed necessary. Additionally, appropriate signage, working practices and worker training will be given should any other overhead cables be encountered.

Fires

As identified in Section 19.6.1.2, fires during the Construction and Pre-Commissioning Phase could occur either as a result of construction activities or as a result of inappropriate human behaviour. Such fires have the ability to impact upon local community assets and the health of local community residents.

Chapter 14 Socio-Economic describes the land uses that occur within the Project Area and within adjacent areas that could be adversely affected by a fire. Sections of the Project Area are forested, interspersed with pockets of open land used primarily for agriculture (including vineyards). The agricultural land is a mixture of shrubby and fallow land and productive agricultural land, mainly vineyards. While fires could spread to neighbouring vineyards and other agricultural land, causing the loss of established productive vineyards, it would be easier to fight and contain a fire spreading through agricultural land compared to forests. Consequently, the potential for economic losses would be limited.

The amount of residential accommodation within the vicinity of the Project Area (as defined in **Chapter 1 Introduction**) is limited. There are no residential properties, either permanently occupied or holiday accommodation, within the Project Area. However, there are the Shingari and Don holiday complexes (tourist resorts) (approximately 1.3 km south of the microtunnel entry points), a group of residential dwellings situated approximately 1.5 km south of the landfall facilities, as well as more concentrated residential developments in Gai Kodzor (approximately 4.5 km northeast of the landfall facilities), Sukko (approximately 3 km south of the microtunnel entry points), Supsekh (approximately 4 km north of the nearest point of the pipelines) and Varvarovka (approximately 1.5 km northwest of the landfall facilities) plus two log cabins that have been built approximately 1.1 km south of the landfall facilities (see **Chapter 9 Air Quality** – Section 9.6.1.5). The nearest identified buildings are thus located near the Varvarovka community approximately 1 km northwest of the landfall section with the intervening land being agricultural in nature with some woodland. The risk from fire to the Varvarovka community is minimal given the distance to Project activities and given the sparse nature of the vegetation between the Project Area and that settlement. Nevertheless, the enforcement of strict fire control measures and the fire detection and fire fighting enactments of the Contractors' Emergency Response Plan (see Section 19.6.1.2) will limit the potential for fire impacts upon residential property.

Protests and Communal Violence

Local residents in the vicinity of the Project Area could potentially be impacted by unplanned events involving construction workforce unrest, civil unrest and worker-community conflict.

Measures will be undertaken to prevent unplanned events caused by the construction workforce protests and disturbances. The construction contractors have the responsibility to provide for the well-being of their workers – this includes compliance with applicable employment laws and regulations, adherence to appropriate OH&S management systems, and the availability of a worker consultation and grievance process. Grievances raised by workers, including South Stream Transport employees and contractors / suppliers' workers, will be handled according to the Worker Grievance Procedure. This procedure is part of the HSSE-IMS and will be implemented via the Environmental and Social Management Plan (ESMP) (see **Chapter 22**

Environmental and Social Management). It will function through all Project phases. The Worker Grievance Procedure will be implemented by South Stream Transport in partnership with its contractors and will ensure that grievances are brought to the attention of the appropriate Project staff and addressed in an appropriate and timely way.

In addition, the well-being of workers will also be assisted through the adoption of the policies and practices including the following (see **Chapter 14 Socio-Economics**):

- Human health resources;
- Working relationships;
- Working conditions and terms of employment;
- Workers' organisations; and
- Non-discrimination and equal opportunities.

In order to minimise the risks associated with workforce conflicts and civil unrest caused by Project activities, South Stream Transport will ensure that the construction contractors adhere to considerate construction practices, including the measures detailed in this ESIA. South Stream Transport will also ensure that security personnel adhere to internationally recognized human rights principles in the provision of Project security services.

As detailed in Section 19.5, South Stream Transport will develop a Security Plan that sits within the broader HSSE-IMS (see **Chapter 22 Environmental and Social Management**) and is integrated with the other South Stream emergency plans discussed in this chapter. Contractors are required to align their own security plans and procedures with the requirements specified in the South Stream Transport Security Plan and in doing so demonstrate due consideration of both applicable law and the Voluntary Principles on Security and Human Rights (the 'Voluntary Principles'). Further detail concerning the Project's implementation of the Voluntary Principles is provided in **Chapter 14 Socio-Economics**.

To further mitigate against civil unrest, South Stream Transport will prepare and implement the Stakeholder Engagement Plan. The Stakeholder Engagement Plan will define community engagement activities that will be undertaken and adhered to, including ensuring access to a suitable community grievance procedure, and undertaking an appropriate community engagement and awareness programme.

In the event of construction workforce / community unrest or conflict there could be human injuries. Therefore, the Emergency Response Plans that will be prepared and maintained by each construction contractor will include measures that aim to protect the workforce and members of the public. These plans will define measures that aim to initially stabilize medical cases (which would be carried out by an on-site first aider, nurse or physician) and then enable evacuation carried out by ambulance or helicopter. The injured party would be evacuated to the nearest designated hospital or accident and emergency centre. Each contractor will ensure that sufficient first-aid or medical staff and equipment are located at the construction site to meet the identified occupational health risks. The location and capability of local ambulance stations (public and private) will be identified (and mapped) together with contact details, times of operation, distance and travel times. A qualified occupational physician will inspect and report on the capacity and capability of these services. A designated hospital or accident and emergency centre will also be identified (including contact details, times of operation, distance and expected travel times).

Traffic Accidents

Pipe sections and other materials will be delivered to the landfall section of the Project from the Novorossiysk port by road using designated access routes. Stakeholder engagement consultation has identified public and community safety concerns as related to traffic accidents when construction vehicles pass through residential settlements (**Chapter 6 Stakeholder Engagement**). Such traffic accidents could be caused by equipment malfunction or by human error.

South Stream Transport will ensure a range of measures will be implemented prior to construction works to address transportation related risks and impacts, including:

- Preparation and implementation of a Logistics Plan to manage and coordinate the transport and logistics requirements of the Project. The Logistics Plan will identify agreed access routes, as well as measures and safeguards to minimise interference with local transportation and routes;
- Preparation and implementation by the contractor of a Construction Traffic Management Plan (CTMP). The CTMP will:
    - Be consistent with, and take into consideration, the Construction Traffic Management Plan (or equivalent) developed for the Russkaya Compressor Station Project;
    - Be aligned with the Logistics Plan and ensure that access to the pipeline landfall and associated above ground installations will be restricted to the agreed access routes and the construction corridor;
    - Ensure that movement of 'outsize' or 'large / long' vehicles, or convoys, will be timed, where practicable, to avoid busy traffic periods and routed to avoid minor roads and villages; and
    - Include strict enforcement of speed limits for employees driving company vehicles and adherence to driving and health and safety guidelines during both work and non-work hours.
- The implementation of safe driving procedure protocols. These protocols will include the following measures:
    - Drivers will be briefed to maintain vehicular access to all existing properties and relevant safety measures to be applied along the designated construction access routes;
    - Training and enforcement to ensure that all South Stream Transport / contractor drivers adhere to all applicable national legislative requirements and driving conditions as specified by South Stream Transport;
    - All drivers will be trained in 'well driven' principles and guidance (Ref. 19.7); and
    - Driving performance will be assessed and monitored with additional training provided if necessary.

Contractors will also be required to regularly inspect and maintain their construction fleet in order to minimise accident risks as associated with mechanical failures. In addition to these risk reduction measures, contractor's Emergency Response Plans will include specific measures to be undertaken in the event of vehicle accidents, including those involving third parties. Any traffic induced oil spillages will be handled in accordance with the contractors Spill Prevention and Response Plan (Section 19.6.1.2).

19.6.2 Commissioning and Operational Phase – Landfall Section

19.6.2.1 Events Identification

During the Operational (including Commissioning) Phase of the Project, unplanned events in the onshore landfall section may occur as a result of accidental leakages of natural gas from the pipeline or from landfall facilities which have the potential to result in fires and explosions.

Table 19.2 lists the activities that could result in an unplanned event, a description of the unplanned event, and the receptors which could be affected.

Table 19.2 Landfall Activities Potentially Resulting in an Unplanned Event (Commissioning and Operational Phase)

Activity	Event	Receptors	
		Environmental	Socio-Economic and Community Health
Operation of the pipelines and landfall facilities	Accidental release of natural gas into the atmosphere	✓	✓
	Fires and explosions	✓	✓
	Protests and communal violence		✓

Some unplanned events have been excluded from the assessment undertaken in this section as they are not expected to lead to significant environmental or socio-economic impacts. Unplanned events that have been excluded from discussion are:

- **Spills of liquid hydrocarbon:** these events could occur during maintenance operations at the onshore landfall facilities, but the frequency of such operations and the volumes of hydrocarbon involved are sufficiently small enough not to warrant a detailed discussion of these events. Such events can be readily accommodated through applicable Emergency Response Plan and Spill Prevention and Response Plan;
- **Vehicular traffic accidents:** considering that no significant vehicular traffic will be associated with the Operational (including Commissioning) Phase of the Project, this aspect has been excluded from the assessment; and
- **Operational worker protests and / or disturbances:** As there will be no full time workers employed for the Project during the Operational Phase of the Project, issues associated with potential worker protests and / or disturbances are thus excluded from the assessment.

19.6.2.2 Potential Impacts to Environmental Receptors

Gas Leakages

The only possible source of a large scale release of gas into the atmosphere would be the result of a pipeline rupture or a planned release of gas from the landfall facilities or pipelines to allow maintenance or repairs to take place. Pipeline ruptures could be caused by factors such as external interference, internal or external corrosion, material and construction defects or ground movement / geohazards. Statistically, a pipeline rupture is a very rare event and the likelihood of such an extreme situation is very low (refer to failure frequencies as detailed in Table 19.3). Table 19.4 also provides calculated failure frequencies for the landfall facilities.

Table 19.3 Calculated Failure Frequencies for One and Four Pipelines (Ref. 19.1)

One Pipeline			
Failure Mode	*Failure Frequency (/1,000 km year)*	*Rupture (%)*	*Leak (%)*
External interference	0.000046	70	30
Internal corrosion	negligible	-	-
External corrosion	negligible	-	-
Material and construction defects	0.001	0	100
Ground movement	0.00001	22	78

Four Pipelines				
	Failure Frequency (/1,000 km year)			
	Buried pipeline sections		*Trenchless pipeline sections*	
	Leak	*Rupture*	*Leak*	*Rupture*
External interference	0.0000554	0.00012935	0	0
Other (Material and construction defects; Ground Movement)	0.040312	0.0000088	0	0.0000022

Table 19.4 Calculated Failure Frequencies for the Landfall Facilities (Ref. 19.1)

Leak Frequency (/year)	Above Ground Equipment		Underground Equipment
	Normal Operation	*Pigging Operation*	
Medium Leak (25 mm)			
1 pipeline	1.42×10^{-3}	1.25×10^{-3}	7.10×10^{-4}
4 pipelines	5.67×10^{-3}	5.02×10^{-3}	2.84×10^{-3}
Large Leak (100 mm)			
1 pipeline	1.11×10^{-4}	1.48×10^{-4}	1.14×10^{-4}
4 pipelines	4.44×10^{-4}	5.92×10^{-4}	4.57×10^{-4}
Very Large Leak (300 mm)			
1 pipeline	1.70×10^{-6}	2.08×10^{-5}	0
4 pipelines	6.80×10^{-6}	8.32×10^{-5}	0

The Project pipelines and the landfall facilities will be designed in compliance with national and internationally recognised standards (Section 5.2.6.1). The Project has developed specific design criteria taking into account Russian legislation and international pipeline industry standards, notably those of Det Norske Veritas[2], and European Standards that apply to the Project overall that aim to minimise the risk associated with gas leakages (and subsequent fires / explosions) and thus protect the environment, the operational workforce, as well as members of the public in surrounding areas. Of note is that the Project design takes account of potential terrestrial geohazards as described in Appendix 19.3.

Such measures aim to minimise the risks of pipeline failures which could result in large scale gas releases. Consistent with GIIP, the landfall facilities in Russia will have local Emergency Shutdown (ESD) valves and safety systems (e.g. alarms and trip systems) installed for each pipeline (Section 5.2.5.2). An ESD valve is a hydraulic actuated and spring return valve designed to stop the flow of a hazardous substance (i.e. the gas) upon the detection of a potentially dangerous unplanned event or non-standard operating conditions. In the unlikely event of rupture of one of the Project pipelines the ESD system will be triggered and the pipelines will isolate themselves. The gas volume in the pipelines will then be automatically isolated from the

[2] As per Section 5.2.6.1, the Project Specific Design Code (PSDC) will be developed during the detailed design stage and which will be primarily based on Det Norske Veritas (DNV) Offshore Standard DNV OS-F101 code 'Submarine Pipeline Systems, 2010' (DNV-OS-F101, 2010). DNV will certify that the offshore gas pipeline is compliant with DNV-OS-F101.

landfall facilities, by closing the landfall facilities inlet and outlet ESD valves, thereby stopping the flow of gas to the pipelines.

The landfall facilities will be equipped with a vent stack. The venting system is designed for venting the gaseous inventory of the pipework within the landfall facilities to the atmosphere (to depressurise) in cases of planned shutdown or maintenance of the pipelines. During normal operations, the vent stack will not emit any gas. Venting will only take place during planned maintenance or shutdown activities that may require gas within certain areas of the landfall facilities to be released to atmosphere (Section 5.6.2.1).

For safety purposes, the location of the vent stack structure is chosen such that the prevailing wind blows gas away from the landfall facilities. The vent stack height has been pre-determined based on safety requirements in the workplace in order to protect workers at the facility from asphyxiation, to ensure adequate dispersion in the atmosphere, and to ensure that an explosive mixture is not present at ground level.

Fires

If leaked gas is ignited, significant acute environmental impacts could be caused by the resulting fire, potentially at large distances from the Pipeline itself in the case of a full bore rupture event (especially if there are dry conditions at the time of such a fire event). In many instances, the area would recover relatively quickly from the effects of a fire (e.g. areas of grassland). However, if the fire was within or adjacent to a woodland area, there may be longer-term environmental damage.

Consistent with GIIP, the likelihood of occurrence of fires will be minimised through the use of a Fire & Gas (F&G) detection system that aims to protect and alert personnel and assets from the consequences of a fire and / or gas release. The F&G detection system is a safeguarding system which acts completely autonomously from other safety systems (Section 5.2.5.7). The landfall facilities F&G detection system will include a number of strategically placed gas, flame and smoke detectors. In addition, the containers housing the electrical and instrumentation (E&I) equipment will be fitted with gas, flame and smoke detection systems as appropriate. The main piping will also be installed underground as much as possible, whilst ESD valves will be installed in pits to minimise exposure to fire and explosion events. Such measures will further reduce the potential occurrence and magnitude of fire events.

In an emergency the landfall facilities will be isolated from the offshore pipeline and the Russkaya CS in Russia and the Receiving Terminal in Bulgaria. There is no requirement for emergency venting (i.e. venting is not part of the ESD logic). However, provisions exist to enable a manual depressurisation of the landfall facilities, if required.

In case of a gas-fuelled fire at the landfall facilities, rapid isolation of the leak will be undertaken as quickly as possible which will reduce the magnitude of any gas leak and limit the duration and intensity of possible fires. The rapid initiation of the isolation provisions will occur following detection of a gas leak or fire by the installed alarm systems. The quantity of gas within the landfall facilities (between the inlet and outlet valves) depends on the operating conditions at the time the valves are closed. The maximum quantity of gas that could be present within the landfall facilities is 42,830 kg.

Additional measures will include the development of an Emergency Response Plan, inclusive of fire prevention and suppression measures (see Section 19.6.1.2). The fire prevention and response measures will include specific actions to prevent the spread of any fires to the surrounding environment. However, provisions for active fire fighting are not foreseen for fire protection of the equipment within the landfall facilities as water based extinguishing systems are not considered an effective measure to extinguish or mitigate the effects of gas fires on gas containing equipment.

19.6.2.3 Socio-Economic Receptors and Community Health

Gas Leakages and Fires

Gas leakages have the potential to impact upon human health receptors. Short term exposure to low concentrations of natural gas may cause headaches, dizziness, drowsiness, nausea and vomiting. High gas vapour concentrations may lead to unconsciousness due to the absence of oxygen. Natural gas is extremely flammable, forming a flammable mixture at a concentration of approximately 5% gas in air (by volume). Therefore, in the unlikely event of a gas leakage, the main risk of concern to community facilities and health is associated with fire and explosion rather than gas exposure.

As identified in Section 19.6.1.3, in the event of a fire, it could spread to the environment that surrounds the landfall section, although fires are unlikely to reach private and residential properties located in the Shingari and Don holiday complexes and Gai Kodzor, Sukko, Supsekh and Varvarovka residential areas.

Section 19.6.2.2 indicates that the Project Pipeline has been designed in a manner that aims to minimise the risks associated with gas leakages and subsequent fires or explosions and thus risks posed to members of the public in surrounding areas. Notwithstanding the stringent standards of design and construction that have been adopted by the Project, it is acknowledged there is a small residual risk that leakages of gas could occur from the pipeline and landfall facilities which could result in a fire / explosion. In developing the Project design, potential third party interference has been taken into account such that the pipeline design includes measures to reduce accidental damage, whilst the landfall facilities will be secured by security fencing, intruder alarms and the surveillance of the real time Closed-Circuit Television (CCTV) by staff based in the Central Control Room (CCR) in accordance with a Security Plan that is being developed by South Stream Transport for the Project.

As indicated in Section 19.6.2.2 during operation, a vent stack located just outside the landfall facilities will be used to depressurise the landfall facilities during a planned shutdown. Given that the vent stack has been designed in order to provide for the safe venting of gas, it is not expected that this venting would pose a risk to the health of residents at nearby receptors given their distance from the vent stack (a minimum 1.1 km). Due to the presence of hydrogen sulphide and mercaptans in the gas, perceptible odour impacts may be expected to occur on a short-term infrequent basis during venting, but this would not be expected to represent a risk to health.

Whilst the risks of a pipeline gas leakages are inherently very low, it is essential to determine what the consequences of any gas leakage could be (ignition and explosion, for example) upon surrounding receptors, and assess the measures that can be implemented to reduce the effects of any such event, regardless of how small the likelihood of occurrence. Such information can then be used to define exclusion zones around Project facilities, within which activities and land uses are restricted. Definition of exclusion zones for the Project has been assisted through the completion of a Quantitative Risk Assessment (QRA) study that has analysed all components of the landfall section of the Project and, based on historical data on components failure and accidents' occurrence, determine the probability of possible leakages, quantify the leakages and determine the associated potential impacts on the public (Ref. 19.1) (Appendix 19.1).

The QRA undertaken has considered the risks to the public associated with the operation of the landfall sections by taking into account the hazards due to the release and dispersion of:

- Toxic substances either contained in the hydrocarbon gasses or used in the processing of these substances, if present; and
- Gaseous and liquid hydrocarbons as well as subsequent fires and explosions.

The QRA was performed following a pipeline specific approach with pipeline specific data. This approach was also applied for the landfall facilities. The risks have been calculated and expressed in terms of Individual Risk (IR) and Societal or Group Risk (GR). As detailed in Appendix 19.1, the QRA considered the risks to the offsite population expressed as the fatality risk per year.

The QRA study has assessed whether the risk to people resulting from the onshore pipeline section (and the landfall facilities) falls within the risk acceptance criteria of the international pipeline industry standards adopted by the Project, and it has enabled a clear and consistent set of exclusion zones to be defined for the Project. Details of the QRA methodology, acceptance criteria and scenarios tested are presented in Appendix 19.1.

The QRA shows that the highest IR is at the ground surface directly over the buried pipeline (maximum 1.8×10^{-7} per year) – this is below the acceptance criteria of 1×10^{-5} and 1×10^{-6} per year.

The population density in the surrounding areas of the planned pipeline route is such that the group risk criteria is not exceeded. No residential buildings are located in the range of the maximum effect distance of 680 m to 690 m (i.e. the maximum distance away from an event that would be adversely affected).

The QRA also shows that for the landfall facilities the distance from the facility fencing to the 1×10^{-5} per year, 1×10^{-6} per year and 1×10^{-7} fatality risk per year contours occur at distances of approximately 20 m, 150 m and 370 m respectively.

Table 19.5 presents the proposed exclusion zones that have been defined for the landfall section of the Project for the protection of public health and infrastructure. These are in accordance with the requirements of Gazprom Standard STO 2-2.1-249 – 2008 for Main Gas Pipelines, the regulatory requirements set out for the Proekt (the Russian Project Design Documentation), and informed by the results of the QRA (Ref. 19.1).

Table 19.5 Exclusion Zones Established for the Russian Landfall Section (Including Landfall Facilities)

Distance from the centreline of outermost pipelines and landfall facilities	Exclusion Conditions
0 to 19 m	Easement zone intended for construction, maintenance and repair of pipeline
19 to 260 m	C- and E-class: no isolated buildings (1-2 levels), dachas, agricultural farms
260 to 345 m	B-class: no cities, settlements, apartments of three levels or more, no developments / buildings with less than 100 people
345 to 410 m	A-class: no airports, railways station, no developments / buildings with population of more than 100 persons

The defined exclusion zones are sufficient to meet the risk acceptance criteria on individual and societal risk for the Project, as defined by industry standards, and to meet the requirements on exclusion zones from local Russian legislation and regulations.

Protests and Communal Violence

Local residents in the vicinity of the Project Area could potentially be impacted by unplanned events involving local civil unrest as associated with Project activities. Such events may occur because of misperceptions or lack of knowledge about the Project.

In order to minimise the likelihood of any civil unrest triggered by the Project's activities, South Stream Transport will prepare and implement the Stakeholder Engagement Plan which will define community engagement activities to be undertaken and adhered to, including public access to a suitable community grievance procedure, and a community consultation and awareness programme. During the Operational (including Commissioning) Phase it will be important to manage the community perception of gas leakage (and fire) risks through the provision of clear information about the Project and its risks during the community consultation and awareness programme.

19.6.3 Decommissioning

The decommissioning programme will be developed during the Operational Phase of the Project (expected service lifetime of the South Stream Offshore Pipeline is 50 years). It is likely that the technological options and preferred methods for decommissioning of such gas transportation systems as the South Stream Offshore Pipeline will be different in 50 years' time.

Consequently, unplanned events associated with the Decommissioning Phase are unknown at this stage; however, it is anticipated that some of the potential unplanned events will be similar in nature to some of those that may arise during the Construction and Pre-Commissioning

Phase. As such, the mitigation actions as defined in Sections 19.5.1 are also likely to be applicable to the Decommissioning Phase.

Under all circumstances, decommissioning activities will be undertaken in accordance with GIIP and with the applicable international and national legislation and regulations prevailing at that time, and in liaison with the relevant regulatory authorities. As part of the decommissioning planning programme, the potential for unplanned events will be considered and appropriate mitigation and management measures put in place to reduce risks and consequences to the surrounding environmental and local community receptors.

19.7 Nearshore and Offshore Section

19.7.1 Construction and Pre-Commissioning Phase – Marine Section

19.7.1.1 Events Identification

During the Construction and Pre-Commissioning Phase of the Project, unplanned events in the nearshore and offshore sections may occur as a result of offshore construction activities, use of maritime vessels and as a result of maritime vessel accidents.

Table 19.6 lists the main activities that could result in an unplanned event, a description of the unplanned event, and the receptors which could be affected.

Table 19.6 Marine Activities Potentially Resulting in an Unplanned Event (Construction and Pre-Commissioning Phase)

Activity	Event	Receptors	
		Environmental	Socio-Economic and Community Health
Offshore construction activities and associated use of maritime vessels	Introduction of invasive species by marine vessels	✓	✓
	Maritime accidents or collisions leading to oil spills (including during bunkering)	✓	✓

Table 19.6 indicates that during the Construction and Pre-Commissioning Phase, there is a risk of maritime vessel accidents and collisions. These events have the potential to impact upon socio-economic and human health receptors. Such maritime vessel accidents and collisions can also result in oil spillages which can have resultant impacts upon environmental, as well as socio-economic receptors. Table 19.6 also indicates the risks associated with the introduction of invasive species by maritime vessels.

In order to assist in defining the risks and potential knock-on environmental impacts associated with maritime accidents and associated oil spills, a maritime risk assessment has been undertaken which has included modelling of marine oil spills that are considered most likely to occur (due to accidental collisions / grounding of marine vessels or during vessel bunkering (refuelling) at both nearshore and offshore locations). The risk assessment assists in defining risk management activities. Details of the maritime risk assessment are presented in Appendix 19.2 which highlights the potential likelihood of accidents occurring. Appendix 19.2 also presents results from the oil spill modelling which has been used to assess the implications and risk management activities as related to environmental, socio-economic and human health receptors as detailed below.

Some unplanned events have been excluded from the assessment as they are not expected to lead to significant environmental or socio-economic impacts. Unplanned events that have been excluded from discussion are:

- **Spillages and discharge of potentially hazardous materials other than fuel / oil spillage:** Spillage of relatively small quantities of potentially hazardous chemicals (discharges of grey / black waste, sewage, garbage, bilge and oily water) from marine plant / vessels can be readily managed through ensuring that vessels operate in accordance with the Marine Pollution (MARPOL) Convention, the Black Sea Contingency Plan and national regulations. All contractors and operators of vessels working on behalf of South Stream Transport will be required to prepare Shipboard Marine Pollution Emergency Plans (SMPEP) as applicable for each vessel. Effective implementation of the SMPEP will mean that the implications of any such events will be sufficiently small enough not to warrant a detailed discussion of these events herein;
- **UXO Clearance:** Pipelay will be preceded by an unexploded ordnance (UXO) survey on part of the route, which will establish the need, and provide guidance for, the removal of boulders, rocks or potential UXO. A UXO clearance plan (if required) will take into consideration the presence of sensitive cultural heritage, marine biological and physical receptors, and will aim to avoid or reduce adverse impacts on these receptors. This process will be managed through the management of change process described in **Chapter 5 Project Description**. The UXO Clearance Plan (if required) will be developed by the Contractor subject to review and acceptance by South Stream Transport in close conjunction with the relevant authorities at the appropriate time. In the event that UXO requires clearance (controlled detonation) in close proximity to an as yet unidentified Cultural Heritage Object (CHO), the possibility that the CHO might be damaged or lost cannot be discounted. **Chapter 16 Cultural Heritage** discusses this issue further noting that the likelihood of such an event is considered remote. UXO clearance via a controlled detonation also has the potential to result in behavioural disturbances to fish / mammals over several kilometres; and
- **Impacts of unplanned pipeline construction events:** During the Construction and Pre-Commissioning Phase a range of unplanned construction events may be encountered, including wet buckle events (whereby the submerged pipeline buckles under pressure and floods with water) or failed hydrotest. Such events have the potential to result in significant construction delays and associated costs. It is considered that the environmental implications of such events (such as pipeline recovery, disposal, relaying) would be similar

to the environmental impacts as associated with routine construction activities as reported within this ESIA. Under such circumstances, remedial activities will be undertaken in accordance with GIIP which will limit the potential for significant environmental impacts.

19.7.1.2 Potential Impacts to Environmental Receptors

Invasive Species

Vessel operations have the potential to inadvertently introduce invasive alien species, either in ballast water, on the biofilm inside ballast tanks or carried as fouling organisms on the vessel hulls. Historically, some introductions of alien species have had extreme ecological consequences, either directly through the introduction of benthic predators such as *Rapana venosa* or through system wide perturbations as exemplified by the invasion of the planktonic ctenophore *Mnemiopsis leidyi.* In other instances, such as the introduction of the bivalve *Anadara inaequivalvis*, the effects have been less severe and in the case of *Beroe ovata*, have in fact served to redress some of the ecological perturbations caused by *M.leidyi*. See **Chapter 12 Marine Ecology** for more information.

Despite its low likelihood of occurrence, there is the possibility of population or community-wide effects on the entire ecology of the Black Sea should invasive alien species be inadvertently introduced. Introduced invasive planktonic species can out-compete native plankton species and cause changes to the marine food web. As such, introduction of invasive species can lead to the decrease in populations of pelagic fish that are the main food of most cetaceans or seabirds. Introduction of benthic predators such as *Rapana venosa* can cause changes to benthic species diversity which in turn can impact larger species (fish, birds or mammals) which feed on these species.

Given the above, the introduction of invasive species, although a rare event, could potentially have significant adverse environmental consequences. It is therefore a key objective of the Project to minimise the likelihood of occurrence of the introduction of invasive species and to develop measures that would effectively minimise the adverse impacts on potentially impacted marine habitats and associated species. Mitigation measures to be applied include the following:

- Where relevant and practical the IPIECA (Global Oil and Gas Industry Association for Environmental and Social Issues) document Alien Invasive Species (Ref. 19.13) and the Oil and Gas Industry, Guidance for Prevention and Management and the International Maritime Organisation (IMO) Ballast Water Management Convention and Guidelines. They will be applied to all marine plant and equipment that is used on the Project and which has the potential to be a vector of live organisms, spores, larvae and young and will include ballast water management, use of antifouling coatings, cleaning of equipment prior to deployment and the change of cooling water. The Contractor HSSE Plan will contain a detailed description of the actions to be taken to implement these requirements, where possible and practicable, including:
    - Vessels entering the Black Sea will have on-board, and implement, a Ballast Water and Sediment Management Plan;

- Vessels entering the Black Sea will have a Ballast Water Record Book to record when ballast water is taken on board; circulated or treated for ballast water management purposes; and discharged into the sea or reception facilities;
- Vessels entering the Black Sea using ballast water exchange will conduct ballast water exchange as far from the nearest land as possible, and in all cases at least 50 nautical miles (nm) from the nearest land and in water at least 200 m in depth;
- Vessels entering the Black Sea will conduct ballast water management in accordance with their year of construction and ballast water capacity and with either the ballast water exchange standards or ballast water performance standards;
- Careful cleaning of hulls and tanks before use and prior to entering the Black Sea; and
- Use of anti-fouling coatings (non-TBT) or sealing coatings to minimise inadvertent transport of organisms.

Maritime Vessel Collisions and Oil Spillages

A maritime vessel collision could conceivably occur at any location along the offshore section of the pipeline route, although the likelihood of such a collision occurring is considered to be very low. The likelihood that such an incident would result in an oil spill is even lower, as a high-energy collision would be required to damage a vessel to such an extent that marine diesel was spilled into the sea.

Appendix 19.1 presents details of maritime risk assessment which has entailed the following:

- Estimate the likelihood of an oil spill occurring following a maritime collision (based on available historical information), and rank these into categories;
- Estimate the severity of the potential consequences of any oil spill that could occur and rank these severities into categories;
- Construct a risk matrix of likelihood and consequence severity; and
- Assess various oil spill scenarios and determine their overall risk rating.

Following an evaluation of potential unplanned collision events, the oil spill scenarios (involving marine diesel oil - MDO) as detailed in Table 19.7 were defined, together with details of potential resultant oil spillages. The maritime risk assessment (Appendix 19.1) goes on to indicate that such unplanned collision events do not present a major risk of oil spills and that overall risk ratings are considered to be acceptable.

Table 19.7 Potential Oil Spill Scenarios in the Marine Area

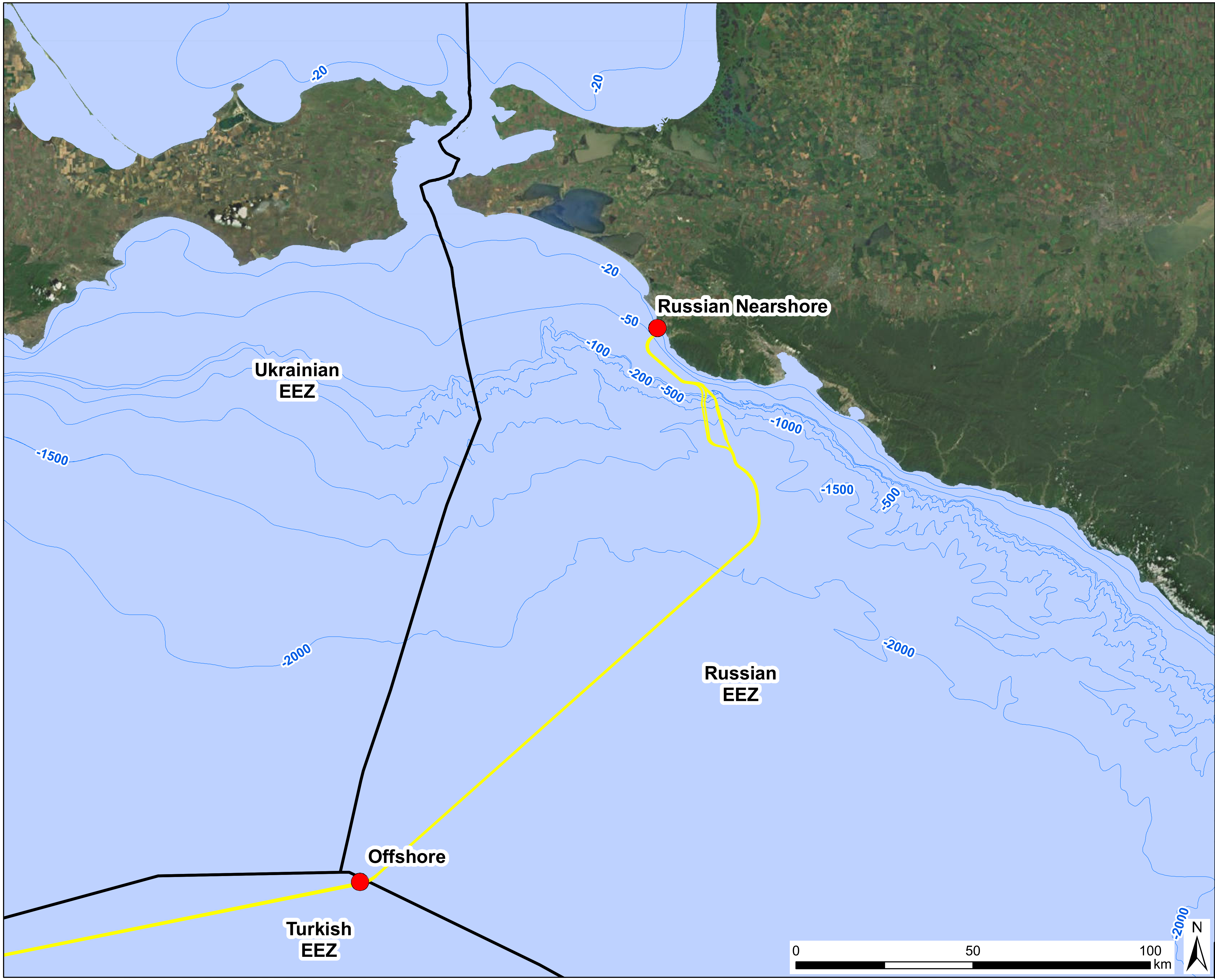
Location	Activities	Event Description	Assumption
Black Sea Nearshore	Dredging and Delivery	Grounding	MDO spillage @750 m^3 (loss of fuel over four hours), grounding on rocky shore.
		Collision with third party	MDO spillage of 1,200 m^3 (loss of fuel over six hours).

Continued...

Location	Activities	Event Description	Assumption
Black Sea Nearshore	Dredging and Delivery	Collision with Project vessel	MDO spillage of 1,200 m^3 (loss of fuel over six hours).
		Sinking	MDO spillage of 1,200 m^3 (loss of fuel over six hours).
		Bunkering at sea	MDO spillage of 10 m^3.
		Refuelling at port	MDO spillage of 10 m^3.
	Pipelay	Grounding	MDO spillage of 1,500 m^3 (loss of fuel over six hours). Grounding on rocky shore.
		Collision with third party	Collision with fully laden oil tanker, MDO spillage of 10,000 m^3, released from 2 wing tanks of tanker vessel (loss of fuel over six hours).
		Collision with Project vessel	MDO spillage of 1,500 m^3 (loss of fuel over six hours).
		Sinking	MDO spillage of 1,500 m^3 (loss of fuel over six hours).
		Bunkering	MDO spillage of 10 m^3.
Black Sea Offshore	Pipe Delivery	Grounding	Not possible.
		Collision with third party	MDO spillage of 2,000 m^3 (loss of fuel over six hours).
		Collision with Project vessel	MDO spillage of @750 m^3 (loss of fuel over six hours).
		Bunkering	MDO spillage of 10 m^3.
		Sinking	MDO spillage of 2,000 m^3 (loss of fuel over six hours).

Complete.

On the basis of the scenarios above, oil spill modelling has been undertaken for selected highest risk scenarios (details are included in Appendix 19.2) and include a nearshore spillage of 1,200 m^3 of MDO and an offshore spillage of 2,000 m^3 of MDO. Figure 19.2 illustrates the oil spillage locations that have been modelled.



LEGEND

- Oil spill modelling locations

Russian Sector of South Stream Offshore Pipeline

- Proposed offshore pipelines
- Exclusive Economic Zone boundary
- Isobaths

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: For Information

Client: South Stream Offshore Pipeline — ENERGISING EUROPE

Project Title: SOUTH STREAM OFFSHORE PIPELINE

Drawing Title: OIL SPILL MODELLING LOCATIONS

Drawn	Checked	Approved	Date
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Oil Spillage Risk Factors

The severity of the consequences of an oil spill depends on several factors including (a) type of oil spilled, (b) the amount of oil spilled and, perhaps most importantly, (c) the proximity of the oil spill to oil-sensitive resources. These issues are considered in the sections below.

a) Type of Oil Spilled

Maritime vessels typically use the following types of fuel oil:

- Marine gas oil (MGO): consisting of only distillates from oil-refining. This fuel is used in the small diesel engines of boats and smaller ships and can be used in auxiliary equipment such as generators and compressors;
- Marine diesel oil (MDO): A blend of heavy gas oil that may contain small amounts of black refinery feed stocks. This is used as fuel by the medium-speed diesel engines of smaller ships and can also be used in auxiliary equipment such as generators and compressors; and
- Intermediate Fuel Oils (IFO): Blends in varying proportion of gas oil and residues from crude oil distillation. This includes IFO-380 or Heavy Fuel Oil (HFO) consisting almost entirely of residues. HFO is used to power the slow-speed cross-head diesel engines used in most large ships and requires heating and purification when stored and used.

Oils have been classified by the International Oil Pollution Compensation Funds, the body involved with compensation for oil spills from tankers, into two groups; 'persistent' oils and 'non-persistent' oils:

- Persistent oils include most crude oils and HFO. When spilled on the open sea these oils progressively 'weather' to produce high-viscosity, water-in-oil emulsions that are very persistent on the sea surface and which contaminate shorelines when they drift ashore; and
- Non-persistent oils are mainly distillate fuels such as gasoline and diesel fuel. When spilled in the open sea these oils evaporate to some degree and are rapidly dispersed and dissipated by the prevailing wave action. MGO and MDO are classified as being non-persistent.

Taking into account the above, where practical, Project vessels deployed in the Project Area will use MGO or MDO, commonly referred to as 'marine diesel' and conforming to ISO-8217:2010 Marine Distillate Fuel Grades DMA, DMB or DMZ (rather than persistent oils such as most crude oils and Heavy Fuel Oil (HFO). As such, the oil spill modelling undertaken as detailed in Appendix 19.1 only considers oil spill scenarios that involve marine diesel.

b) Amount of Oil Spilled

The amount of oil spilled from an incident influences the area which is potentially affected. A large volume oil spillage has the ability to impact a wider area than a lower volume spillage given the ability of wind, waves and marine currents to disperse oil spillages.

c) Proximity of the Oil Spill to Oil-Sensitive Resources

Oil spills in the open ocean appear to be dispersed and dissipated by the effects of wind, waves and currents which reduces their ability to reach coastal sites. Some scattered tar balls can be found along coastlines which are evidence of past oil spills of crude oil and HFO, or caused by operational activities such as tank-washing.

Potential Impacts Upon Marine Ecology Sensitive Receptors

Typically ecological impacts are more severe when oil spills occur in shallower nearshore waters where spilled oil can affect the shoreline or be naturally dispersed into shallow water by wave action. Different organisms have different sensitivities and vulnerabilities to the toxic and physical effects of spilled oils. A spill of a relatively small amount of oil close to particularly sensitive coastal sites such as mud-flats and salt marshes can cause more ecological damage than a larger oil spill further from such sensitive sites. Spilled oil that becomes naturally dispersed by wave action in shallow water can cause adverse effects to habitats such as fish nurseries.

The principal areas of ecological concern with respect to oil spills are:

- Impacts on organisms in the water column; such as marine mammals, plankton and fish in open water, caused by the potentially toxic components in oils;
- Impacts on seabirds on the sea surface caused by oil contaminating the plumage of seabirds leading to the loss of insulation and subsequent hypothermia; and
- Impacts on coastal habitats (including bird populations) should the spilled oil at sea subsequently drift ashore where damage may be caused by the physical nature of the emulsified oil that smothers small organisms.

Section 12.4 of this ESIA Report (Baseline Marine Ecology) describes the marine habitats within and in proximity of the Project Area. This section indicates that along the eastern Black Sea coast, faunal groups of particular interest, either due to their value or vulnerability, include a variety of commercial fish species (e.g. anchovy, turbot, sprat etc.), endangered species (e.g. sturgeon), marine mammals and seabirds. Marine flora is also important, particularly red and brown macroalgae.

Oil Spill Mitigation Measures

Given the presence of the sensitive marine ecological species as indicated in the section above, an oil spill would potentially have significant adverse consequences. It is therefore a key objective of the Project to minimise the likelihood of occurrence of an oil spill and to develop Oil Spill Prevention and Response Plans that would effectively minimise the potential for adverse impacts on potentially impacted marine species and habitats.

Mitigation measures to be applied include the following:

- Where practical, vessels deployed in the Project Area will use MGO or MDO and, therefore, any accidental spill of fuel will have less adverse consequences than a spill that involves heavier fuels;
- All contractors and operators of vessels working on behalf of South Stream Transport will be required to develop and implement an Oil Spill Prevention and Response Plan. South Stream

Transport will ensure that contractor Oil Spill Prevention and Response Plans are appropriately aligned with the Black Sea Contingency Plan (Ref. 19.2). The Oil Spill Prevention and Response Plans will specifically target the prevention of potential oil spillage incidents as detailed in Table 19.7;

- The contractor will develop and implement Standard Operational Procedures (SOPs) which will define procedures that involve the handling of fuels / oils that aim to minimise the potential for spillages;
- Contractors and operators of vessels working on behalf of South Stream Transport will operate in compliance with MARPOL regulations on oil spill prevention and response and are required to prepare Shipboard Oil Pollution Emergency Plans (SOPEP) and Shipboard Marine Pollution Emergency Plans (SMPEP) as applicable for each vessel (Ref. 19.3; Ref. 19.5). The SOPEPs will specify the control and response measures that have to be available on board every vessel to respond to a spill that does not require external intervention; and
- Marine vessel crews will have the appropriate training, qualification and certification to undertake the tasks required during the construction of the pipelines.

The mitigation measures indicated above will minimise the likelihood of an oil spill occurring, and thus reduce the potential adverse impacts to marine habitats in the event of a spill.

19.7.1.3 Potential Impacts to Socio-Economic Receptors and Community Health

Invasive Species

As detailed in Section 19.7.1.2, vessel operations have the potential to inadvertently introduce invasive alien species, either in ballast water, on the biofilm inside ballast tanks or carried as fouling organisms on the vessel hulls. As the introduction of invasive species can have knock-on effects for larger species higher up the food chain; commercially important fish populations could be impacted through a decrease in the availability of their food source. A collapse or reduction in the fish stocks would cause a reduction in the fish available to local fishers.

The mitigation measures as detailed in Section 19.7.1.2 aim to minimise the likelihood of occurrence of the introduction of invasive species which thus minimise the potential for adverse socio-economic impacts as related to fish stock levels.

Maritime Vessel Collisions and Oil Spillages

Beach Users and Tourism

The mitigation measures as highlighted in Section 19.7.1.2 minimise the risk of an oil spill occurring. In addition, the maritime risk assessment and oil spill modelling results as included in Appendix 19.2 has established that the construction of the sub-sea natural gas pipelines across Russian waters does not present a major risk of oil spills and that the fuels used by Project vessels, if spilt, would evaporate to a significant degree with the remainder being naturally dispersed in the water column by wave action within a few days of being spilled.

Nevertheless an oil spill could, in theory, give rise to adverse impacts on the tourism industry in the Anapa Region. **Chapter 14 Socio-Economics**, Section 14.4.10 Baseline has identified that the Anapa Region is a focal point for coastal-related tourism and that the industry is a major employer in the region. The baseline has also identified that the tourism industry in the Anapa Region, particularly that which is focused on beaches and coastal activities, is heavily concentrated to the south of the Project Area (e.g. Sukko Beach).

An oil spill could potentially spread beyond the immediate area and could reach the coastal areas to the south of the Project Area, thereby potentially impacting the key coastal tourism precinct in the Anapa Region. If there was an oil spill that prevented tourists from using the beaches, swimming in the sea, or pursuing other Black Sea based or related recreational activities, the tourism industry in the Region could suffer economically (including long term tourist cancellations). However, as for beach users themselves, the severity of the impact would depend on the extent of the spill, its distribution and whether or not it occurred just prior to or during the peak summer season. Considering that any disruption due to oil spillages would be limited to a few days indicates that the economic impact on the tourism industry would be limited, even if the spill did occur just prior to or during the peak summer season.

Potentially, the greatest risk associated with an oil spillage would be to the reputation of the Region's beaches, and associated tourism industry, as an attractive and pristine seaside holiday destination. This could lead to a drop off in bookings over the remainder of the season and, possibly even in subsequent years. The relatively short duration of any visible oil in the water would limit the opportunity for adverse publicity, especially of a visual nature. However, the possibility of reputation damage for the area cannot be discounted. As described in Section 19.7.1.2, Project marine construction activities do not present a major risk of oil spills whilst construction-related activities in the marine environment that could give rise to an accidental oil spill will be undertaken in line with the Oil Spill Prevention and Response Plans to be prepared by contractors and operators of vessels working on behalf of South Stream Transport. Such measures thus minimise the risks of an oil spill and subsequent adverse impacts upon beach users and tourism.

Fisheries

Oil spills have the potential to affect fishery resources in a number of ways as described in the sections below.

Fish or Other Seafood Products - Mortality

Despite the susceptibility of juvenile stages of fish to relatively low concentrations of oil in the water column, adult free swimming fish and wild stocks of commercially important species will tend to swim away after detecting oil in the water column and thus it is unlikely that a spill will cause serious mortalities in any wild stocks. In general, juvenile fish and eggs are significantly more susceptible to oil pollutants than adults, and thus oil spillages can result in localised mortalities. Following a spillage, the reproductive success of unaffected fish, as well as the influx of eggs, juveniles and adults from unaffected areas leads the recovery of stock numbers. Given that many marine species produce vast numbers of eggs and larvae that are widely distributed by tidal currents means that species can recover from any mortality events as a result of short-term unfavourable conditions. Thus, the depletion of adult stocks is very rarely recorded following spillages as marine organisms can generally adapt to high mortalities though production of large numbers of eggs and replacement from outside the affected area.

Oil concentrations in the water column decline rapidly and are normally confined within the area of the spill so the impacts will be potentially more significant nearshore on more sessile animals, such as mussels. As well as mortality, there may be other effects such as changes in behaviour, feeding, growth or reproduction.

The impacts of an oil spill will depend upon the type of oil used - Section 19.7.1.1 details that spillages of non-persistent oils such as MGO and MDO when spilled in the open sea evaporate to some degree and are rapidly dispersed and dissipated by wave action. The effects of an oil spill are also dependent upon the duration of the exposure to the components in the oil. Bivalves and crustaceans located in intertidal or shallow sub tidal areas are particularly vulnerable to contamination from some of the lighter, more aromatic, compounds in oil.

Fish or Other Seafood Products – Sub lethal Effects

Fish or other seafood products can become tainted, defined as giving the product a petroleum taste or smell. Although it is essentially non-harmful to consumers, it can affect the marketability of the product and is most common in bi-valve molluscs and other filter feeding, sedentary animals (marine bottom-dwelling animals attached to the substrate). There are no set threshold values to determine if a product is tainted, subsequently it cannot be determined through chemical analysis, but only through taste (organoleptic testing). In the event of an oil spill, if there are signs of shellfish / fish oil tainting or contamination, any resultant imposed authority restrictions on fishing activities could result in detrimental impacts upon local fishers.

Damage to Fishing Gear

It is considered that the risks of damage and contamination to fishing gear is very low, given that following a spillage, any affected areas would be avoided by fishing vessels, whilst MGO or MDO spillages are expected to be rapidly dispersed.

Fisheries - Mitigation

The maritime risk assessment and oil spill modelling as presented in Appendix 19.2 has established that Project construction activities do not present a major risk of oil spills and that the fuels in question, if spilt, would evaporate to a significant degree with the remainder being naturally dispersed in the water column by wave action within a few days of being spilled. This reduces the potential for adverse impacts upon local fisheries and the local and regional fisheries industry. In addition, as indicated in Section 19.7.1.2, contractors and operators of vessels working on behalf of South Stream Transport will be required to develop and implement an Oil Spill Prevention and Response Plan. Vessels will also need to operate in compliance with MARPOL regulations on oil spill prevention and response and are required to prepare SOPEP and SMPEP as applicable for each vessel (Ref. 19.3; Ref. 19.4). The SOPEPs will specify the control and response measures that have to be available on board every vessel to respond to a spill that does not require external intervention. Such measures will further limit the potential for adverse impacts upon local fisheries and the local and regional fisheries industry.

South Stream Transport will ensure that contracts with vessel owners include appropriate oil spill compensation provisions to cover such potential socio-economic oil spill consequences.

19.7.2 Commissioning and Operational Phase – Marine Sections

19.7.2.1 Events Identification

During the Operational Phase (including Commissioning) of the Project unplanned events at sea may occur as a result of accidental leakages of natural gas from the subsea pipeline, as well as the introduction of invasive species by maintenance vessels.

Table 19.8 below lists the activities that are discussed in this section that could result in an unplanned event, describes the events, and the receptors that could be affected.

Table 19.8 Marine Activities Potentially Resulting in an Unplanned Event (Commissioning and Operational Phase)

Activity	Event	Receptors	
		Environmental	Socio-Economic and Community Health
Operation of the pipelines	Failure / damage to the pipeline which may result in gas releases and fire / explosions	✓	✓
	Introduction of invasive species by marine vessels	✓	✓

In order to assist in the risk assessment process, a Shipping Risk Report was prepared for the Project (Ref. 19.5). The report considers the risks to the marine pipelines posed by shipping in the Black Sea. The following shipping hazards were identified as posing a potential risk to the integrity of the pipelines:

- **Ship sinking onto and damaging the pipeline:** The risks of ship sinking damaging the pipelines can occur along the entire pipeline route, although there is only a risk when the ship is large enough to cause damage to the pipeline;
- **Ship grounding onto the pipeline:** Ship grounding becomes a risk when the ship is large or heavy enough to cause damage to the pipeline. In addition, grounding can only occur in shallow water. Based on the main characteristics of ships, ships are generally at risk from grounding when navigating in water with a depth of less than 18 m. Given that the pipeline at the Russian nearshore will be buried in such water depths, the risks of pipeline damage by ship grounding is considered to be negligible (Ref. 19.5);
- **Ship anchoring damaging the pipeline:** Risks associated with anchoring in the vicinity of the pipeline are two-fold:

- **Anchor drop:** An anchor, with impact energy sufficient to create significant damage, can be dropped directly on the pipeline; or
- **Anchor drag:** An anchor dropped in the vicinity of the pipeline can subsequently be dragged interacting with the pipeline; and

- **Ships dropping objects (such as containers) onto the pipeline:** The risks of ships dropping objects into the pipeline can occur along the entire pipeline route. When a container hits the top of a pipeline, the result can be a dent in a bare steel pipeline or, when the pipeline has concrete weight coating, a cracked coating possibly combined with a dent in the steel pipeline.

The hazards as detailed above have the potential to result in pipeline damage / failure, which could result in the release of gas (and potential subsequent fire) from the sub-sea pipeline which has the potential to impact upon the environment and human health receptors. However, due to the pipeline engineering design standards being applied which aim to minimise the potential for pipeline rupture and associated gas leakages (see Section 19.6.2.2), and the use of exclusion zones along the offshore pipeline (see Section 5.6.7), the potential for such a safety incident from an offshore pipeline is remote.

It is noted that there is a risk of encountering geohazards along the offshore pipeline route. Geohazards associated with the offshore environment include seismic activity, soft sediments, shallow gas and gas seeps. Appendix 19.3 presents details of potential marine geohazards and the resultant pipeline design responses.

For a fire incident following a gas leakage to impact upon human health receptors, it would require a pipeline failure and gas leakage, followed by ignition at the sea surface in conjunction with a passing vessel. The most likely occurrence of this type of event would be where an object such as a container or the vessel itself, causes an impact failure by sinking on the pipeline as detailed above. The potential resultant impacts associated with environmental and human health receptors are discussed below.

Some unplanned events have been excluded from the assessment undertaken in this section as they are not expected to lead to significant environmental and socio-economic impacts. Unplanned events that have been excluded from discussion are:

- **Pipeline repairs / salvage as associated with unplanned events:** following unplanned events there may be the need for pipeline salvage / repair works. It is considered that such activities would be similar to pipeline construction activities. Under such circumstances, salvage / remedial works would be undertaken in accordance with GIIP which would limit the potential for significant environmental impacts; and

- **Maritime vessel collisions and resultant oil spillages:** given the low volume of survey and maintenance vessels anticipated to be used during the Operational Phase, it is considered that the risks of collisions and oil spillages is so remote that is can be scoped out of the assessment. Maritime vessels operated on behalf of South Stream Transport will be operated in accordance with GIIP which would limit the potential for spillages and associated significant environmental impacts, whilst Oil Spill Prevention and Response Plans will still be required to limit the potential for oil spills and resultant impacts.

19.7.2.2 Potential Impacts to Environmental Receptors

Invasive Species

Maritime vessel operations during the Operational Phase will be limited to the periodic use of maintenance and monitoring vessels (see **Chapter 5 Project Description**). During routine monitoring or in the event that repairs are necessary, there is potential for vessels to be used from outside of the Black Sea. As such, there is the potential for such vessels to inadvertently introduce invasive alien species to the marine environment in the same manner as described in Section 19.7.1.2 for the Construction Phase.

The potential environmental consequences of introducing invasive species are considered in Section 19.7.1.2. Given the limited maritime vessel use required during the Operational Phase, it is considered that the risks of such events occurring is less than during the Construction Phase.

The mitigation measures as detailed in Section 19.7.1.2 will be applied during the Operational Phase in order to minimise risks to the marine environment from the inadvertent introduction of invasive species from maritime vessels.

Gas Leakages

Any gas released from a damaged sub-sea pipeline would rise through the water column as a plume of gas bubbles. On reaching the sea surface, the gas would disperse into the air.

As detailed in Section 19.6.2.2, gas releases into the atmosphere would not result in acute environmental impacts. The impacts would be chronic through the addition of greenhouse gases to the atmosphere. Such gas releases would not be significant in terms of increasing overall Russian Federation greenhouse gas emissions, although methane levels at the release site would be temporarily elevated which could locally impact upon any present marine ecology, including seabirds.

Gas passage through the water column could also impact upon marine organisms (such as fish and marine benthos), resulting in potential acute or chronic impacts depending upon exposure levels and environmental conditions (e.g. water temperature, dissolved oxygen) (Ref. 19.6). Gas is able to rapidly penetrate into marine organisms (especially through the gills) and disturb the main functional systems (respiration, nervous system, blood formation, enzyme activity, and others). Initially, organisms such as fish may exhibit behavioural symptoms such as fish excitement, increased activity, scattering in the water. Thereafter, further exposure can lead to symptoms of poisoning. As with most toxicants, early life stages are most vulnerable to effects.

Section 19.6.2.2 provides details of the measures included in the pipeline design that aim to minimise the potential for uncontrolled gas releases from the pipeline, and the actions that would be taken in the event of an unplanned gas release (to be defined in the contractor Emergency Response Plans).

Of note is that a number of Project design control measures have been identified to reduce the risk of geohazards impacting upon the integrity of the offshore pipeline which could result in gas leakages (refer to Appendix 19.3). During the Development Phase, geohazard mapping was undertaken to facilitate the pipeline route alignment as based on marine survey findings and associated engineering assessments (Ref. 19.9 and 19.10). In addition, the occurrence of mass movements triggered by events such as earthquakes was taken into account during the pipeline design process (Ref. 19.8). As detailed in Section 5.2.6.1, the pipelines will be designed in accordance with DNV-OS-F101 which considers standards for geohazard risk analyses. The pipeline design thus aims to minimise the occurrence of the unplanned gas releases following pipeline damage by unplanned events, whilst the Emergency Preparedness and Response Plan will further minimize the potential risks and environmental consequences of such events.

19.7.2.3 Potential Impacts to Socio-Economic Receptors and Community Health

Invasive Species

As detailed in Section 19.7.2.1, during the Operational Phase, there remains a low level risk that vessels from outside of the Black Sea will be used for pipeline repairs. In order to minimise risks to commercially important fish populations from the inadvertent introduction of invasive species from maritime vessels (as described in Section 19.7.1.3), the mitigation measures as detailed in Section 19.7.1.2 will be applied during the Operational Phase.

Gas Leakages and Fire

Should the marine pipeline rupture via the unplanned events as detailed in Section 19.7.2.1, gas would rise through the water column and disperse into the air.

Short-term human exposure to low concentrations of natural gas may cause headaches, dizziness, drowsiness, nausea and vomiting. High vapour concentration may lead to unconsciousness due to the absence of oxygen. Asphyxiation of any person present on a ship within the gas cloud was assumed to be a very unlikely scenario by the Shipping Risk Report (Ref. 19.5) as the gas concentration in the air would rapidly decrease to below harmful levels.

Natural gas is extremely flammable, forming a flammable mixture at a concentration of approximately 5% gas in air (by volume). In the unlikely event of a gas leakage, the risk to community facilities and health is associated with fire and explosion rather than gas exposure. Ignition of the gas cloud by an ignition source present on a ship in the gas cloud could result in a flash fire and harm, including potential ship's crew fatalities as well as result in vessel damage. For this risk analysis it was assumed that:

- Ships having performed anchoring operations that interact with the pipelines will be present in the gas cloud as they will have stopped or be close by; and
- Ships sinking or dropping containers on the pipelines would not be present in the gas cloud.

In order to minimise such risks to ships, the pipeline design standards as detailed in Section 5.2.6.1 aim to minimise the potential for pipeline rupture and associated gas leakages, and thus minimise the potential socio-economic implications. In addition, in order to minimise potential damage to the subsea pipelines (e.g. dragged anchors, fishing gear etc.), as well as minimise the risks to third party vessel occupants, exclusion zones will be put in place along the pipeline route during the Operational Phase. As detailed in Section 5.6.7, it is anticipated that the exclusion zone will extend to 0.5 km either side of the outermost pipelines from the microtunnel exit pit until the Russian / Turkish EEZ boundary (except for a section on the Russian continental slope where the pipelines diverge into two groups of two) (refer to Figure 5.41).

Section 19.7.2.2 also indicates that gas leakages can impact upon marine fish, although any such events are unlikely to result in widespread impacts upon fisheries. Following a gas leakage, the main impact may be the temporary exclusion of fishing vessels from potentially affected areas.

19.7.3 Decommissioning

The approach presented in Section 19.6.3 as related to the potential for unplanned events during the decommissioning of onshore pipelines are also applicable to the decommissioning of the marine pipeline. Thus as part of the decommissioning planning programme, the potential for unplanned events will be considered and appropriate mitigation and management measures put in place to reduce risks and consequences to the surrounding environmental and local community receptors.

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Ref. 19.15	IFC (2012) Performance Standard 4 - Community Health, Safety, and Security. Accessed at: http://www.ifc.org/wps/wcm/connect/a40bc60049a78f49b80efaa8c6a8312a/PS4_English_2012.pdf?MOD=AJPERES Accessed on 25 November 2013.

Chapter 20: Cumulative Impact Assessment

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20 Cumulative Impact Assessment

20.1 Introduction

While the impacts of an individual project may be judged to be acceptable, there is also a need to consider the potential for a project's impacts to interact with impacts associated with other developments – so called "cumulative" impacts.

This chapter presents a cumulative impact assessment (CIA) for the Project. The sections herein present details of applicable CIA guidance, the adopted CIA methodology, CIA scoping and impact assessment. The CIA takes account of planned and reasonably defined developments in the vicinity of the Project.

20.2 Definitions

International Finance Corporation (IFC) Performance Standard (PS) 1 (Ref. 20.1) defines cumulative impacts as:

"*impacts that result from the incremental impact, on areas or resources used or directly impacted by the project, from other existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted*".

The impacts of the Project thus need to be considered in conjunction with the potential impacts from other future developments or activities that are planned and reasonably and are located within a geographical scope where potential environmental and social interactions could act together with the Project to create a more (or less) significant overall impact.

20.3 CIA Guidance

20.3.1 International Finance Corporation (IFC) Guidance

IFC PS 1: Assessment and Management of Environmental and Social Risks and Impacts (Ref. 20.1) recognises that in some instances, developers need to consider cumulative impacts in their environmental and social impact and risk identification and management process.

PS 1 states that the impact and risk identification process:

"*will take into account the findings and conclusions of related and applicable plans, studies, or assessments prepared by relevant government authorities or other parties that are directly related to the project and its area of influence*" including "*master economic development plans, country or regional plans, feasibility studies, alternatives analyses, and cumulative, regional, sectoral, or strategic environmental assessments where relevant*".

Furthermore, it goes on to state that:

"*the client can take these into account by focusing on the project's incremental contribution to selected impacts generally recognized as important on the basis of scientific concern or* *concerns from the Affected Communities within the area addressed by these larger scope regional studies or cumulative assessments*".

In order to provide guidance on undertaking a CIA, IFC released a guidance note in August 2013 titled "*Cumulative Impact Assessment and Management – Guidance for the Private Sector in Emerging Markets*" (Ref. 20.2). This guidance note uses the concept of Valued Environmental and Social Components (VECs), these being VECs being environmental and social attributes that are considered to be important in assessing risk[1], which can include:

- Physical features;
- Wildlife populations;
- Environmental processes;
- Ecosystem conditions (e.g. biodiversity);
- Social conditions (e.g. health, economics); or
- Cultural aspects.

The IFC guidance note provides a six step process for assessing the potential for cumulative impacts upon VECs as follows:

- Scoping Phase I identifying – VECs, spatial and temporal boundaries;
- Scoping Phase II – other activities and environmental drivers;
- Establish information on the baseline status of VECs;
- Assess cumulative impacts on VECs;
- Assess significance of predicted cumulative impacts; and
- Management of cumulative impacts – design and implementation.

This CIA has used the IFC guidance note as a framework for assessing potential cumulative impacts associated with the Project and reasonably defined developments.

20.4 CIA Methodology

The CIA methodology adopted has been defined taking into account the six step process as detailed in the IFC CIA guidance note (Ref. 20.2) (Section 20.3.1). The bullet points presented below detail the activities that have been undertaken as part of this CIA:

- **Scoping Phase I:** this entailed defining which VECs needed to be included within the CIA taking into account the characteristics of the Project and the prevailing environmental and social conditions within areas that are potentially impacted by the Project. The VEC identification process has been assisted through the completion of engagement activities

[1] VECs are considered to be equivalent to "receptors" as defined in **Chapter 3 Impact Assessment Methodology**.

with applicable stakeholders. This phase of the assessment has also required setting temporal and spatial boundaries of the CIA for specific VECs;

- **Scoping Phase II:** this required the identification of other projects or human activities that could potentially impact upon defined VECs that could result in cumulative impacts. An analysis has then been undertaken which aims to define those development projects that are scoped into the CIA given their potential ability to generate a cumulative impact associated with the Project (due to temporal / spatial interactions with the Project);
- **Establish Information on the Baseline Status of VECs:** defining the baseline characteristics of VECs is an important stage in the CIA process, as this identifies their sensitivity to change. Note that relevant baseline information has been provided in Chapters 7 to 18 of this ESIA Report and is not reproduced here; and
- **Assess Cumulative Impacts Upon VECs:** taking into account the Project's predicted impacts upon identified VECs, an assessment has been undertaken to evaluate the ability of the Project to interact with other planned or reasonably defined developments in such a manner that gives rise to a cumulative impact (where the temporal and spatial influences may coincide). Note that the assessment presented in this chapter only considers the residual impacts arising from the Project (i.e. impacts following the application of mitigation measures as detailed in this ESIA Report). It follows that the chapter only considers those VECs that will experience any degree of residual impact associated with the Project. Thus VECs, for which there is a Project residual impact that is deemed to be insignificant in this ESIA, do not need to be included in the CIA in accordance with IFC CIA guidance note (Ref. 20.2) (see Table 20.1).

Table 20.1 Scoping Criteria for Inclusion of VECs in the CIA

Residual Impact			
Not Significant	Low	Moderate	High
Scoped out of CIA	Reviewed for potential cumulative impacts	Scoped into CIA	

As detailed in Table 20.1, where VEC residual impacts are defined as being Moderate or High Adverse, these are scoped into the CIA. Where VEC residual impacts are assessed as being Not Significant, these can be scoped out of the CIA (given that such VECs are either of negligible sensitivity or impact magnitudes are negligible – refer to impact significance matrix Table 3.3 in **Chapter 3 Impact Assessment Methodology**). For VEC residual impacts that are defined as being of Low Adverse, the applicable VECs have been subject to further evaluation to see if there is scope for cumulative impacts to be generated.

- **Assess Significance of Predicted Cumulative Impacts:** significant cumulative impacts have been evaluated as far as possible using the impact significance matrix presented in **Chapter 3 Impact Assessment Methodology**. Note that this has been possible only where the magnitude of impacts is capable of definition, for example, through readily accessible Environmental Impact Assessment (EIA) / ESIA reports or project documentation). It is beyond the reasonable scope of this ESIA Report to undertake an impact assessment of other developments that may occur within the vicinity of the Project. Where such information is not available, the assessment of potential cumulative impacts has been qualitative, and has relied upon professional judgement using the impact significance definitions described in **Chapter 3 Impact Assessment Methodology.** The assessment has not considered unplanned events as discussed in **Chapter 19 Unplanned Events**; and

- **Management of Cumulative Impacts – Design and Implementation:** should the CIA indicate that there is a potential cumulative impact which is of Moderate or High significance, the need for additional mitigation or management actions (or monitoring) (beyond those which are targeted at Project-induced impacts as reported within this ESIA Report) has been specified.

20.5 CIA Scoping Phase I: VECs, Temporal and Spatial Boundaries

20.5.1 VEC Identification

The ESIA Report considers the potential Project impacts across a wide range of VECs. These VECs have been defined by taking into account the prevailing environmental and social conditions in the Project Area, and the ability of the Project to impact upon these resources (during all Phases of the Project). Consultation with relevant stakeholders has been a key component of the environmental and social resource identification process – stakeholder engagement activities are detailed in **Chapter 6 Stakeholder Engagement**.

A summary of the VECs (receptors) that have been considered within this ESIA Report, and thus within this CIA, comprise the following:

- Physical (i.e. non-living environmental components, including air quality, water bodies, landscapes, terrestrial soils, marine sediments and geology);
- Marine ecology (i.e. marine habitat, flora and fauna);
- Terrestrial ecology (i.e. terrestrial habitat, flora and fauna); and
- Human (i.e. landowners and residents of local communities, local economy, marine users, cultural heritage).

20.5.2 Temporal and Spatial Boundaries

The CIA temporal boundary covers the Project Construction and Pre-Commissioning Phase and the early Operational Phase. However, the degree of uncertainty increases the further into the future the assessment extends. As such, potential cumulative impacts during the Decommissioning Phase have been scoped out of the assessment given that the decommissioning programme is uncertain and will be developed during the Operation Phase of the Project.

A review, and relevant studies if necessary, will be undertaken during the Operational Phase to confirm that the planned decommissioning activities are the most appropriate to the prevailing circumstances. The review would outline management controls and demonstrate that the decommissioning activities will not cause unacceptable cumulative environmental and social impacts should there be other developments in the vicinity of the proposed decommissioning works.

The geographic boundaries of the CIA have been defined taking into account the Project characteristics (**Chapter 5 Project Description**) and the assessment areas applied to defined VECs as included within the various technical assessments (Chapters 8 to 18) within this ESIA Report. A flexible approach has been maintained, such that the boundaries of the assessment vary depending on the characteristics of the potentially impacted VEC. The geographic boundary thus varies from the space occupied by a small VEC feature (e.g. a discrete feature of cultural heritage value) to a large geographic region or habitat within which a particular VEC occurs (e.g. habitat occupied by a protected species). The spatial extent of relevant VECs is detailed in the various technical assessments as presented within this ESIA Report.

20.5.3 Further Evaluation of Low Significance Impact to VECs

Table 20.2 presents a summary of the impact assessment as reported within this ESIA Report and identifies residual impacts on defined VECs during the Project Construction and Pre-Commissioning and Operational Phases.

As per the IFC guidance note (Ref. 20.2), this CIA considers those VECs that will be impacted by the Project with any degree of residual impact – thus VECs for which there is an impact that is deemed to be Not Significant do not need to be included and can be scoped out of this CIA. Where the Project residual impact significance is defined to be Moderate or High, the applicable VEC is scoped into the CIA. Residual impacts defined as Low have been subject to further evaluation in order to see if there is potential for cumulative impacts to be generated. Text highlighted in grey in Table 20.2 indicates that the VEC and associated impact source are scoped into the CIA on the basis of a High, Moderate or Low (following further evaluation) residual impact.

Table 20.2 illustrates the VECs and impact sources scoped into the CIA on the basis of a **Moderate Adverse** residual impact, which are:

- Construction Phase impacts upon the prevailing landscape character and visually sensitive human receptors;
- Reduced residential amenity for residents in local communities, specifically northeast Varvarovka, during the Construction and Pre-Commissioning Phase due to potential combined noise and visual impacts;
- Construction Phase impacts upon marine cultural heritage resources; and
- Waste disposal of material at the Alfa Landfill.

These issues are further considered in Section 20.7 together with discussion of selected VECs which experience **Low Adverse** residual impacts, in order to explore the potential for cumulative impacts. Section 20.7 also includes, on the basis of professional judgement, some VECs which experience a **Not Significant** residual impact.

Table 20.2 Summary of Project Residual Impacts

ESIA Chapter	VEC	Impact Source	Project Construction and Pre-Commissioning – Residual Impact	Project Operation – Residual Impact
Soil, Surface Water and Groundwater (Chapter 8)	Soil	Potential contamination of the soils through use and storage of materials, increased susceptibility to erosion, changes in soil properties and unstable ground (Construction and Pre-Commissioning Phase). Potential for leaks and spills, vegetation management along the permanent Right of Way (RoW), and interaction of Project infrastructure with natural geomorphological processes (Operational Phase).	Low Adverse	Low Adverse
	Surface Water	Potential contamination through use and storage of materials, surface water run-off across disturbed soils and river crossings by the Pipeline and access road (Construction and Pre-Commissioning Phase). Potential contamination by surface water run-off and access road, and river crossings by the Pipeline and access road (Operational Phase).	Not Significant to Low Adverse	Not Significant to Low Adverse

Continued…

ESIA Chapter	VEC	Impact Source	Project Construction and Pre-Commissioning – Residual Impact	Project Operation – Residual Impact
	Groundwater	Potential contamination through use and storage of materials, groundwater control, the mobilization of existing contamination and hydro-testing (Construction and Pre-Commissioning Phase). Potential contamination and the potential influence of the pipeline structure on the groundwater flow regime (Operational Phase).	Not Significant to Low Adverse	Not Significant to Low Adverse
Air Quality (Chapter 9)	Human receptors	Emissions from marine vessels and construction plant during pipeline installation (Construction and Pre-Commissioning Phase). Dust generation (Construction and Pre-Commissioning Phase). Emissions from road traffic movements (Construction and Pre-Commissioning Phase). Emissions from marine vessels, onshore plant, and fugitive gas emissions from gas pipeline (Operational Phase).	Not Significant (CO, benzene, PM and SO_2), Low Adverse (NO_2) Not Significant Not Significant	Not Significant

Continued…

ESIA Chapter	VEC	Impact Source	Project Construction and Pre-Commissioning – Residual Impact	Project Operation – Residual Impact
	Ecological receptors (protected and non-protected habitats and vegetation	Emissions from marine vessels and construction plant during pipeline installation (Construction and Pre-Commissioning Phase). Dust generation (Construction and Pre-Commissioning Phase). Emissions from road traffic movements (Construction and Pre-Commissioning Phase). Emissions from marine vessels, onshore plant, and fugitive gas emissions from gas pipeline (Operational Phase).	Not Significant to Low Adverse Not Significant Not Significant	Not Significant
Noise and Vibration (Chapter 10)	Human receptors (including residential dwellings, cemeteries and places of worship) and ecological receptors	Construction plant and vehicles (Construction and Pre-Commissioning Phase). Pipeline pressure testing (Pre-Commissioning Phase). Routine maintenance, vehicle movements and operational activities (Operational Phase).	Not Significant or Low Adverse (associated with use of Varvarovka Bypass Road) Low Adverse (night-time noise)	Not Significant / Low Adverse

Continued…

ESIA Chapter	VEC	Impact Source	Project Construction and Pre-Commissioning – Residual Impact	Project Operation – Residual Impact
Terrestrial Ecology (Chapter 11)	Designated sites	Construction activities resulting in habitat degradation and introduction of invasive species (Construction and Pre-Commissioning Phase). Maintenance of the RoW area and movement of people and machinery (Operational Phase).	Not Significant	Not Significant
	Notable habitats and flora	Loss of habitat and notable plant species resulting from vegetation clearance during soil stripping and land clearance (pipeline route, landfall facilities and construction sites) (Construction and Pre-Commissioning Phase). Maintenance of the RoW area and movement of people and machinery (Operational Phase).	Not Significant	Not Significant
	Reptiles (including Nikolski's tortoise) and amphibians	Impacts upon reptiles during site preparation and construction, loss of foraging habitat during construction (Construction and Pre-Commissioning Phase). Maintenance of the RoW area and movement of people and machinery (Operational Phase).	Not Significant	Not Significant

Continued…

ESIA Chapter	VEC	Impact Source	Project Construction and Pre-Commissioning – Residual Impact	Project Operation – Residual Impact
	Mammals (including bats)	Killing, injury and disturbance of individuals (including roosting bats); loss of foraging habitat during construction; noise and vibration emissions from vehicles, plant, and construction activities/disturbance to individuals during site preparation and construction works (Construction and Pre-Commissioning Phase). Maintenance of the RoW area and movement of people and machinery (Operational Phase).	Not Significant / Low Adverse	Not Significant
	Invertebrates	Killing and injury of individuals during site preparation and construction and loss of foraging and sheltering habitat (Construction and Pre-Commissioning Phase). Maintenance of the RoW area and movement of people and machinery (Operational Phase).	Not Significant	Not Significant
	Avifauna	Killing, injury and disturbance of birds and loss of habitat (Construction and Pre-Commissioning Phase). Maintenance of the RoW area and movement of people and machinery (Operational Phase).	Not Significant / Low Adverse	Not Significant

Continued...

ESIA Chapter	VEC	Impact Source	Project Construction and Pre-Commissioning – Residual Impact	Project Operation – Residual Impact
	Aquatic receptors	Killing and injury to aquatic species (Construction and Pre-Commissioning Phase). Maintenance of the RoW area and movement of people and machinery (Operational Phase).	Not Significant / Low Adverse	Not Significant
Marine Ecology (Chapter 12)	Marine mammals	Impacts due to construction activities (Construction and Pre-Commissioning Phase). Impacts due to operational activities (Operational Phase).	Low Adverse	Low Adverse
	Seabirds	Impacts due to construction activities (Construction and Pre-Commissioning Phase). Impacts due to operational activities (Operational Phase).	Low Adverse	Low Adverse
	Plankton	Impacts due to construction activities (Construction and Pre-Commissioning Phase). Impacts due to operational activities (Operational Phase).	Low Adverse	Low Adverse
	Soft substrate benthos	Impacts due to construction activities (Construction and Pre-Commissioning Phase). Impacts due to operational activities (Operational Phase).	Low Adverse	Low Adverse

Continued...

ESIA Chapter	VEC	Impact Source	Project Construction and Pre-Commissioning – Residual Impact	Project Operation – Residual Impact
	Benthic invertebrates	Impacts due to construction activities (Construction and Pre-Commissioning Phase). Impacts due to operational activities (Operational Phase).	Low Adverse	Low Adverse
	Macrophyte stands	Impacts due to construction activities (Construction and Pre-Commissioning Phase). Impacts due to operational activities (Operational Phase).	Low Adverse	Low Adverse
	Fish	Impacts due to construction activities (Construction and Pre-Commissioning Phase). Impacts due to operational activities (Operational Phase).	Low Adverse	Low Adverse
Landscape and Visual (Chapter 13)	Landscape character	Temporary alteration to landscape due to construction activities (Construction and Pre-Commissioning Phase). Permanent presence of landfall facilities and permanent RoW as part of the landscape; nuisance light pollution at night associated with facility lighting (Operational Phase).	Low to Moderate Adverse (Undulating Plateau LCA)	Not Significant to Low Adverse

Continued…

ESIA Chapter	VEC	Impact Source	Project Construction and Pre-Commissioning – Residual Impact	Project Operation – Residual Impact
	Human receptors	Construction disturbance and visual intrusion (Construction and Pre-Commissioning Phase). Visual intrusion due to permanent presence of landfall facilities and permanent RoW as part of the landscape; nuisance light pollution at night associated with facility lighting (Operational Phase).	Not Significant to Moderate Adverse (views of construction work on the landfall section)	Not Significant to Low Adverse
Socio-Economic (Chapter 14) and Chapter 15 Community Health, Safety and Security	Human receptors	Employment generation (Construction and Pre-Commissioning Phase). Potential for reduced business revenues (commercial fishing businesses) (Construction and Pre-Commissioning Phase) Potential for reduced business revenues due to construction activity (Shingari and Don holiday complexes) (Construction and Pre-Commissioning Phase).	Beneficial Not Significant Not Significant	

Continued…

ESIA Chapter	VEC	Impact Source	Project Construction and Pre-Commissioning – Residual Impact	Project Operation – Residual Impact
	Human receptors (continued)	Potential for reduced business revenues due to construction activity (Anapa Resort Town tourism sector) (Construction and Pre-Commissioning Phase).	Not Significant	
		Potential for reduced business revenues due to construction activity (Varvarovka Horse Riding Business) (Construction and Pre-Commissioning Phase).	Low Adverse	
		Economic displacement due to changes in land use (Construction and Pre-Commissioning Phase).	Low Adverse	
		Impacts on public safety, including traffic related risks, and security (Construction and Pre-Commissioning Phase).	Low/Moderate Adverse	
		Impact on amenity of Sukko and Shingari beach for recreational users (Construction and Pre-Commissioning Phase).	Low Adverse	
		Reduced amenity for visitors to the Varvarovka (Russian Orthodox and Armenian) Cemetery (Construction and Pre-Commissioning Phase).	Low Adverse	
		Reduced residential amenity for residents in Local Communities, specifically northeast Varvarovka (Construction and Pre-Commissioning Phase)	Moderate Adverse	
		Spread of sexually transmitted infections (STIs) due to influx of workers (Construction and Pre-Commissioning Phase).	Low Adverse	

Continued...

ESIA Chapter	VEC	Impact Source	Project Construction and Pre-Commissioning – Residual Impact	Project Operation – Residual Impact
Socio-Economic (Chapter 14) and Chapter 15 Community Health, Safety and Security	Human receptors (continued)	Potential for reduced property values due to the creation of safety exclusion zones (Operational Phase).		Not Significant
		Public anxiety over large volumes of gas close to local communities (Operational Phase).		Not Significant
	Local, regional and national businesses	Local and regional businesses benefit from spending on local accommodation, goods, services and facilities.	Beneficial	Beneficial
Ecosystem Services (Chapter 17)	Crops	Loss of current production and future use, reduced accessibility of land, potential loss of jobs (Construction and Pre-Commissioning Phase).	Low Adverse	Not Significant
		Severance of agricultural land and loss of productivity / efficiency due to operation of the Pipeline (Operational Phase).		
	Capture fisheries	Changes in fishery productivity, loss of access to fishing grounds, barrier to migration (Construction and Pre-Commissioning Phase).	Not Significant	Not Significant
		Potential (or perceived) disturbance to fish communities, loss of access to fishing grounds, snagging of equipment (Operational Phase).		

Continued…

ESIA Chapter	VEC	Impact Source	Project Construction and Pre-Commissioning – Residual Impact	Project Operation – Residual Impact
	Water supply	Reduced accessibility of water resources (Construction and Pre-Commissioning and Operational Phase).	Not Significant	Not Significant
	Hazard regulation	Increases in flood / landslide risk, changes in coastal erosion rates (Construction and Operational Phase).	Low Adverse	Not Significant
	Air quality regulation	Lower air quality, human health risk, impact on tourism (Construction and Pre-Commissioning and Operational Phase).	Not Significant	Not Significant
	Water quality regulation	Risk to human health (Construction and Pre-Commissioning and Operational Phase).	Low Adverse	Not Significant
	Soil quality regulation	Lower soil productivity, health risks to workers, reduced ecosystem functioning (Construction and Pre-Commissioning and Operational Phase).	Not Significant	Not Significant
	Tourism and recreation values	Reduced recreational use of area and corresponding impact on livelihoods (Construction and Pre-Commissioning and Operational Phase).	Low Adverse	Not Significant
	Cultural and spiritual values	Loss of cultural and aesthetic value of landscape and disturbance to cemetery (Construction and Pre-Commissioning and Operational Phase).	Low Adverse	Low Adverse

Continued…

ESIA Chapter	VEC	Impact Source	Project Construction and Pre-Commissioning – Residual Impact	Project Operation – Residual Impact
	Wild species diversity	Increase vulnerability of threatened species, loss of valued habitat (Construction and Pre-Commissioning Phase). Injury and death of wild species from vehicle and vessel collisions, disturbance from noise (Operational Phase)	Not Significant	Not Significant
Cultural Heritage (Chapter 16)	Terrestrial cultural heritage objects	Construction impacts and construction traffic impacts upon monuments, cemeteries (Construction and Pre-Commissioning Phase).	Not Significant to Low Adverse*	
	Marine heritage features	Construction impacts and marine traffic impacts upon marine archaeology (Construction and Pre-Commissioning and Operational Phase).	Not Significant to Moderate Adverse†	Low Adverse
Waste Management (Chapter 18)	Natural resources and the receiving environment	Waste materials generated and disposed of during the Construction and Pre-Commissioning and Operational Phases.	Not Significant to Low Adverse other than Moderate Adverse impacts as associated with waste disposal at Alfa Landfill‡	Not Significant / Low Adverse other than Moderate Adverse impacts as associated with waste disposal at Alfa Landfill

* Excludes currently unknown items and sites of heritage significance
† Excludes currently unknown marine archaeology
‡ Moderate adverse impact due to non-compliance with IFC criteria (i.e. waste disposal to an unlined landfill)

Complete.

20.6 CIA Scoping Phase II: Other Developments

20.6.1 Introduction

This section defines the planned and reasonably defined developments in the vicinity of the Project. If the Project is able to interact with such developments (temporally and / or spatially), the Project may be able to exert a potential cumulative impact.

Information has been obtained from the Project stakeholder engagement and consultation process (**Chapter 6 Stakeholder Engagement**), in particular information has been obtained from local, regional, governmental organisations and from a review of the open literature.

20.6.2 Development Proposals

The following planned and reasonably defined development proposals have been identified in the vicinity of the Project:

- Project connection with South Stream Pipeline (Turkish Sector) at the Russian / Turkish EEZ border;
- The Russkaya compressor station (CS) and associated pipelines (Ref. 20.3 and Ref. 20.4);
- Other developments as included in the Anapa District Growth Development Plan (GDP) (Ref. 20.5);
- The Residence of Utrish development (Ref. 20.6);
- The Zapovedny (Reserved) development (Ref. 20.6);
- The Club Village Chateau development (Ref. 20.6);
- The "Clearing in the Woods" ("Lesnaya Polyana") development (Ref. 20.6 and Ref. 20.7);
- Rosneft oil and gas exploration activities (Ref. 20.8);
- Other developments in eastern Sukko (Ref. 20.9); and
- The Anapolis development (Ref. 20.9).

Other than the Rosneft oil and gas exploration activities, there are no known marine development proposals outside of the Project to develop new uses or intensify existing uses in either the nearshore or offshore sections of the Project Area.

Figure 20.1 shows the location of the Russkaya CS and associated pipelines and the potential residential developments at Lesnaya Polyana (labelled A in Figure 20.1), Utrish (labelled B in Figure 20.1), Zapovedny (labelled C in Figure 20.1), Club Village Chateau (labelled G in Figure 20.1) and the Anapolis development (labelled D in Figure 20.1). Figure 20.2 shows indicative locations of conceptual developments as contained within the Anapa District GDP (also refer to Figure 14.10). These proposed developments are discussed in the sections below.

20.6.2.1 Project Connection with South Stream Pipeline at the Russian / Turkish EEZ Border

The South Stream Offshore Pipeline will traverse the Black sea via the Russia, Turkey and Bulgaria EEZs. The Project (Russian Sector) will therefore interface with the South Stream Offshore Pipeline (Turkish Sector) located in the Turkish EEZ. During the Construction and Pre-Commissioning Phase, activities taking place within Turkish waters will be similar to those taking place in the Russian offshore areas, including:

- Mobilisation of vessels to and from site and vessel movements within construction spread;
- Perform pre-lay, as-laid, and as-built ROV surveys etc.;
- Delivery of fuel, pipe and other supplies including hazardous substances to pipe-laying vessel by supply vessel;
- Storage of fuel and other hazardous materials;
- Refuelling of vessels, plant and machinery;
- Helicopter operations for crew changes;
- Maintenance of plant and machinery;
- Waste generation from vessel operations;
- Use of fresh water maker / desalination unit and vessel cooling water system; and
- Night time working.

During the Operational Phase, the South Stream Offshore Pipeline - Turkish Sector, in Turkish waters, will be subject to the same maintenance regime as being applied to the deep water pipelines in Russia (refer to **Chapter 5 Project Description**).

20.6.2.2 Russkaya Compressor Station (CS) and Pipelines

The Project landfall facilities will be connected to the Russkaya CS via four 3.2 kilometre (km) long onshore pipelines (see Figure 20.1). The Russkaya CS, and the four connecting pipelines, are being developed by Gazprom Invest as part of the "Expansion of the UGS to provide gas to South Stream pipeline" (UGS - United Gas Supply System) and do not form part of the Project. However, the Russkaya CS and the four connecting pipelines have been defined as associated facilities (refer to **Chapter 5 Project Description**)[2].

The Russkaya CS will be located in the Anapa administrative district of the Krasnodar Region on a green field site and in a relatively isolated location. The village of Gai Kodzor is located approximately 1.2 km northeast of the Russkaya CS site, whilst Sukko is located approximately

[2] OECD Common Approaches (Ref. 20.13) defines associated facilities as being "facilities that are not a component of the project but that would not be constructed or expanded if the project did not exist and on whose existence the viability of the project depends; such facilities may be funded, owned, managed, constructed and operated by the buyer and/or project sponsor or separately from the project."

2.9 km to the south and Varvarovka is approximately 4.25 km to the west of the Russkaya CS site.

The construction of the Russkaya CS forms part of the first stage (Western corridor) of the UGS expansion, which is expected to be operational in 2016. The capacity of the Russkaya CS will be increased during the second stage (Eastern corridor) of the UGS expansion, which is expected to be commissioned and operational in 2019. A storage area for material and equipment, the Materials and Equipment Depot (MED), will also be established during this second stage.

The Russkaya CS includes the following (Ref. 20.3 and Ref. 20.4) main technical equipment within the site limit:

- Input pipelines with gas inlet piping machinery stations;
- Gas treatment units;
- Compressor works with gas pumping unit (GPU) of unit rating 25 - 50 MW and individual gas air cooling units; and
- Gas flow rate metering unit (GFMU).

The Russkaya CS development footprint has been estimated based upon data as presented in the Russkaya EIA documentation (Ref. 20.3 and Ref. 20.4) as follows:

- The compressor station construction footprint is assessed to be approximately 52 ha;
- Assuming a 120 m wide construction corridor for the 3.2 km long pipelines connecting the Russkaya CS with the South Stream Transport landfall facilities, the pipeline Right-of-Way (RoW) equates to a construction area of approximately 38.7 ha; and
- The construction footprint for the Gazprom Invest permanent access road is estimated to be approximately 4.5 ha.

In addition to the above, an area of approximately 16.1 ha has been assumed to be required for a temporary construction works area (located to the northwest of the Russkaya CS construction footprint).

Given the above, the total construction footprint of the Russkaya CS development is assessed to be approximately 111.3 ha.

In addition to the above, the Russkaya CS includes a tie in with the trunk gas pipeline with a PIG receiver, a gas processing unit, emergency diesel power stations, auxiliary power supply stations, a production and operations building, a machinery and repair shop with reserve motor storage, a boiler room, a gas-meter station, a thermal waste-decontamination unit, tanks with oil products, a road vehicle car park and washing area and a sewage treatment plant.

The MED will meet Russkaya CS operational requirements by acting as a storage area for materials and equipment and will be located 290 m to the north northwest of the Russkaya CS. The MED will include an entry area with changing rooms, heated warehouse, cooled warehouse, open storage area, automatic diesel power station (ADPS), diesel storage tank and local treatment facilities for rainwater.

The main construction period for the Russkaya CS is predicted to last for 34 months. It is noted that early works and site preparation activities for the Russkaya CS commenced in early 2013. The first phase of the main construction period is anticipated to commence in January 2014 and last 22 months until October 2015. The second phase of construction is proposed to start in May 2015 and last 18 months until October 2016. A six day working week and ten hour working day are likely to be adopted during the construction phase.

The construction phase of the Russkaya CS will consist of both offsite and on-site preparatory work. The offsite preparatory work will include activities such as the construction of the planned access road, preparation of a temporary construction compound including accommodation, the delivery of pre-fabricated buildings for storage and household needs, the laying of temporary utility lines and the repair or upgrade of existing roads for use during construction. The on-site preparatory work will include temporary areas for erecting cranes, protection of underground utilities with reinforced concrete slabs, construction of storage and assembly areas, arrangement of temporary site utilities, construction of temporary pedestrian paths and lighting of the construction site. Activities involved in the construction of the Russkaya CS include excavation, piling, laying of utilities, erection of above ground structures, installation of process piping and equipment, internal plumbing work, electrical work and commissioning.

The potential environmental impacts associated with the development of the Russkaya CS are reported in the development EIA documentation (Ref. 20.3 and Ref. 20.4). As indicated above, the Russkaya CS construction programme will in part overlap with proposed Project construction works.

Given its definition as an associated facility, key findings of the Russkaya EIA are detailed in Appendix 20.1. The Appendix also presents South Stream Transport's commitments in relation to Russkaya CS as an associated facility. The commitments will be implemented though the HSSE Interface Management Procedure for Gazprom Invest which is part of South Stream Transport's HSSE Integrated Management System.

20.6.2.3 Rosneft Oil and Gas Exploration

Rosneft is a Russian oil and gas company that is planning to develop a number of concession blocks within the Black Sea off the Russian coastline, namely: the Tuapse Trough, West-Chernomorsky and the South-Chernomorsky offshore areas (see Figure 20.3).

According to Rosneft's 2012 Annual Report (Ref. 20.8), the Tuapse Trough has a potential recoverable resource estimated at approximately 1.2 billion tonnes of oil equivalent and that 3D seismic work totalling approximately 4,200 km^2 was completed in 2012, whilst 3D seismic data obtained earlier have been processed. The West-Chernomorsky area has an estimated recoverable resource equal to approximately 1.4 billion tonnes of oil equivalent within a block area of approximately 9,000 km^2. Rosneft has carried out seismic works to study the area and has identified six promising formations. Rosneft press releases (Ref. 20.10) report that two exploration wells are to be drilled in 2015 - 2016 in line with license obligations. The South-Chernomorsky area has a recoverable resource of approximately 0.47 billion tonnes of oil equivalent and the area has been subject to 2D seismic surveying in 2012.

South Stream Transport has met with Rosneft to discuss potential interactions between Rosneft's oil and gas exploration activities and the Project. However, further information detailing Rosneft's exploration locations and programme are not available at the time of writing.

20.6.2.4 The Clearing in the Woods ("Lesnaya Polyana")

This is a proposed 16.5 hectare residential development with approximately 160 land plots that is currently under construction and essentially an extension of the town of Varvarovka (Figure 20.1 – development A) (Ref. 20.6). The development site is located approximately 500 m northwest of the microtunnel entry points and 1.5 km southwest of the landfall facilities.

It is understood from the site developer (February 2014 Ref. 20.11) that construction of the access roads and site levelling have been completed, whilst works are on-going with regard to the water supply. It is also understood from the developer that some land plots have been sold, but that housing construction activities are planned this year and continue for the next two to three years. There is thus the potential for the development construction works to overlap with the construction works associated with the Project (**Chapter 14 Socio-Economics**). The development may also be defined as a sensitive receptor if some works are completed and properties are inhabited prior to the start of the Construction and Pre-Commissioning Phase of the Project, although this is considered unlikely to happen given the status of the development proposals.

20.6.2.5 The Residence of Utrish Development

This is a potential residential development in the settlement of Sukko covering an area of approximately 16 hectares, located approximately 2.55 km southeast of the microtunnelling point (Figure 20.1 – development B). This housing complex consists of (Ref. 20.6):

- 14 houses with a small number of apartments;
- 46 town houses (terraced houses);
- 44 cottages; and
- Commercial areas and social infrastructure.

It is understood from the developer (February 2014 Ref. 20.11) that four to five houses have been sold and are now occupied, whilst 20 to 25 townhouses have also been sold. The development's proposed construction phase runs from 2011 – 2015 and thus there is a potential for on-going construction works to overlap with those of the Project.

20.6.2.6 The Zapovedny (Reserved) Development

This residential development comprises approximately 114 residential dwellings located in the southern part of Sukko (area of approximately 11.5 hectares), approximately 3.5 km east-southeast of the microtunnelling point (Figure 20.1 – development C) (Ref. 20.6). It is understood from the site developer (February 2014 Ref. 20.11) that the development road system has been completed and that works are starting with regard to the electricity supply. There is thus the potential that on-going construction works overlap with those of the Project.

20.6.2.7 Other Developments in Eastern Sukko

Other potential developments in eastern Sukko include the following (Ref. 20.9) (see Figure 20.1):

- Children's Entertainment Park covering an area of approximately 89 ha which may be developed before 2019 (labelled E in Figure 20.1); and
- Resort-Residential District "Gornoye Ozero" which would comprise apartments and low-rise houses, social infrastructure (educational, health care, sport and leisure facilities) and commercial facilities (e.g. shopping centre, restaurants, hotels etc.) (labelled F in Figure 20.1). This particular development will extend over an area of approximately 240 ha. It is understood from the developer (February 2014 Ref. 20.11) that the project is at the design stage and that the aim is to have the facility fully developed before 2020.

The programme for these potential developments is uncertain, although it is considered most likely that if developed, they would be constructed after the Project Construction and Pre-Commissioning Phase.

20.6.2.8 Club Village Chateau

The Club Village Chateau development (see Figure 20.1) involves the development of approximately 45 chateaus. These chateaus will be constructed within an area of existing vineyards such that each chateau will be located within a land plot which has its own private vineyard (Ref. 20.6).

The development plot has a total area of approximately 83 ha, although the construction works are estimated to impact upon approximately 20% of the total development footprint (calculated from a review of the proposed development layout proposals) thus impacting upon an area of approximately 16.6 ha.

It is understood from the developer (February 2014 Ref. 20.11) that the development is currently on hold and that works will only proceed following completion of the Project Construction Phase given that the road which passes through the development plot will be used as a Project access road.

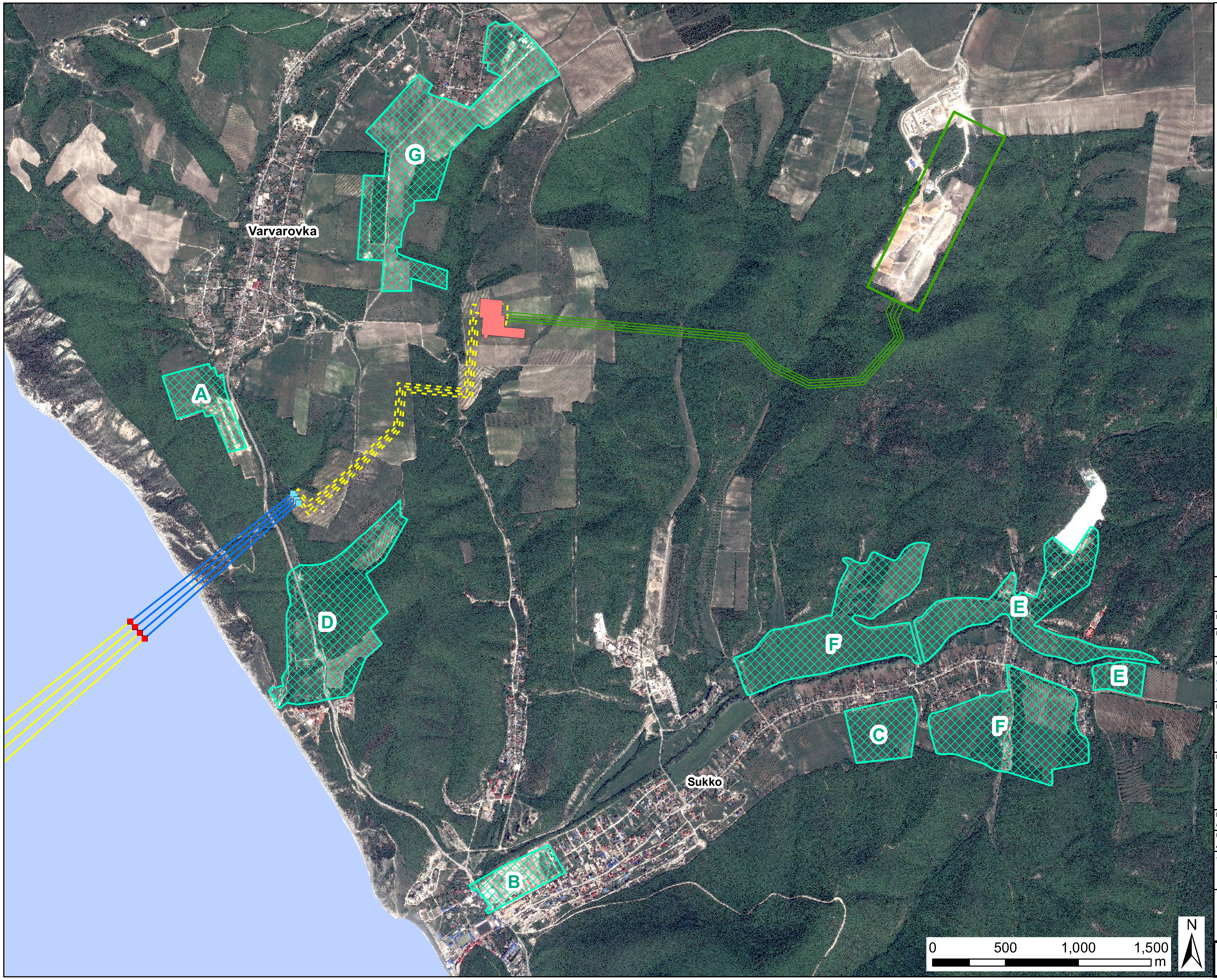
20.6.2.9 The Anapolis Development

This is a proposed mixed use district development that includes residential properties, commercial facilities, hotels and associated infrastructure. The development site covers an area of approximately 66.7 hectares, and is located approximately 350 m south of the Pipeline alignment (Figure 20.1) (Ref. 20.9). It is understood from the site developer (February 2014 Ref. 20.11) that some construction works are planned to start this year, although this depends upon progress in terms of water and electricity connections (understood to be planned for 2015). There is thus the potential that future construction works could overlap with those of the Project.

20.6.2.10 Anapa GDP Proposals

The Anapa GDP (Ref. 20.5) contains potential development proposals that may be developed over the next 20 years. These development proposals are at the conceptual planning stage and thus there is uncertainty as to when they will occur and their associated development footprints. Of note to this assessment is reference to the following development proposals (Figure 20.2; also refer to Figure 14.10):

- Planned expansion of northern Gai Kodzor in areas free from existing structures that are within the existing boundaries of the village (approximately 4.5 km northeast of the landfall facilities);
- The low-rise residential development in the central, western and southern parts of Supsekh making use of undeveloped land within the settlement and 39 hectares of agricultural land (located approximately 3.5 km northwest of the Pipeline). The development may also include new secondary education schools, kindergartens, district hospital, out-patient clinic, emergency medical service department, fire station, shopping and routine services facilities and sports facilities;
- The allocation of shopping, public catering and roadside service facilities along the Anapa to Sukko motorway on the southern outskirts of the village of Supsekh;
- Development in the southern part Varvarovka. The design includes a low-rise residential estate, a kindergarten, a clinic and a new motorway to start in the region of the Supsekh cemetery and run parallel to the coastline, along Marusenkov Gaping to the Anapa to Sukko motorway; and
- Development of Sukko within the undeveloped areas within the existing village, including residential areas in the valley on the right bank of the Sukko River, in the central part of the village and to the south of Gornay Street (approximately 2.55 km southeast of the Project). The development proposals also include a school, kindergarten, medical clinic, centre for spa services, and the construction of a waterfront pedestrian area with parks and landscaping along the Sukko River, plus construction of a 3 km beach strip with waterfront facilities and relevant infrastructure (existing beach length is approximately 650 m long).



LEGEND

Proposed residential development

A - The Clearing in the Woods ("Lesnaya Polyana") development

B - The Residence Of Utrish development

C - The Zapovedny (Reserved) development

D - Resort-Residential District "Anapolis"

E - Children's Entertainment Park

F - Resort-Residential District "Gornoye Ozero"

G - "Chateau" development

Russian Sector of South Stream Offshore Pipeline

Proposed landfall section pipelines

Landfall facilities

Proposed microtunnels

Proposed offshore pipelines

Microtunnel entry shaft

Microtunnel exit pit

United Gas Supply System

Russkaya compressor station

United Gas Supply System pipelines

Projection: Lambert Conformal Conic

Revision Details	By	Check	Check Date	Suffix

Purpose of Issue: For Information

Client: South Stream Offshore Pipeline — ENERGISING EUROPE

Project Title: SOUTH STREAM OFFSHORE PIPELINE

Drawing Title: LOCATION OF KNOWN AND POTENTIAL DEVELOPMENTS IN THE VICINITY OF THE PROJECT

Drawn	Checked	Approved	Date
AH	RW	MW	24 Feb 2014

URS Internal Project No.	Scale @ A3
46369082	1:25,000

URS Infrastructure & Environment UK Limited
Scott House
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Hampshire, RG21 7PP
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Drawing Number: Figure 20.1 | Rev

Plot Date: 24 Feb 2014
File Name:\\15004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 20 Cumulative Impacts\Figure 20-1 Location of Known and Potential Developments in the Vicinity of the Project.mxd

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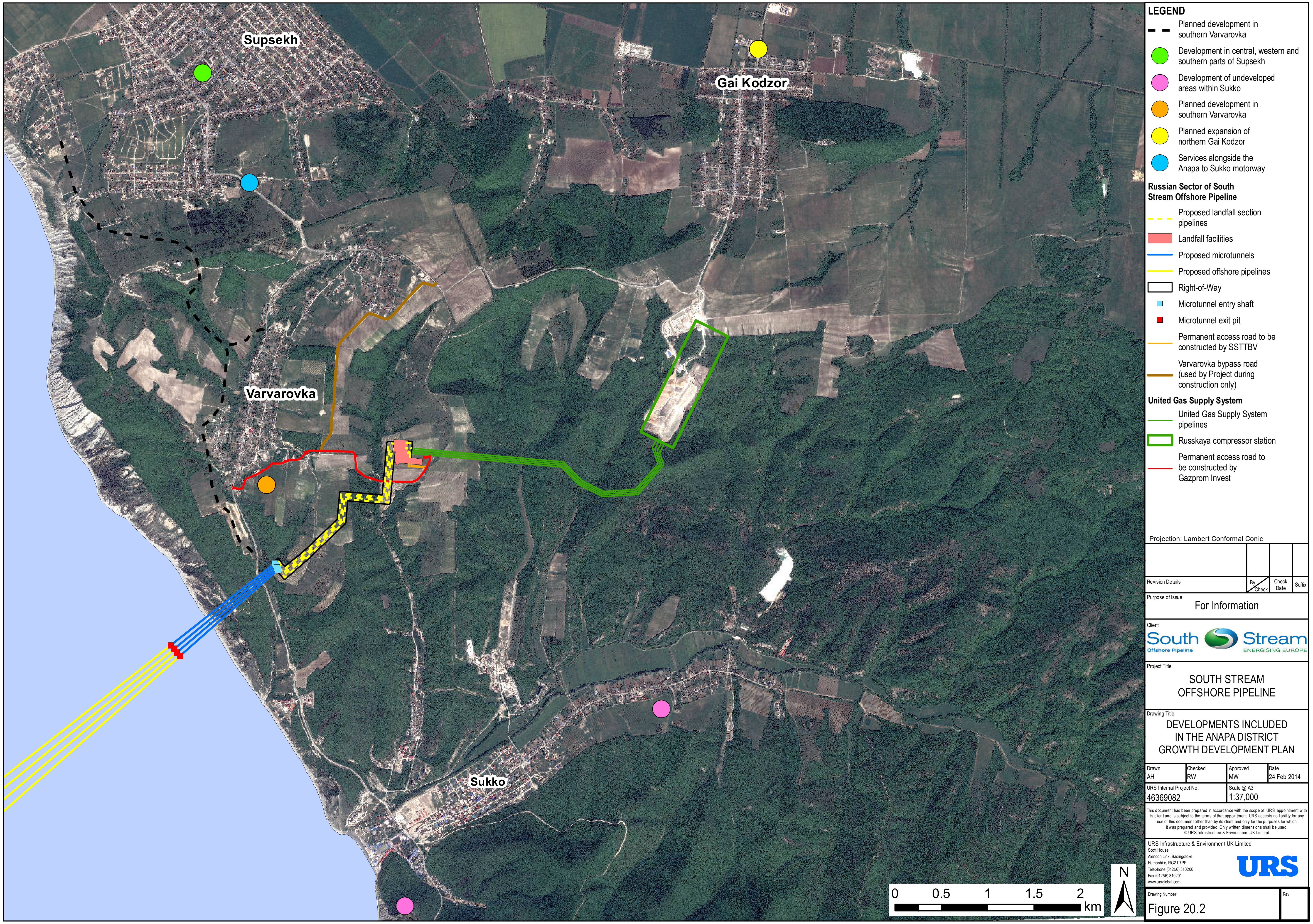

Revision Details	By Check	Check Date	Suffix

Purpose of Issue
For Information

Client
South Stream Offshore Pipeline ENERGISING EUROPE

Project Title
SOUTH STREAM OFFSHORE PIPELINE

Drawing Title
DEVELOPMENTS INCLUDED IN THE ANAPA DISTRICT GROWTH DEVELOPMENT PLAN

Drawn	Checked	Approved	Date
AH	RW	MW	24 Feb 2014

URS Internal Project No.	Scale @ A3
46369082	1:37,000

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Drawing Number	Rev
Figure 20.2	

Plot Date: 24 Feb 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Chapter 20 Cumulative Impacts\Figure 20-2 Developments included in the Anapa District Growth Development Plan.mxd

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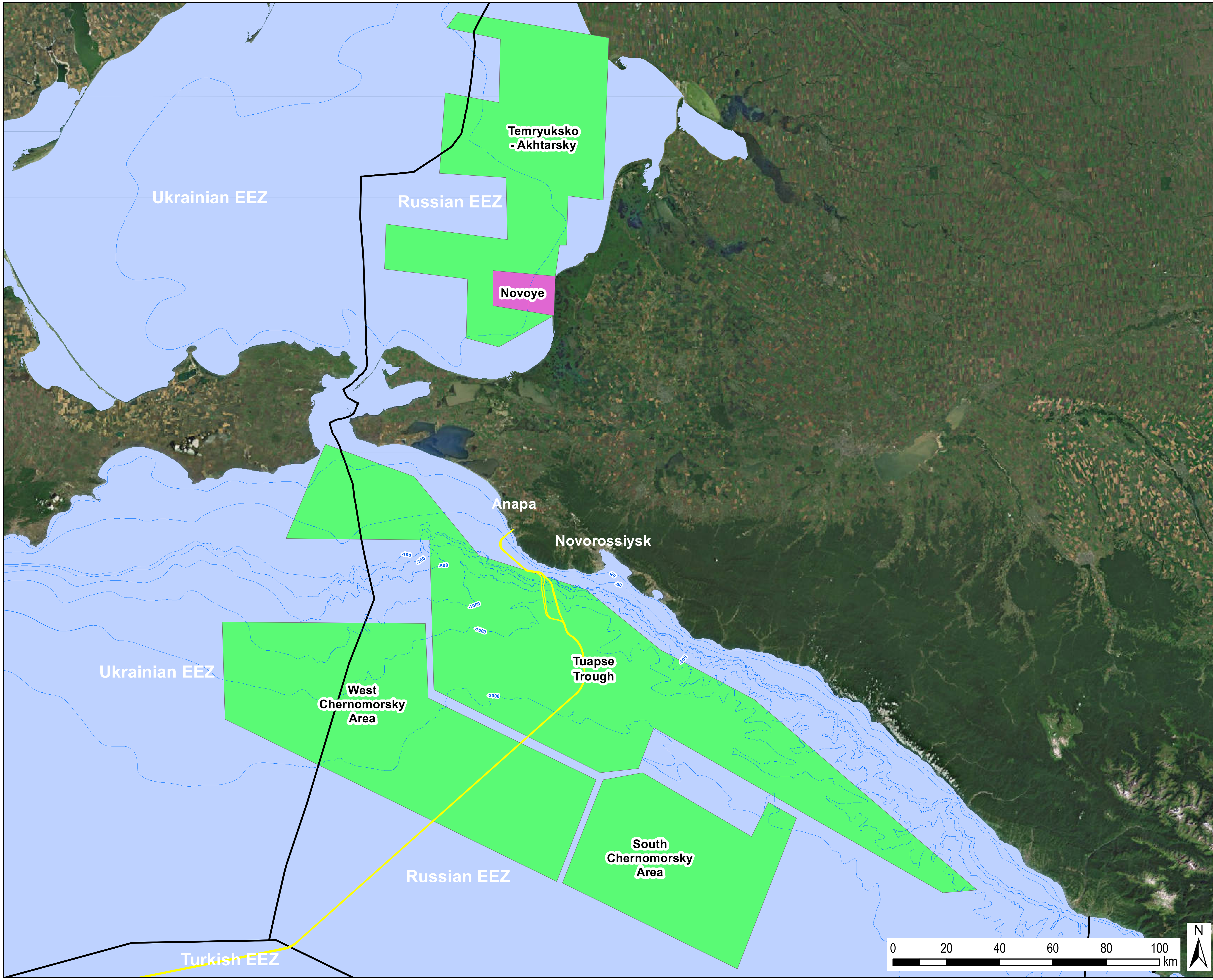

LEGEND
Licence Block
Field
Proposed offshore pipelines
Exclusive Economic Zone boundary
Isobaths

Projection: Lambert Conformal Conic

Revision Details	By / Check	Check / Date	Suffix

Purpose of Issue
For Information

Client
South Stream Offshore Pipeline — ENERGISING EUROPE

Project Title
SOUTH STREAM
OFFSHORE PIPELINE

Drawing Title
INDICATIVE ROSNEFT OIL
LICENSE BLOCKS IN THE
VICINITY OF THE PROJECT

Drawn	Checked	Approved	Date
DH	RW	MW	24 Feb 2014

URS Internal Project No.	Scale @ A3
46369082	1:1,300,000

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Drawing Number	Rev
Figure 20.3	

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20.6.3 Development Proposal CIA Analysis

Section 20.6.2 above defines the planned and reasonably foreseeable or defined development proposals in the vicinity of the Project. An analysis has been undertaken of development proposal features (programme, distance from the Project activities, development footprint characteristics) in order to ascertain the Project's potential to contribute to a cumulative impact during its Construction and Pre-Commissioning and Operational Phases. This analysis is presented in Table 20.3 and details which development proposals have been scoped in and out of the CIA (i.e. developments scoped out of the assessment are considered to not have the ability to generate a significant cumulative impact as associated with the Project) or where development proposals have a high degree of uncertainty or are undefined such that the potential for cumulative impacts cannot be appropriately assessed.

On the basis of the development cumulative impact analysis as detailed in Table 20.3, the following developments have been scoped into the CIA[3]:

- Russkaya CS and associated pipelines;
- Lesnaya Polyana;
- Club Village Chateau; and
- Anapolis mixed use development.

Other developments have been scoped out of the CIA on the basis that:

- The temporal or spatial interactions with the Project are such that significant adverse cumulative impacts would be avoided;
- The development proposals are only at the conceptual stage; or
- There is lack of information available to undertake a meaningful assessment.

[3] The Lesnaya Polyana, Club Village Chateau, and the Anapolis mixed use developments are all being progressed by Fund Yug properties.

Table 20.3 Project Cumulative Impact Analysis of Development Projects

Development	Interaction with Project	Scoped In / Out of CIA
South Stream Pipeline – Turkey	Construction works will be taking place within Russian waters and Turkish waters at the same time, and thus the potential for concurrent activities to generate a cumulative impact needs to be considered (potential transboundary impacts are discussed in **Chapter 21 Transboundary Impact Assessment**). Based on the current Project programme, construction activities will be taking place in Russian and Turkish waters at the same time for a duration of approximately 171 days. The construction spreads in Turkey and Russia will be travelling at the same speed, whilst there will be at least 470 km between these spreads at any given time. Given this distance between the construction spreads and given the limited range of impacts that are associated with the works (such as underwater noise impacts upon marine mammals and fish), it is considered that concurrent activities within Turkey and Russian offshore areas will not be able to generate any significant cumulative impacts. Similarly any concurrent Operational Phase maintenance activities taking place are not anticipated to generate any significant cumulative impacts.	Scoped out

Continued…

Development	Interaction with Project	Scoped In / Out of CIA
Russkaya CS (see Figure 20.1)	The Project landfall facilities will be connected to the upstream pipeline network which forms part of the Expansion of the UGS and includes the Russkaya CS. Some construction activities will occur at the same time as Project construction works. The Russkaya CS development thus interacts with the Project both spatially and temporally. Given that the Russkaya CS and the four connecting pipelines have been defined as associated facilities, there is a need to consider the Russkaya CS development's potential environmental and social implications given that such impacts will be additional to the impacts Project impacts (and as reported within the ESIA technical assessment chapters). In addition to the discussion on cumulative impacts as presented herein, Appendix 20.1 provides details of the Russkaya CS environmental impacts as reported in the development EIA (Ref. 20.3 and Ref. 20.4). Thereafter the appendix presents an appraisal of potential combined impacts of the Russkaya CS plus the Project. This combined appraisal has a different focus to the CIA – namely the CIA focuses on the risks of concurrent Project and Russkaya CS (and other developments scoped into the CIA) activities generating cumulative impacts upon sensitive receptors (VECs) that are common to both developments, whereas the collective appraisal considers the potential impacts of the Project and the Russkaya CS development (as though this were one development) upon sensitive receptors (during construction and operational phases).	Scoped in
Rosneft Oil Exploration Licenses (see Figure 20.3)	As illustrated in Figure 20.3, the Project offshore pipelines pass through the Rosneft exploration blocks at Tuapse Trough and West Chernomorsky. As detailed in Section 20.6.2.3, specific details regarding Rosneft exploration proposals are not currently available. It is not possible to undertake a meaningful cumulative impact assessment due to a lack of available information. South Stream Transport will seek to further liaise with Rosneft with the aim of minimising the potential for any cumulative marine environmental impacts that might result from any simultaneous activities.	Scoped out (due to lack of available information)

Continued…

Development	Interaction with Project	Scoped In / Out of CIA
Lesnaya Polyana development (see Figure 20.1 development A)	This residential development is currently under construction and will extend the town of Varvarovka towards the Project. The development site is located approximately 500 m northwest of the microtunnel entry points and approximately 1.5 km southwest of the landfall facilities. If construction of this residential development is part-complete by the time the Project construction works start, the development residents would be sensitive receptors, and have been considered as such where relevant within this ESIA. Construction activities could be concurrent with those of the Project. Given the location of the development and potential for construction activities to be concurrent with those of the Project, this development has been scoped into the CIA.	Scoped in
Utrish development (see Figure 20.1 development B)	The proposed development site is highly modified and is located in the north-western urban fringe of Sukko (located approximately 2.55 km southeast of the microtunnelling point). The urban nature of the proposed development site, and the degree of separation between the development site and the Project, indicates that there is very little scope for any potential significant cumulative impacts upon area VECs. As such, this proposed development has been scoped out of the CIA.	Scoped out (but considered within the landscape and visual impact)
Zapovedny development (see Figure 20.1 development C)	The proposed development site is highly modified and is located in the southern urban fringe of Sukko (located approximately 3.5 km east-southeast of the Project). The urban nature of the proposed development site, and the degree of separation between the development site and the Project, indicates that there is very little scope for any potential significant cumulative impacts upon area VECs. As such, this proposed development has been scoped out of the CIA.	Scoped out (but considered within the landscape and visual impact)

Continued...

Development	Interaction with Project	Scoped In / Out of CIA
Other developments in eastern Sukko (see Figure 20.1 developments E and F)	The programme for these potential developments is uncertain, although it is considered most likely that if developed, they would be constructed after the Project Construction Phase. These proposed development sites are high modified and located on the urban fringe of Sukko (located at least approximately 3 km east-southeast of the Project). The modified nature of the proposed development sites, the uncertain nature of when they are to be developed, and the degree of separation between the development sites and the Project, indicates that there is very little scope for any potential significant cumulative impacts upon area VECs. As such, these proposed developments have been scoped out of the CIA.	Scoped out (but considered within the landscape and visual impact)
Club Village Chateau development (see Figure 20.1 development G)	The proposed development involves the construction of approximately 45 chateaus within an area of existing vineyards. This development covers an area of approximately 83 ha (located approximately 200 m to the northeast of the Landfall Facilities), although construction works are estimated to impact upon an area of approximately 16.6 ha (with the remaining area of vineyards being unaffected). It is understood that the development is on hold and will only proceed following completion of the Project Construction Phase given that the road which passes through the development plot will be used as a Project access road. Given the location of the development, this development has been scoped into the CIA, although the development programme indicates that Construction Phase cumulative impacts will be avoided.	Scoped in
Anapolis development (see Figure 20.1 development D)	This proposed mixed use development covers an area of approximately 66.7 hectares and is located approximately 350 m south of the Pipeline alignment. The construction phase for this development may start within 2014. Given the location of the development, this development has been scoped into the CIA.	Scoped in

Continued…

Development	Interaction with Project	Scoped In / Out of CIA
Anapa District GDP (see Figure 20.2 and Figure 14.10)	These proposed developments are at the conceptual planning stage and thus there is little information available regarding the development details (e.g. development footprints) and their associated construction programmes. It is, however, considered most likely that these areas would only be developed after completion of Project construction activities. Given the nature of these proposed developments, their degree of separation from the Project, and the conceptual nature of such proposals (meaning that there is a lack of information available to assess the potential for cumulative impacts), these development proposals have been scoped out of the CIA.	Scoped out

Complete.

20.7 CIA and Significance Assessment

Section 20.5.3 defined the VECs and associated impact sources that need to be considered as part of the CIA, namely the following:

- Construction Phase impacts upon the prevailing landscape character and visually sensitive human receptors;
- Reduced residential amenity for residents in local communities, specifically north east Varvarovka, during the Construction and Pre-Commissioning Phase due to potential combined noise and visual impacts;
- Construction Phase impacts upon discrete marine cultural heritage resources; and
- Waste disposal of material at the Alfa Landfill.

Section 20.6.3 identified the developments that have the potential to interact with the Project (spatially and / or temporally) in a manner that could result in significant cumulative impacts (additive, interactive or spin-off impacts as per Section 20.2).

The sections below consider the potential for VECs to experience potential cumulative impacts, focusing in particular upon the VECs and associated impact sources highlighted in the bullet points above. In addition, the sections below also consider some VECs which experience a Not Significant or Low Adverse residual impact (as detailed in Table 20.2) where the potential for cumulative impacts warrants further consideration due to the sensitivity / importance of affected VECs. To assist with this process, the various development projects included in Section 20.6 have been considered, together with VEC residual impact levels as indicated in Table 20.2 and VEC location. Table 20.4 summarises the results from this analysis and indicates which developments have been considered by the various VEC-specific cumulative impact assessments.

The potential for cumulative traffic and transportation impacts has also been considered. Whilst traffic is not a defined VEC, traffic flow changes have the ability to impact upon VECs i.e. human receptors that are being considered within this CIA.

In the sections below, if a cumulative impact risk is identified, the significance of the potential cumulative impact is either quantified or qualified (depending upon data availability).

Table 20.4 Developments Considered by Each VEC Cumulative Assessment

Project VECs	Russkaya CS	Lesnaya Polyana	Club Village Chateau	Anapolis Development	Rosneft Oil and Gas Exploration Activities	Utrish Dev-elopment	Zapovedny (Reserved) Development	Developments in Eastern Sukko	Anapa District GDP
Soils, Surface Water and Groundwater	✓	✓	✓	✓					
Air Quality	✓ Construction phase only	✓ Construction phase only	✓ Construction phase only	✓ Construction phase only					
Noise and Vibration	✓ Construction phase only								
Terrestrial Ecology	✓	✓	✓	✓					
Marine Ecology									
Landscape and Visual	✓	✓	✓	✓		✓	✓	✓	

Continued...

Project VECs	Russkaya CS	Lesnaya Polyana	Club Village Chateau	Anapolis Development	Rosneft Oil and Gas Exploration Activities	Utrish Dev-elopment	Zapovedny (Reserved) Development	Developments in Eastern Sukko	Anapa District GDP
Socio-economics	✓	✓	✓	✓					
Ecosystem Services	✓	✓	✓	✓					
Cultural Heritage – Terrestrial	✓								
Cultural Heritage - Marine									
Waste Management	✓								

✓ indicates developments scoped in

Complete.

20.7.1 Soil, Groundwater and Surface Water

Chapter 8 Soil, Groundwater and Surface Water (summarised in Table 20.2) reports that the residual impacts upon soils, surface water and groundwater are predicted to be either **Not Significant** or **Low Adverse** during all Project phases, with impacts generally being local to the Project site and its immediate surrounds. This indicates that the Project's ability to contribute to a soils, surface water and groundwater cumulative impact with other potential developments scoped into the CIA is very limited.

20.7.1.1 Russkaya CS Development

The sections below consider the potential for cumulative soils, surface water and groundwater impacts of the Project and the Russkaya CS (and associated pipelines) as this represents the scenario with the greatest risk of generating a potential cumulative impact upon these resources:

- **Soils:** A number of Low Adverse impacts have been identified during the Construction and Pre-Commissioning Phases on Agricultural, Fluvisol and Phaeozem soils (due to activities such as the storage and use of potentially polluting materials; vegetation clearance which increases soil susceptibility to erosion; earth moving activities increasing the risk of slope failures / soil movement / subsidence / slope erosion and soil compaction); loss of soil by excavations) (**Chapter 8 Soil, Groundwater and Surface Water**).

  The Russkaya CS construction activities have the potential to impact upon the same soil types as those impacted by the Project. The Russkaya CS EIA Report (Ref. 20.3 and Ref. 20.4) highlights that a range of mitigation measures will be applied to reduce impacts upon soil resources. Whilst the Russkaya CS development and the Project both have the potential to impact upon soil resources, both will adopt a range of mitigation measures to limit the impacts associated with land clearance and earthworks, accidental leakages and spillages. In addition, the areas collectively impacted are also spatially limited to the development footprints, which are small when compared to the regional soil resource. On this basis, no significant cumulative impacts on area soil resources are anticipated with respect to the concurrent development of the Russkaya CS and the Project.

  No significant cumulative impacts on soils are anticipated during the Operational Phase given that all Project impacts are predicted to be **Not Significant**;

- **Groundwater:** the assessment presented in **Chapter 8 Soil, Groundwater and Surface Water** indicates a **Low** Adverse residual impact upon the superficial aquifer and carbonate aquifer both during the Construction and Pre-Commissioning Phase and the Operational Phase. Impacts potentially arise due to the storage and use of potentially polluting materials; leaks of seawater from the Pipeline to groundwater during hydro-testing and groundwater quality impacts during microtunnelling.

  The Russkaya CS development is located over the same aquifer system as the Project. With the exception of using water supply wells, the construction activities for the Russkaya CS development are similar to the Project. The Russkaya CS EIA Report (Ref. 20.3 and Ref. 20.4) highlights that a range of mitigation measures will be applied to reduce impacts upon groundwater resources.

Whilst the Russkaya CS and the Project both have the potential to impact upon the area's groundwater resources, they will adopt a range of mitigation measures to limit the impacts associated with wastewater management and disposal, stormwater management and the disposal and accidental leakages and spillages. The area that could be collectively impacted is small relative to the entire carbonate aquifer. On this basis, no significant cumulative impacts on the area's groundwater resource are anticipated. Given the distance of over 5 km between the Project and the Russkaya CS water supply wells, a cumulative impact upon groundwater resources is not anticipated during the Project Operational Phase; and

- **Surface Waters:** the assessment presented in **Chapter 8 Soil, Groundwater and Surface Water** indicates **Not Significant / Low** Adverse residual impacts upon a number of surface water features, namely the Shingar River, a tributary in the Graphova Gap, and an existing surface water abstraction during both the Construction and Pre-Commissioning Phase and the Operational Phase.

  The Russkaya CS development pipeline section is partly located within the same surface water catchment (the tributary in the Graphova Gap) as the majority of the Project. The construction activities for the Russkaya CS development are similar to the Project. The Russkaya CS development has the potential to impact upon surface waters in the Project Area only during periods when the watercourses are flowing and may impact upon the downstream stretches of the tributary in the Graphova Gap. The Russkaya CS EIA Report (Ref. 20.3 and Ref. 20.4) highlights that a range of mitigation measures will be applied to reduce impacts upon surface water resources.

  The Russkaya CS and the Project will both adopt a range of mitigation measures to limit the impacts associated with activities such as land clearance, earthworks, open-cut river crossings, wastewater management and disposal, storm water management and disposal and accidental leakages and spillages.

  Overall it is considered that there is a potential for low significance cumulative impacts on surface water resources. However, any such impacts would be temporary due to the ephemeral nature of the watercourses in the catchment and the temporary duration of development activities.

  Significant cumulative impacts upon surface water during the Operational Phase are not anticipated given that the Russkaya CS and the Project will both adopt a range of mitigation measures to limit the impacts associated with the presence of the technical facilities and access roads, accidental leakages and spillages, and on-going vegetation control along the RoWs of the respective pipelines.

20.7.1.2 Lesnaya Polyana, Club Village Chateau and Anapolis Developments

The potential for cumulative soils, surface water and groundwater impacts as associated with the Lesnaya Polyana, Club Village Chateau and Anapolis developments are considered in the sections below:

- **Lesnaya Polyana:** given the nature and scale of the development (16.5 ha), its location on highly modified land on the outskirts of Varvarovka, and given that it is understood that site levelling has already been carried out, cumulative soil, surface water and groundwater impacts are not anticipated during the Project Construction Phase. This is particularly the case if the development construction works are completed prior to Project development.

During the Project Operational Phase, the Lesnaya Polyana development is not anticipated to generate any cumulative soil, surface water and groundwater impacts given the residential nature of the development (without any significant soil, surface water and groundwater impact sources). Whilst the source of water supply to the development is uncertain, it is assumed that the use of any water supply wells will be undertaken in compliance with local regulatory authority requirements in a manner that does not adversely impact upon groundwater resources;

- **Club Village Chateau:** soil, surface water and groundwater impacts during the Project Construction Phase would be avoided given that it is understood that the Club Village Chateau development will be delayed until after completion of Project construction activities (given that the road which passes through the development plot will be used as a Project access road).

  During the Project Operational Phase, construction and then use of the Club Village Chateau development is not anticipated to generate any cumulative soil, surface water and groundwater impacts given the disturbed nature of the site and the semi-rural residential nature of the development (without any significant soil, surface water and groundwater impact sources). Whilst the source of water supply to the development is uncertain, it is assumed that the use of any water supply wells will be undertaken in compliance with local regulatory authority requirements in a manner that does not adversely impact upon groundwater resources; and

- **Anapolis Development:** it is currently uncertain if this Anapolis development's construction phase will coincide with the Project Construction Phase. If such works were to coincide, it is considered that given the nature of the Anapolis development, and given the mitigation measures to be employed by the Project, that significant cumulative soil, surface water and groundwater impacts will be avoided.

  During the Project Operational phase, use of the Anapolis development is not anticipated to generate any cumulative soil, surface water and groundwater impacts given the mixed use residential nature of the development (without any significant soil, surface water and groundwater impact sources). Whilst the source of water supply to the development is uncertain, it is assumed that the use of any water supply wells will be undertaken in compliance with local regulatory authority requirements in a manner that does not adversely impact upon groundwater resources.

20.7.2 Air Quality

Chapter 9 Air Quality (as summarised in Table 20.2) reports that the residual air quality impacts upon human and ecological VECs are all predicted to be either Not Significant or **Low Adverse** during all Project phases. This indicates that the Project has limited potential to contribute to an air quality cumulative impact when considering the other developments scoped into the CIA. Nevertheless, the sections below discuss potential cumulative air quality issues during the Construction and Pre-Commissioning Phase taking into account the construction of the Russkaya CS development as well as construction of other potential developments in the vicinity of the Project (see Table 20.4).

20.7.2.1 Russkaya CS Development

Construction and Pre-Commissioning Phase

The sections below consider the potential for dust and nitrogen dioxide related cumulative impacts from concurrent construction of the Russkaya CS and the Project.

The EIA for the Russkaya CS (Ref. 20.3 and 20.4) does not quantify dust emissions from construction equipment and vehicles. However, most dust including the finer particulates, is anticipated to be deposited within approximately 1 km of an emission source – as such, dust from the Russkaya CS construction works are unlikely to affect Gai Kodzor, which is the nearest populated area (located approximately 1.6 km north of the Russkaya CS construction site). Given that the Project would not result in any dust related impacts upon Gai Kodzor a dust related cumulative impact would be avoided at these residential receptors. Similarly, no other VECs are anticipated to experience a dust related cumulative impact.

The greatest air quality impact from the construction of the Russkaya CS and associated pipeline is on nitrogen dioxide (NO_2) concentrations. The Russkaya CS EIA (Ref. 20.3 and 20.4) has assessed the impact of its construction phase activities on 20 minute Maximum Permissible Concentration (MPC) nitrogen dioxide concentrations. Concentrations are predicted to increase at Gai Kodzor from the current level, which is approximately 25% of the national regulatory limit, to 33% of the regulatory limit.

The receptors most likely to be affected by potential cumulative construction impacts as associated with the Russkaya CS and the Project are as follows (refer to Figure 9.4 in **Chapter 9 Air Quality** for receptor locations):

- Receptor 5 (Lesnaya Polyana) – Most affected by the Project Construction Phase. The southern boundary of a proposed residential development currently under construction lies approximately 500 m northwest of the microtunnel entry points and 1.5 km southwest of the landfall facilities; and
- Receptor 10 (Gai Kodzor) – Most affected by the construction of the Russkaya CS. The southern edge of the nearby town Gai Kodzor lies approximately 4.5 km northeast of the landfall facilities.

The construction of the Russkaya CS pipeline from the compressor station to the landfall facilities could occur simultaneously with the laying of the Project Pipeline. If the works were to occur simultaneously, the theoretical combined impact of the two construction operations is provided in Table 20.5.

Table 20.5 Assessment of Potential Cumulative Construction Impacts on MPC NO_2 Concentrations

Receptor	South Stream Construction Impact (% MPC)	Russkaya CS Construction Impact (% MPC)	Combined Impact (% MPC)	Impact Significance
Receptor 5	65	2	67	Low Significance
Receptor 10	28	8	36	Not Significant

Table 20.5 illustrates that the national (and Project Standard) requirement that concentrations should not exceed 0.8 of the MPC would be satisfied at both receptors (see **Chapter 9 Air Quality** for more details). Taking background concentrations into account, the total MPC concentration would be 71% of the MPC at Receptor 5 and therefore below the national requirement.

As described in **Chapter 9 Air Quality**, an impact of the magnitude predicted at Varvarovka (Receptor 5) is more than 50% of the short term standard of 200 $\mu g/m^3$ and as such is categorised as a high magnitude impact. As this impact would occur in an area containing receptors of 'negligible' sensitivity (residential properties outside of urban centres), it can be regarded as an impact of Low Adverse significance (with the Russkaya CS construction works making an insignificant contribution to this impact). At Gai Kodzor, the impact is less than 50% of the short term limit. This is categorised as a moderate magnitude impact (on a low sensitivity receptor), and can be regarded as being **Not Significant**.

The analysis above indicates that concurrent construction of the Russkaya CS and the Project would not result in a significant cumulative nitrogen dioxide MPC impact. Furthermore this cumulative assessment is based on unfavourable meteorological conditions, and thus the analysis represents an improbable very worst case. Similarly, receptors located further from the two developments are not predicted to experience a cumulative nitrogen dioxide impact during the Construction and Pre-Commissioning Phase.

20.7.2.2 Lesnaya Polyana and Anapolis Developments

The Lesnaya Polyana and the Anapolis developments have the potential to generate airborne dust, emit atmospheric emissions associated with the site plant, and generate additional truck movements if they are constructed at the same time as the Project construction activities. However, these impacts are likely to be localised and short-term in nature. Dust and site plant emissions are likely to only be an issue in the immediate vicinity of these sites (with the majority of the construction generated dust depositing within 100 m), and hence should not contribute to a cumulative air quality impact when considered with the Project.

For the Lesnaya Polyana development, construction is already underway and, despite being unlikely, could be complete and fully occupied in advance of construction starting on the Project. This would essentially eliminate the potential for air quality related cumulative impacts.

Recognising it might be completed and occupied, the Lesnaya Polyana development has already been considered as a sensitive receptor in the air quality impact assessment (Receptor 5), which concluded that this receptor would experience a **Not Significant** dust impact during the Construction Phase of the Project. Given the dust generated by the Lesnaya Polyana and Anapolis developments is expected to be localised and that the Project's impact on Lesnaya Polyana has been assessed as **Not Significant**, the cumulative impacts associated with construction dust and site plant emissions are therefore also expected to remain **Not Significant**.

The effect on air quality from traffic generation associated with these residential schemes during their construction is expected to be relatively minor, as such traffic is likely to be well distributed across the regional road network. The assessment of road traffic emissions for the Project showed that construction road traffic contributes relatively little to pollutant concentrations along the two key transport routes for the Project, and that the Project would have a negligible magnitude impact upon air quality. On the basis that the marginal increase in traffic flow along these routes is not expected to result in a discernible increase in the pollutant levels, the cumulative impact for air quality is expected to remain **Not Significant**.

20.7.2.3 Club Village Chateau

Whilst the Club Village Chateau development has the potential to generate airborne dust and emit atmospheric emissions as associated with the site plant, and generate additional truck movements, this development will not take place until after completion of Project construction activities. As such, cumulative construction air quality impacts would be avoided.

20.7.3 Noise and Vibration

An assessment of the worst case noise and vibration impacts associated with Project construction has been undertaken which indicates that noise and vibration impacts will generally be **Not Significant** at all existing sensitive receptors neighbouring the Project. As such the Project has limited potential to contribute to a cumulative noise and vibration impact in combination with the other developments scoped into the CIA.

Whilst it is considered that the Project has a very limited potential to contribute to cumulative noise and vibration impacts with the Russkaya CS (due to residual impact magnitudes largely being of negligible magnitude), the sections below test this hypothesis by considering the potential cumulative noise impacts of the Project and the Russkaya CS (and associated pipelines) assuming that both construction programmes occur simultaneously. This represents the scenario with the greatest risk of generating a potential cumulative noise and vibration impact.

The closest noise sensitive residential receptors, and hence the receptors likely to be affected by worst case noise levels generated by concurrent Project and Russkaya CS construction activities, are as follows (refer to Figure 10.2 in Chapter 10 for receptor locations):

- Receptor 3 - A residential dwelling situated in the north-eastern part of Varvarovka, approximately 1.4 km north of the landfall facilities;

- Receptor 4 - A residential dwelling situated in the north-eastern part of Varvarovka, approximately 1.5 km north of the landfall facilities; and
- Receptor 8 - Two log cabins that have recently been built on cleared land, approximately 1.3 km south of the landfall facilities.

The construction of the Russkaya CS pipeline from the compressor station to the landfall facilities could occur simultaneously with the laying of the Project Pipeline. An assessment of the worst case construction noise impacts is summarised in Table 20.6, taking the highest predicted construction noise at identified receptor locations.

Table 20.6 Assessment of Cumulative Construction Impacts

Receptor	South Stream Construction Noise Level (dB(A))	Russkaya CS Construction Noise Level (dB(A))	Worst Case Cumulative Noise Level (dB(A))	Russian Noise Limit (dB(A))	Impact Significance
Receptor 3	40	19	40	55	Not Significant
Receptor 4	50	21	50	55	Low Adverse
Receptor 8	40	22	40	55	Not Significant

Table 20.6 indicates that the noise generated by concurrent construction of the Project and the Russkaya CS will have an impact of **Low Adverse** significance at the most exposed receptor (Receptor 4). However, the predicted noise level and therefore impact significance is the same as for the Project only scenario as detailed in **Chapter 10 Noise and Vibration** and thus the Russkaya CS construction works are not causing an additional noise impact at Receptor 4. At receptors 3 and 8, the significance of the noise impact is **Not Significant**. As the daytime noise limit of 55 dB(A) as given in the Russian Federation regulations (and IFC[4]) will not be exceeded at any of these receptors, it is considered that all these noise impacts are acceptable.

The analysis above indicates that concurrent construction of the Project and the Russkaya CS facilities will not result in a significant cumulative noise impact at locations exposed to both developments.

20.7.4 Terrestrial Ecology

Section 20.5.3 indicated that residual terrestrial ecological impacts associated with Project induced habitat loss will be **Not Significant** or of **Low Adverse** significance, which indicates that the Project's ability to contribute to a cumulative terrestrial ecological impact, when considering the other developments scoped into the CIA, is very limited and can thus be scoped

[4] The Russian Regulations provide a more stringent approach to the limiting of noise than that given in the IFC General EHS Guidelines as there is no allowance for elevated noise levels where the prevailing ambient noise climate is already over the prescribed noise limit – refer to **Chapter 10 Noise and Vibration**.

out of the CIA. However, given the ecological sensitivity of the area in the vicinity of the Project, the sections below consider the potential for cumulative ecological impacts as a result of the other development scoped into the CIA (see Table 20.4).

20.7.4.1 Russkaya Compressor Station (CS)

The Russkaya CS development (Ref. 20.3 and Ref. 20.4) comprises three components of interest to this cumulative impact assessment: the compressor station, the four pipelines (referred to hereafter as the Russkaya CS Right of Way (RoW) running from the compressor station to the Project's landfall facility, and a permanent access road which runs from near the town of Varvarovka, eastward across the Graphova Gap, past the Project's landfall facilities to the safety valve station of the Russkaya CS development (the 'Gazprom Invest permanent access road' - see **Chapter 5 Project Description** for the location of this permanent access road).

The Russkaya CS EIA Report (Ref. 20.3 and Ref. 20.4) has been reviewed in order to determine if significant cumulative effects between the Project and Russkaya CS are likely. The report presents the terrestrial ecology baseline for the Russkaya CS development and presents an assessment of the likely effect of the development on terrestrial ecology receptors.

To supplement the information contained within the Russkaya CS EIA, a walkover survey of the Russkaya CS RoW was undertaken in June 2013 in conjunction with ecology surveys for the Project (see Section 11.4.4.1). That walkover survey mapped vegetation to a distance of 100 m either side of the Russkaya CS RoW centreline and recorded incidental sightings of Red Data Book (RDB) species.

The paragraphs below present a receptor-based assessment of the potential for significant cumulative impacts resulting from combined impacts of the Russkaya CS and the Project. This assessment is based on this ESIA for the Project, on the information described in the Russkaya CS EIA, and on the June 2013 walkover survey data.

Habitats and Flora

Surveys for the Russkaya CS EIA recorded woodland, meadow, and anthropogenic habitats (including agricultural land). The 2013 walkover survey classified these habitats and recorded their extent and distribution within 100 m of the Russkaya CS RoW centreline. Habitats recorded included shiblyak, mesophilic forest, juniper woodland, secondary steppefied meadow, mesophilic meadow, and agricultural habitats.

The Russkaya CS EIA reports that the impact of construction of the Russkaya CS on these habitats will directly (through habitat loss) and indirectly (degradation) affect areas of both natural and modified habitats, including large swathes of woodland (predominantly shiblyak) habitat. The area of habitat loss is not, however, quantified within the Russkaya CS EIA.

For the purpose of this CIA, and to provide an indication of the area likely to be directly affected by the Russkaya CS RoW, a 120 m wide construction corridor has been assumed which equates to a construction area of approximately 38.7 ha. Based on available information, the footprint of the compressor station is approximately 52 ha, whilst the construction footprint for the Gazprom Invest permanent access road is estimated to be approximately 4.5 ha and an area of approximately 16.1 ha will be required as a temporary construction works area. The total construction footprint of the Russkaya CS development is thus assessed to be approximately 111.3 ha (see Section 20.6.2.2).

Table 20.7 presents a comparison of the direct habitat loss occurring as a result of the Project compared to that as a result of the Russkaya CS RoW. The habitat type for the footprint of the compressor station is given as "unknown" because this is not described in the Russkaya CS EIA, and the South Stream Transport 2013 survey was unable to survey the compressor station footprint as construction had already started; however, satellite imagery suggests that the dominant habitat types may have been agricultural, meadow, and forest.

Table 20.7 Comparative Direct Habitat Loss Between the Project and the Russkaya CS

Habitat Type	Project Direct Habitat Loss (ha)	Russkaya CS Direct Habitat Loss (ha)
Shiblyak	3.5	57
Juniper woodlands	2.6	5.3
Mesophilic forest	1.4	5.4
Steppefied secondary meadow	4.1	21.3
Mesophilic meadow	0	0.4
Agricultural habitats	53.5	21.9
Total	**65.1**	**111.3**

The Russkaya CS EIA proposes control measures to avoid impacts to habitats, and proposes mitigation measures aimed at replacing lost habitat; measures are described to avoid pollution and degradation to habitats, and habitat creation and compensatory planting measures (where possible). It is not, however, clear within the Russkaya CS EIA whether the mitigation measures proposed will reduce residual impacts on ecological receptors to not significant levels.

Construction of both the Russkaya CS and the Project will result in the loss of ecologically valuable habitats (see Table 20.7). The residual impact for habitat loss for the Project are anticipated to be **Not Significant** due to the provision of mitigation measures to safeguard habitats during construction, and where significant impacts occur, to implement habitat reinstatement and creation. This includes provision for a Biodiversity Action Plan (BAP) which will aim to achieve no net loss of biodiversity, and in the case of a component of Critical Habitat (such as mesophilic forest), a net gain.

Accordingly, the Project is not anticipated to significantly contribute to cumulative impacts with the Russkaya CS. There is, however, an opportunity to enhance the benefits to biodiversity management if the Project's mitigation measures were extended to encompass the wider area. South Stream Transport will therefore seek to engage with Gazprom Invest with an aim to align

Gazprom Invest's mitigation measures with those of the Project, where practicable. Furthermore, in developing their BAP, South Stream Transport will seek to engage with Gazprom Invest with an aim to develop measures that would enhance biodiversity management within the wider area.

Fauna

The Russkaya CS EIA recognises that habitat loss and degradation have the potential to adversely affect terrestrial fauna, including herpetiles (such as the RDB species Nikolski's tortoise), mammals (including bats), and birds (including breeding and migratory species). The Russkaya CS EIA does not, however, quantify this loss or ascribe a clear significance to this loss.

The walkover survey of the Russkaya CS RoW conducted by South Stream Transport in 2013 identified very similar habitat types to those recorded within the Landfall Study Area (although, generally speaking, of a greater extent - see Table 20.7). It is therefore likely that the assemblage of species supported by habitats within the Russkaya CS zone of influence is similar to that of the Landfall Study Area, although potentially supporting larger populations considering the larger size of the Russkaya CS footprint.

Based on information contained within the Russkaya CS EIA, and supplementary information gathered by South Stream Transport, predicted impacts of the Russkaya CS development on fauna include the following:

- Direct loss and indirect degradation to habitats (foraging, sheltering, breeding, and hibernation);
- Habitat fragmentation and severance; and
- Potential mortality, injury and disturbance to species supported within these habitats.

These issues are discussed in turn below.

Direct Loss and Indirect Degradation to Habitats

The Russkaya CS EIA proposes measures to avoid and mitigate for habitat loss and degradation - this includes measures for habitat reinstatement and creation, where appropriate. The Russkaya CS EIA also argues that, following construction, additional beneficial effects for some species will be realised (including herpetiles, birds, mammals, and invertebrates), as meadow habitat develops along the previously forested Russkaya CS RoW. Although not clearly reported within the Russkaya CS EIA, it is implied that the long term effect of the loss of habitat for fauna is anticipated to be not significant.

As discussed in **Chapter 11 Terrestrial Ecology**, the Project is not anticipated to significantly reduce the extent or diversity of suitable habitat in the long term, due to the implementation of mitigation measures (including provision of a BAP).

Habitat Fragmentation and Severance

Construction of the Project and the Russkaya CS development, which are anticipated to occur simultaneously, both have the potential to fragment habitat and restrict the movement of species within the local environment. Habitat fragmentation and severance is likely to occur due to the following elements of both projects:

- Project: Construction of the eastern-most access road, running north-south;
- Project: Construction of the western-most microtunnel access road, running north-south;
- Project: The South Stream Transport RoW and landfall facilities, running generally east-west;
- Russkaya CS: The permanent access road running east-west; and
- Russkaya CS: The Russkaya CS RoW and compressor station, running generally east-west.

Construction of the RoWs of both projects will result in a relatively temporary obstruction (1 – 2 years) to faunal movement. Once construction is completed, the RoWs are not anticipated to limit the movement of species within the landscape. However, the access roads, if permanent, have the potential to disrupt the movement of species (as well as cause mortality due to collisions) in the long term. The species groups that are likely to be affected by habitat fragmentation and severance include herpetiles and non-flying, small mammal species.

Measures to safeguard species from collision-based mortality during construction have been proposed for the Project in this ESIA Report (**Chapter 11 Terrestrial Ecology**). This includes the erection of herpetile and small mammal-proof fencing, which is designed to exclude these species from the construction areas and access roads. Furthermore, it is proposed that the Project install a number of under-road tunnels with the purpose of allowing herpetiles to pass beneath the roads once constructed. Tunnels will be placed at appropriate locations to ensure that there are a sufficient number to mitigate the severance effect.

Measures to reduce the effect of severance (both short- and long-term) and habitat fragmentation are not proposed in the Russkaya CS EIA Report. Although it is not anticipated that the Project's contribution to the cumulative impact of severance will be significant, there is nonetheless the potential for habitat severance within the wider environment to be exacerbated if the Russkaya CS development does not implement appropriate mitigation.

As discussed above, South Stream Transport will engage with Gazprom Invest with an aim to align Gazprom Invest's mitigation measures with those of the Project, where practicable.

Direct Mortality, Injury and Disturbance

There is the potential for both the Project and Russkaya CS to cause direct mortality, injury or disturbance of fauna during construction, including RDB species.

The Russkaya CS EIA proposes measures to avoid impacts on fauna, including control measures to avoid environmental pollution and fires, restrict the extent of construction to only necessary areas, and avoidance of vegetation clearance during sensitive periods; with respect to the latter, the bird breeding season is addressed, although no mention is made of the herpetile hibernation period. In addition, the following measures are proposed in the Russkaya CS EIA Report specifically for RDB species:

- Restriction of spring burns of grass vegetation which might lead to the death of animals;

- Banning of chasing animals, destroying nests and shelters, and illegal shooting;
- Banning keeping tame animals in residential settlements, control on keeping guard dogs on the construction sites; and
- Minimising disturbance in areas adjacent to the construction site.

It is not clear in the Russkaya CS EIA Report whether the proposed mitigation measures will reduce residual impacts of mortality, injury and disturbance on ecological receptors to non-significant levels.

For the purpose of this CIA, an attempt has been made to estimate the number of Nikolski's tortoise with the potential to be directly impacted during construction phases of both projects; this has not been undertaken within the Russkaya CS EIA. This estimate has been based on density figures for the tortoise within the Abrau peninsula, derived from a recent publication (Ref. 20.12). The combined area which is likely to be directly affected by both developments and the extrapolated density value are presented in Table 20.8. It is important to note that these figures are based on the density of tortoises within each habitat type during the species' activity period (approximately April – November) and do not reflect species density during hibernation.

Table 20.8 Number of Nikolski's Tortoise Potentially Present in Areas of Direct Habitat Loss (Combined for Both Developments)

Habitat	Area of Loss5 (ha) (combined for the Project and the Russkaya CS development)	Density of Nikolski's Tortoise/ha	Individuals Potentially Present
Juniper woodlands	7.9	1.95 – 2.85	15.4 – 22.5
Mesophilic forest	6.8	0.1 – 1.6	0.7 – 10.9
Steppefied secondary meadow	25.8	2.21	57
Shiblyak	60.5	0.1 – 1.6	6.1 – 96.8
Unknown (Russkaya CS Footprint)	75.4	Unknown	n/a
Total	**176.4**		**79.2 – 187.2**

This estimate, based on the area of habitat to be directly impacted, should be viewed as the minimum number of tortoises which could potentially be affected by both developments. This does not take into account the range of indirect impacts (disturbance during breeding/hibernation, habitat severance and associated reduced access to resources etc.) which have the potential to affect the wider local tortoise population supported by habitats outside of the development's construction footprint. The number of tortoises affected could, therefore, be significantly higher than the 80 – 188 which have the potential to experience direct effects.

[5] Includes both temporary and permanent habitat loss.

Assuming that the published density figures are applicable to the combined project construction areas, Table 20.8 indicates that removal of various habitat types has the potential to directly affect (through mortality, injury, or direct loss of habitat) 80 - 188 tortoises (noting that the contribution of the Project equates to approximately 19% of the lower range (or 15 of the 80 tortoises) and approximately 13% of the upper range (or 24 of the 188 tortoises). Combined direct habitat losses could thus impact upon approximately 1.1% - 2.7% of the Abrau peninsula's Nikolski's tortoise population (Ref. 20.11), a significant proportion of the regional Nikolski's tortoise population.

The Project will implement various measures to safeguard this species during the Construction Phase (including design controls, appointment of an Ecological Clerk of Works (ECoW), sensitive timing of works, as well as fencing and a programme of capture and placement). These measures, in conjunction with implementation of a BAP, are anticipated to reduce the residual impact of potential Project-related mortality, to **Not Significant** levels. The contribution of the Project to potential cumulative impacts upon herpetiles is, therefore, considered to be **Not Significant**.

Nonetheless, as discussed above, South Stream Transport will engage with Gazprom Invest with an aim to align Gazprom Invest's mitigation measures with those of the Project, where practicable. Of particular importance should be the avoidance of impacts through the sensitive timings of works (including the herpetiles hibernation period), implementation of herpetile fencing and a programme of translocation, and adherence to Good International Industry Practice (GIIP) (see Section **Chapter 11 Terrestrial Ecology**).

20.7.4.2 Lesnaya Polyana

The Lesnaya Polyana development is located approximately 500 m to the north of the Project. The site is located within an area that consists of predominantly agricultural land. It is, however, adjacent to an area of what is likely to be shiblyak woodland. Given the limited extent of the proposed development, and its siting on an area of (predominantly) previously developed land, it is not anticipated that this development would result in a significant ecological impact in combination with the Project.

20.7.4.3 The Anapolis Development

The Anapolis mixed use development covers an area of approximately 65 hectares and is located approximately 350 m south of the Project's microtunnel entry shafts. The construction phase for this development is currently uncertain and no EIA is currently available for review. The cumulative impact assessment has, therefore, been undertaken based on available information regarding the location and extent of the Anapolis development and, as a large proportion of Anapolis falls within the Landfall Study Area, information gathered for the ESIA.

Habitats, Flora and Fauna

Based on information gathered for the ESIA, data on the habitats contained within Anapolis' development footprint is presented within Table 20.9. For illustrative purposes, the area of habitat loss for the Project and Russkaya CS are also presented.

Table 20.9 Comparative Direct Habitat Loss Between the Project, Russkaya CS and Anapolis

Habitat Type	Project's Direct Habitat Loss (ha)	Russkaya CS Direct Habitat Loss (ha)	Anapolis Development Footprint (ha)
Shiblyak	3.5	57	29.3
Juniper woodlands	2.6	5.3	4.3
Mesophilic forest	1.4	5.4	4.5
Steppefied secondary meadow	4.1	21.3	1.4
Mesophilic meadow	0	0.4	1.2
Tomillyar	0	0	0.7
Agricultural habitats / urban areas	53.5	21.9	13.1
Unknown	N/A	N/A	9.4
Total	**65.1**	**111.3**	**64.9**

Information is not available at present on what proportion of the habitats contained within the Anapolis development footprint would be subject to direct loss. There is, however, the potential for the development to result in the direct loss and indirect degradation of relatively large areas of natural habitat.

As a large proportion of Anapolis is located within the Landfall Study Area, it is likely that populations of species which have been recorded during surveys for the Project, including herpetiles, birds, mammals, and invertebrates, will use and be supported by the habitats contained within the Anapolis footprint.

In terms of potential cumulative impacts to fauna, the following impacts are considered key to the CIA:

- Direct loss and indirect degradation to habitats (including foraging, sheltering, breeding, and hibernation habitat for species); and
- Potential mortality, injury and disturbance to species supported within these habitats.

Anapolis is not anticipated to contribute to or exacerbate the impact of habitat fragmentation or severance in combination with the Project.

Cumulative habitat loss within the wider environment is acknowledged as a potentially significant adverse impact if appropriate measures are not taken to mitigate for this loss. The residual impacts for the Project are anticipated to be **Not Significant**, due to the provision of mitigation measures (including a BAP) which will aim to achieve no net loss of biodiversity and a net gain in Critical Habitat. Accordingly, the Project is not anticipated to make a significant contribution to cumulative impacts with Anapolis or any other cumulative scheme.

However, where there is opportunity to do so, the benefits for biodiversity due to the Project's mitigation measures (e.g. BAP) will be extended to encompass the wider area. South Stream Transport will engage with the Anapolis developers (Fund Yug) with the aim of aligning Anapolis' mitigation measures with those of the Project, developing measures that would enhance biodiversity management within the wider area.

20.7.4.4 Club Village Chateau

As detailed in Section 20.6.2.8, the Club Village Chateau development (see Figure 20.1) involves the development of approximately 45 chateaus within an area of existing vineyards. The development plot covers a total area of approximately 83 ha, although the construction works are estimated to impact upon approximately 20% of the total development footprint (calculated from a review of the proposed development) thus an area of approximately 16.6 ha. It is understood that the development will only proceed following completion of the Project Construction Phase given that the road which passes through the development plot will be used as a Project access road. The Club Village Chateau development is located approximately 250 m and 1,500 m, at its nearest and furthest point, respectively, northwest of the Project's RoW and landfall facilities.

Habitats and Flora

Based on available information, it is estimated that construction activities are likely to directly affect approximately 16.6 ha of the development site occupied by vineyard / meadow habitat and shiblyak woodland. Based on information gathered for the ESIA, data on the habitats contained within Club Village Chateau development footprint is presented within Table 20.10. For illustrative purposes, the area of habitat loss for the Project, the Russkaya CS and the Club Village Chateau development are presented.

Table 20.10 Comparative Direct Habitat Loss between the Project, Russkaya CS and the Club Village Chateau Development

Habitat Type	Project's Direct Habitat Loss (ha)	Russkaya CS Direct Habitat Loss (ha)	Club Village Chateau Development Habitat (ha)
Shiblyak	3.5	57	2.2
Juniper woodlands	2.6	5.3	0
Mesophilic forest	1.4	5.4	0

Continued…

Habitat Type	Project's Direct Habitat Loss (ha)	Russkaya CS Direct Habitat Loss (ha)	Club Village Chateau Development Habitat (ha)
Steppefied secondary meadow	4.1	21.3	0
Mesophilic meadow	0	0.4	0
Tomillyar	0	0	0
Agricultural habitats / urban areas	53.3	21.9	14.4
Total	**65.1**	**111.3**	**16.6**

Complete.

Cumulative habitat loss within the wider environment is acknowledged as a potentially adverse impact if appropriate measures are not taken to mitigate for such losses. The residual impacts of the Project are anticipated to be **Not Significant**, due to the provision of mitigation measures (including a BAP) which will aim to achieve no net loss of biodiversity and a net gain in Critical Habitat. Accordingly, the Project is not anticipated to make a significant contribution to cumulative impacts with the Club Village Chateau development or any other cumulative scheme.

Nevertheless, South Stream Transport will engage with the developers of the Club Village Chateau development (Fund Yug) with the aim of aligning their mitigation measures with those of the Project, where practicable.

Fauna

As a large proportion of the Club Village Chateau development is contiguous with the Project's Study Area, it is likely that populations of species which have been recorded during surveys for the Project, including herpetofauna, birds, mammals, and invertebrates, will use and be supported by the habitats contained within the Club Chateau Village development footprint.

In terms of potential cumulative impacts to fauna, the following impacts are considered key to the cumulative impact assessment:

- Direct loss and indirect degradation to habitats (including foraging, sheltering, breeding, and hibernation habitat for species);
- Potential mortality, injury and disturbance to species supported within these habitats; and
- Habitat fragmentation and severance.

The Project will implement various measures to safeguard species during the Construction Phase (including design controls, appointment of an Ecological Clerk of Works (ECoW), sensitive timing of works, as well as fencing and a programme of capture and placement). These measures, in conjunction with implementation of a BAP are anticipated to reduce the residual impact of potential Project-related mortality, to **Not Significant** levels. The contribution of the Project to cumulative impacts is, therefore, considered to be **Not Significant**.

Although it is not anticipated that the Project's contribution to the cumulative impact of severance will be significant, there is nonetheless the potential for habitat severance within the wider environment to be exacerbated if the Club Village Chateau development does not implement appropriate mitigation. As discussed above, South Stream Transport will engage with the developers of the Club Village Chateau development (Fund Yug) with an aim to align their mitigation measures with those of the Project and develop measures to enhance biodiversity management within the wider area where practicable.

20.7.4.5 All Developments

The sections above consider the potential for cumulative ecological impacts to be generated taking account of the various developments scoped into the CIA. However, Table 20.11 considers potential cumulative habitat losses should the Project, the Russkaya CS, Anapolis and the Club Village Chateau developments all be constructed.

Table 20.11 Comparative Direct Habitat Loss of the Project, Russkaya CS, Anapolis and the Club Village Chateau Developments

Habitat Type	Project's Direct Habitat Loss (ha)	Total Direct Habitat Loss (ha) from the Project, Russkaya CS, Anapolis and the Club Village Chateau Developments
Shiblyak	3.5	92
Juniper woodlands	2.6	12.2
Mesophilic forest	1.4	11.3
Steppefied secondary meadow	4.1	26.8
Mesophilic meadow	0	1.6
Tomillyar	0	0.7
Agricultural habitats / urban areas	53.3	102.7
Unknown	-	9.4
Total	**65.1**	**257.9**

Table 20.11 indicates that Project, the Russkaya CS, Anapolis and the Club Village Chateau developments could result in the direct cumulative loss of approximately 257.9 ha habitat loss (of which approximately 25% is associated with the Project).

Such cumulative habitat loss within the wider environment is acknowledged as a potentially significant adverse impact if appropriate measures are not taken to mitigate for this loss. The residual impacts for the Project are anticipated to be **Not Significant**, due to the provision of mitigation measures (including a BAP) which will aim to achieve no net loss of biodiversity and a net gain in Critical Habitat. Accordingly, the Project is not anticipated to make a significant contribution to the cumulative impacts due to habitat losses as associated with these collective developments.

As discussed above, South Stream Transport will engage with the developers of the Anapolis and the Club Village Chateau developments (Fund Yug) and with Gazprom Invest with an aim to align their mitigation measures with those of the Project and develop measures to enhance biodiversity management within the wider area, where practicable.

20.7.5 Marine Ecology

Chapter 12 Marine Ecology (as summarised in Table 20.2) reports that residual marine ecology impacts are predicted to be **Low Adverse.**

As illustrated in Section 20.6.3, none of the developments scoped into the CIA involve significant marine construction activities (see Table 20.4) (noting that the Russkaya CS development will involve the use of marine vessels for materials supply, whereas impacts upon ecological receptors (such as noise) are most likely to be associated with pipe-laying and trenching activities rather than marine vessel passage). As such, it is considered that none of these developments has the potential to generate any potentially significant cumulative marine ecological impacts.

As noted in Table 20.3, with regard to potential Rosneft oil and gas exploration activities, South Stream Transport will seek to further liaise with Rosneft with the aim of minimising the potential for cumulative marine environmental impacts that might result from any simultaneous activities.

20.7.6 Landscape and Visual Impacts

Chapter 13 Landscape and Visual (as summarized in Table 20.2) indicates that during the Construction and Pre-Commissioning Phase the Undulating Plateau landscape character area (LCA) would be subject to a temporary **Moderate** Adverse impact. However, such impact would be short term and will be **Not Significant** during the Operational Phase. With regard to visual impacts, during the Construction and Pre-Commissioning Phase the majority of residual visual impacts are identified to be either **Not Significant** or **Low Adverse**. However, a number of **Moderate Adverse** residual visual impacts have been identified in respect of the following receptors (principally due to the visual intrusion of construction activities and equipment):

- Recreational visitors to the seashore;
- Walkers on the coastal path along the cliff top;
- Visitors to the Russian Orthodox and Armenian cemetery at Varvarovka;
- Residents living at north east Varvarovka; and
- Recreational boat users.

These impacts are mostly direct, temporary and short-term. Visual impacts during the Operational Phase would be either **Not Significant** or **Low Adverse**.

The sections below consider the cumulative impacts upon landscape character and visual receptors resulting from the Project in combination with the various developments scoped into the CIA during the Construction and Pre-Commissioning Phase only (as potential Operational Phase cumulative impacts are considered to be **Not Significant**) (see Table 20.4).

20.7.6.1 Undulating Plateau Landscape Character Area

Construction and Pre-Commissioning Phase site clearance and construction works for the Project are assessed to result in a temporary **Moderate Adverse** residual impact upon the Undulating Plateau LCA. Additional landscape and visual impacts will also result from some of the developments scoped into the CIA that will be under development within the Undulating Plateau LCA at the same time as Project construction activities – e.g. construction works associated with the Russkaya CS, the Lesnaya Polyana development, the Club Village Chateau and the Anapolis development (the assessment also considers as applicable land developments such as those at Utrish, the Zapovedny development and developments in eastern Sukko) (see Table 20.4).

The area of the Russkaya CS development would equate to approximately <2% (approximately 95 ha) of the total LCA within the Survey Area (approximately 4,241 ha). Thus the Russkaya CS development plus the Project would cover a combined area that equates to approximately <2.25% of the LCA area within the Survey Area. Therefore, these collective developments will only impact upon a minimal total area of the Undulating Plateau LCA. Furthermore, the undulating nature of this LCA result in concealed areas of land which can will largely hide developments such as the Russkaya CS and the Project landfall facilities from certain viewpoints. In addition, some of the impacts of construction upon the Undulating Plateau LCA will be reversible through the restoration of affected landscapes. Areas which are required to be left open of vegetation (the cumulative pipeline RoWs) will form features resembling unsealed tracks or roads, which are already a characteristic feature within landscape, as such tracks form the majority of the access routes to agricultural / viticultural fields.

Overall, it is considered that the collective impact upon the Undulating Plateau LCA remains Moderate Adverse, with a moderate change in localised areas which would not compromise the overall integrity of the LCA. It is also considered that the LCA has the capacity to absorb these developments. As such, the impacts of these developments would not act together with the Project's impacts to create a more significant overall landscape impact, thus indicating that cumulative impacts upon landscape character would be avoided.

20.7.6.2 Visual Receptors

Table 20.12 considers the potential for cumulative impacts at the various visual receptors scoped into the cumulative landscape and visual impact assessment during the Construction and Pre-Commissioning Phase.

Table 20.12 Potential for Cumulative Impacts upon Visual Receptors during the Construction and Pre-Commissioning Phase

Visual Receptor	Sensitivity	Project Impact Magnitude	Project Residual Impact Significance	Potential for Cumulative Impacts	Impact of Project plus Other Developments	Significance of Cumulative Impact
Visitors to the Russian Orthodox and Armenian cemetery at Varvarovka	Moderate	Moderate	Moderate	There are open views from the cemetery across the wooded valley selected for the landfall section, where nearby access roads and construction activity will be visible at a distance of approximately 1 km. At a distance of over 3.7 km, the construction of the Russkaya CS will potentially form a barely perceptible element of the views from this receptor. No other potential developments in the area will be visible to cemetery visitors.	Moderate	Not Significant
Residents living at north east Varvarovka	High	Moderate	Moderate	Above the newly constructed acoustic barrier, the taller construction plant of the Russkaya CS will potentially form a perceptible element of the views from this receptor. The construction of The Club Village Chateau development is not planned to be undertaken during the Construction Phase, and therefore no other potential developments in the area will be visible from this receptor group.	Moderate	Not Significant

Continued…

Visual Receptor	Sensitivity	Project Impact Magnitude	Project Residual Impact Significance	Potential for Cumulative Impacts	Impact of Project plus Other Developments	Significance of Cumulative Impact
Walkers on the coastal path along the cliff top	High	Low	Moderate	Views from the coastal path vary considerably depending on location and direction of view. From a short stretch of the path in the immediate vicinity of the landfall section, construction works will be visible looking inland at a distance of approximately 2.3 km. The Russkaya CS RoW would be barely perceptible beyond the Project construction works, at a distance of approximately 4.8 km. Other potential developments in the area will not be visible to coastal path users, although the Anapolis development would be visible from some parts of the coastal path which would represent an extension to the Shingari Holiday Complex (noting that construction works are not anticipated to be concurrent with the Project).	Moderate	Not Significant

Continued…

Visual Receptor	Sensitivity	Project Impact Magnitude	Project Residual Impact Significance	Potential for Cumulative Impacts	Impact of Project plus Other Developments	Significance of Cumulative Impact
Recreational visitors to the seashore, including the public beaches at Sukko and Anapa, and the private beach at the Shingari and Don holiday complexes.	High	Moderate	Moderate	Recreational users of the seashore will be able to see occasional maintenance vessels on the nearshore / offshore sections. There will be no views of the Russkaya CS (at a distance of 4.7 km) or other potential developments in the area. Some parts of the Anapolis development would be visible to some visitors, although construction works are not anticipated to be concurrent with the Project.	Moderate	Not Significant
Recreational boat users	Moderate	Moderate	Moderate	Recreational boat users will be able to see occasional maintenance vessels on the nearshore / offshore sections. There will be no views of the Russkaya CS (at a distance of approximately >5 km to the nearest section of coastline) or other potential developments in the area. Some parts of the Anapolis development would be visible to some boat users, although construction works are not anticipated to be concurrent with the Project.	Moderate	Not Significant

Complete.

The section above indicates that during the Project Construction Phase, the Project's impacts upon sensitive visual receptors would not be elevated by the other developments in the area, indicating that cumulative impacts would be avoided.

20.7.7 Socio-economics and Community Health and Safety

Chapter 14 Socio-Economics (as summarised in Table 20.2) indicates that the Project is anticipated to generate some limited beneficial impacts at the local level as a result of employment generation whilst local and regional businesses are likely to receive some limited benefits from spending on local accommodation, goods, services and facilities during the Construction and Pre-Commissioning Phase. During the Operational Phase, beneficial impacts are anticipated to be at the national level only and associated with increased demand for Russian gas and increased government revenues, taxes and royalties.

Project impacts associated with reduced revenues for tourism-related businesses, including Shingari and Don holiday complexes and also those comprising the Anapa Resort Town tourism sector, due to construction activity and economic displacement due to changes in land use have been assessed as **Not Significant**. Impacts associated with reduced revenues for the Varvarovka Horse Riding Business, under a worst-case scenario due to the potential severance of a horse riding route used by the business during the Construction Phase, have been assessed as **Low Adverse**. Potential impacts on public safety and security, on the amenity of recreational users of Sukko and Shingari beaches, and on the amenity of visitors to Varvarovka Cemetery have been assessed as **Low Adverse** (Construction and Pre-Commissioning Phase). Impacts on the amenity experienced by residents in north east Varvarovka, during the Construction and Pre-Commissioning Phase due to noise and visual impacts, have been assessed as **Moderate Adverse**. During the Operational Phase of the Project, the socio-economic impacts on property owners associated with the creation of the safety exclusion zones are assessed to be **Not Significant**.

Given that the majority of residual socio-economic adverse impacts are either **Not Significant** or **Low Adverse**, the Project has limited potential to contribute to an adverse socio-economic cumulative impact (see Table 20.4). Similarly, the Project's contribution to beneficial cumulative impacts is also limited. Nevertheless, the sections below discuss potential cumulative socio-economic impacts associated with the Construction and Pre-Commissioning Phase and the Operational Phase.

20.7.7.1 Construction and Pre-Commissioning Phase

All of the development proposals as detailed in Section 20.6.2 (and Table 20.4) have the potential to generate additional employment and additional demand for goods and services in the municipal district, and potentially further afield. Specific to the Russkaya CS, the EIA (Ref. 20.3 and Ref. 20.4) states that the creation of new jobs in the construction industry and more jobs in the service sector will result in positive impacts at a regional level. It further states that local companies may benefit from supplying construction related goods, equipment and services during construction of the development, as well as from increased demand arising from the presence of a non-local workforce. While the precise scale of increased employment and additional demand for goods and services associated with the Russkaya CS is not known, it is likely to amplify the limited beneficial economic impacts associated with the Project for local communities. It is, therefore, expected that the beneficial impact of the Project on local employment and the demand for goods and services would be elevated by the other cumulative development proposals.

Chapter 14 Socio-Economics identified the potential for **Not Significant** and **Low Adverse** economic and community-related residual impacts on several receptors in relation to construction works in the nearshore and offshore sections; this included the Shingari and Don Holiday Complexes, the Anapa Resort Town tourism sector, the Varvarovka Horse Riding Business, as well as due to amenity impacts on recreational users of Sukko and Shingari beaches and also visitors to the Varvarovka Cemetery. However, most of the developments scoped into the CIA located in the Anapa Resort Town municipal district are not located within view of the coast at the Shingari Holiday Complex and Sukko Beach, nor will they have any indirect impacts on the coastal environment. The potential Anapolis development will be located adjacent to the Shingari Holiday Complex, however, it is considered most likely that this development's construction phase will occur after the Project, thus avoiding the potential for Construction Phase cumulative impacts. Furthermore, the visual impact assessment has also concluded that cumulative impacts on assessed recreational and tourism-related receptors would not be significant. Therefore, other development proposals in the vicinity of the Project are not anticipated to give rise to any adverse economic cumulative impacts on these receptors.

With regard to the impact on the Varvarovka Horse Riding Business, the assessment was based on a potential worst-case scenario due to the lack of clear understanding of the precise alignment of the routes used by the business; with a commitment made to work with the horse riding business to undertake further investigation and, if necessary, to identify a suitable alternative route. This mitigation, if required, would also consider the location of cumulative developments to ensure that any identified alternative route was not compromised by such developments. It is expected that having regard to cumulative developments in this way would ensure that impacts on the business would not be exacerbated as a result of any cumulative development.

The socio-economic assessment has also identified the potential for **Moderate Adverse** amenity-related impact on residents in north east Varvarovka. This assessment has been concluded on the basis of the results of the noise and visual impact assessments; which have shown the potential for low and moderate adverse residual impacts. In both cases, the cumulative assessments for noise and visual (see Section 20.7.3 and Section 20.7.6) have concluded that the other developments scoped into the CIA would not be likely to add to or exacerbate such impacts upon residents in north east Varvarovka. Accordingly, it is concluded that there would be no additional cumulative amenity-related impacts on residential receptors in north east Varvarovka.

With regard to impacts on land users, the Russkaya CS, Lesnaya Polyana and Anapolis developments are being developed on former agricultural fields, removing those fields from agricultural use. Specific to the Russkaya CS, the EIA (Ref. 20.3 and 20.4) has stated that the impact on agricultural land will be negligible, in part due to the temporary nature of the impact and also due to mitigation, including compensation and re-cultivation of the affected land, which will be applied. In the case of the other two sites, the site land and surrounding land is all owned and managed by the same parent company.

It is presumed that for the Russkaya CS, all of the associated impacts have been subject to (or will be subject to) the relevant regulatory requirements governing the process of change of land use and, where applicable, take up of land, including with regard to reimbursement in full for losses associated with the short-term and long-term cessation of existing land uses (as stated within the Russkaya CS EIA). Therefore, it is not expected that the developments scoped into the CIA will give rise to any adverse cumulative economic impacts in this regard.

With regard to impacts on the community due to the conduct of the workforce during the Project Construction and Pre-Commissioning Phase, it is possible that the construction workforce for some of the other development proposals will include at least a portion of non-local workers. Specific to the Russkaya CS, the EIA (Ref. 20.3 and 20.4) has stated that there is the potential for construction to require non-local workers from other areas of Krasnodar Krai. It is further known that a construction labour camp has been constructed to the north of Gai Kodzor for non-local workers for whom the construction site is too far from their usual place of residence to allow them to travel on a daily basis. The impact assessment for the Russkaya CS does not define the number of construction workers or assess the potential impact of the presence of the non-local workers on the health, safety and security of the local population, and it is not known if there is a management regime in place to govern the behaviour of the workers if and when they are out in neighbouring towns and villages. Therefore, it is possible that the presence of non-local workers could potentially lead to adverse impacts on public safety and security.

Given the mitigation measures as recommended in **Chapter 15 Community Health, Safety and Security**, the Project's impacts resulting from the conduct of the construction workforce in the community and the spread of sexually transmitted infections (STIs) due to the influx of workers to the area are both assessed as being **Low Adverse** (see **Chapter 15 Community Health, Safety and Security**). Additional workers associated with other developments could potentially exacerbate these impacts. South Stream Transport will liaise with Gazprom Invest with the aim of developing aligned and coordinated mitigation approaches to minimise the potential for cumulative public health and security impacts as associated with the influx of construction workers and construction activities.

20.7.7.2 Commissioning and Operational Phase

Chapter 14 Socio-economics identified beneficial impacts arising from the increase in government revenues and increased demand for goods and services associated with the gas extraction industry in Russia. Specific to the Russkaya CS, the EIA (Ref. 20.3 and 20.4) identified long term economic beneficial effects for Russia due to increased potential for gas exports, and the potential for associated increases in foreign current revenues and tax revenues for the (Russian Federal) state budget. However, as the assessment of beneficial impacts presented in Chapter 14 assumed completion and operation of the entire South Stream Pipeline System, the cumulative impacts of the Russkaya CS have already been accounted for.

With regard to impacts on land use associated with the operational safety exclusion zones, the Russkaya CS will not itself directly impact on the same land as impacted by the Project. Additionally, the compressor station and the pipelines leading from it westwards to the Project landfall facilities are entirely surrounded by forest, and so the creation of any similar safety exclusion zones (if designated) would not restrict any commercial or residential land uses. The remaining other developments scoped into the CIA will not have any impacts in this regard.

20.7.8 Ecosystem Services

As detailed in Section 20.3 the CIA methodology considers VECs which are environmental and social attributes that should *"reflect public concern for social, cultural, economic or aesthetic values, and also the scientific concerns of the professional community"* (Ref. 20.2). There are therefore strong parallels between VECs and ecosystem services, where the type and level of service provision (and the value this confers) is determined by:

- The condition of the underlying habitat or ecosystem type;
- The functioning of ecosystem processes and the interactions between them; and
- The importance of the services to beneficiaries (in terms of livelihoods, health, safety, and cultural heritage) and the Project (in terms of social, operational, financial, regulatory, and reputational risks).

IFC PS1 limits the cumulative impacts to be addressed to *"those impacts generally recognised as important on the basis of scientific concerns and / or concerns from Affected Communities"* (Ref. 20.1). The CIA is therefore concerned with assessing the incremental impact of the Project on *priority* ecosystem services and their beneficiaries in relation to the combined impacts of multiple developments. For the purposes of this assessment, VECs are therefore defined as the priority ecosystem services as identified in **Chapter 17 Ecosystem Services**.

Chapter 17 describes residual impacts upon the following ecosystem services: crops, capture fisheries, water (supply), hazard regulation, air quality regulation, water quality regulation, soil quality regulation, tourism and recreation values, cultural and spiritual values and wild species diversity). As summarised in Table 20.2, all residual impacts are predicted to be either **Not Significant** or **Low Adverse** during all Project phases. This indicates that the Project's ability to contribute to a cumulative impact upon ecosystem services in the vicinity of the Project with other potential developments scoped into the CIA is limited.

However, as detailed in Section 20.4, where there are Low Adverse residual impacts, further evaluation has been undertaken to see if there is scope for cumulative impacts to be generated, for the following ecosystem services:

- **Crops:** Project clearance of agricultural land, restrictions on re-use, dust released during construction activities and leaks or spills could result in a **Low Adverse** impact on crop production, and the associated loss of jobs. As indicated in **Chapter 17 Ecosystem Services**, the Project will result in around 8.7 ha of agricultural land being taken out of agricultural use permanently, 23.75 ha will require temporary clearance before being returned to the land owner following the Construction Phase, whilst 21.05 ha will be returned to the landowners, but future use will be restricted;
- The Russkaya CS, Lesnaya Polyana, Anapolis and Club Village developments will all impact upon some agricultural areas, thus removing further land from agricultural use. The Russkaya CS development could impact upon approximately 21.9 ha of agricultural land – although the Russkaya CS EIA (Ref. 20.3 and 20.4) states that the residual impact on

agriculture would be negligible given that: damage will be compensated in accordance with Russian law; some impacts will be temporary; and upon completion of construction, some land will be re-cultivated and returned to the land users in a condition suitable for agriculture. The Lesnaya Polyana development is understood to have already resulted in land being cleared, whilst the Anapolis development is estimated to result in the loss of approximately 13.1 ha of agricultural land (see Table 20.9) and Club Village Chateau development will potentially remove approximately 14.4 ha of vineyards (see Table 20.10). These developments will all result in additional losses of agricultural land. However, with the implementation of defined Russkaya CS mitigation proposals, and given that the Lesnaya Polyana, Anapolis and Club Village Chateau sites are all owned by the same developer who is potentially able to absorb any displaced workforce at other owed sites, significant cumulative impacts upon this ecosystem service are not anticipated;

- **Hazard Regulation:** Activities such as ground works, vegetation clearance, and changes to topography undertaken for the proposed developments scoped into the CIA could have a collective impact on soils and water flows in the area which could potentially increase the risk of hazards such as flooding and landslides to beneficiaries living and working within the Local Area. However, as set out in Section 20.7.1, there are unlikely to be any significant cumulative soil or water resource impacts as generated by the Project and the Lesnaya Polyana, Club Village Chateau or Anapolis developments. With regard to the Russkaya CS, the mitigation measures set out for the Project (including restoration of natural vegetation) and those defined for the Russkaya CS development mean that any cumulative impacts on surface water flows and soil stability are likely to be of **Low Significance** due to the ephemeral nature of the watercourses in the catchment and the temporary duration of development construction activities;
- **Water Quality Regulation:** As identified in **Chapter 17 Ecosystem Services**, the main impacts on the regulation of water quality are likely to arise in the marine environment due to disturbance of sediment during dredging processes and potential leaks and spills. Since none of the proposed developments have a marine component, significant cumulative impacts on marine water quality regulation will be avoided. Within the terrestrial environment, vegetation clearance together with increased risk of spillages from other developments scoped into the CIA could potentially have a greater cumulative impact on the regulation of surface water quality (e.g. potential cumulative impacts on the Shingari River arising from the Project (microtunnelling site) and developments such as Lesnaya Polyana, Club Village Chateau and Anapolis). However, as set out Section 20.7.1, the low likelihood of spillages, differences in the development construction schedules, together with the localised and temporary nature of any water quality impacts suggests that cumulative impacts are unlikely to be significant. As such there are not likely to be any significant cumulative impacts on the regulation of marine and fresh water quality or those who benefit from this service;
- **Tourism and Recreation Values:** The developments scoped into the CIA and Project together are unlikely to have any cumulative impact on the provision of, or access to, tourism and recreation services (e.g. through loss of access to recreational areas). However, there are potential impacts upon the quality of tourism and recreation services due to cumulative impacts on the prevailing landscape character and visually sensitive human receptors during construction and operation. As discussed in Section 20.7.6 and Section

20.7.7, any such visual impacts are not likely to be significant due to the distance of developments from the receptors, the ability of the natural environment to absorb visual impacts of development, and the difference in timing schedules of the developments.

Given this, it is considered that the cumulative impacts of the Project and the developments scoped into the CIA are unlikely to have a significant lasting impact on the ability of any residents or visitors to benefit from the recreational and tourism opportunities provided by the affected ecosystems; and

- **Cultural and Spiritual Values:** The developments scoped into the CIA have the potential to affect the provision of cultural and spiritual values through impacts upon the prevailing landscape character within which sites and features of cultural and spiritual significance reside. However, as set out in Section 20.7.6, the cumulative impact of the collective developments will only impact a small area of the landscape. Furthermore, the undulating nature of the landscape is effective at absorbing such developments and habitat restoration activities will further reduce any impacts. Potential human receptors identified in **Chapter 17 Ecosystem Services** who benefit from this service include visitors to the Varvarovka cemetery who are likely to be subject to visual and noise disturbance. However, at a distance of over 3.7 km, the construction of the Russkaya CS will form a barely perceptible element of the views from this receptor and there are no other potential developments in the area that will be visible to cemetery visitors. However, the combined traffic from the Project and Russkaya CS may result in greater cumulative impact on visitors to the cemetery and in order to minimise such impacts South Stream Transport will liaise with Gazprom Invest with the aim of developing aligned and coordinated traffic management plans.

20.7.9 Cultural Heritage

Chapter 16 Cultural Heritage (as summarised in Table 20.2) reports residual cultural heritage impacts as follows:

- Residual impacts predicted to be **Not Significant** or **Low Adverse** for all terrestrial cultural heritage features, with impacts mainly being related to ground disturbance and increases in construction traffic; and
- Residual impacts predicted to be **Not Significant** or **Low Adverse** for marine cultural heritage features, except Moderate Adverse impacts upon RU-MCH-003 amphora and RU-MCH-004 wooden shipwreck.

All terrestrial cultural heritage residual impacts are predicted to be either **Not Significant** or **Low Adverse** during all Project phases. Given that none of the developments scoped into the CIA (see Table 20.4) will have a direct impact upon any of these defined terrestrial cultural heritage features indicates that cumulative impacts will be avoided.

However, the construction vehicles servicing the Russkaya CS development will use some of the same access routes used by the Project, including a permanent access route that will be constructed by Gazprom Invest. This permanent access road will be located in proximity of a known cultural heritage receptor (the Varvarovka Russian and Armenian cemetery (RU-TCH-06)), but its route has been selected to avoid running directly alongside the cemetery

(**Chapter 16 Cultural Heritage**). Due to the road alignment, visitors to the cemetery will experience an impact of negligible magnitude (resulting in residual impact of Not Significant) due to the Project. Nevertheless, the combined traffic from the Project and Russkaya CS may result in greater cumulative impact on visitors to the cemetery and in order to minimise such impacts South Stream Transport will liaise with Gazprom Invest with the aim of developing aligned and coordinated traffic management plans.

With regard to marine cultural heritage, none of the developments scoped into the CIA involve significant marine construction activities or seabed intervention works (noting that the Russkaya CS development will involve the use of marine vessels for materials supply which are not anticipated to impact upon marine cultural heritage) (see Table 20.4). As such, it is considered that no potentially significant cumulative cultural heritage impacts will occur (both Construction and Pre-Commissioning Phase and Operational Phase).

As noted in Table 20.3, with regard to potential Rosneft oil and gas exploration activities, South Stream Transport intends to liaise with Rosneft with the aim of minimising the potential for cumulative marine environmental impacts that might result from any simultaneous activities.

20.7.10 Waste Management

Chapter 18 Waste Management included an assessment of waste management impacts arising from the Project waste streams that will be produced during the Construction and Pre-Commissioning Phase and during the Operational Phase. The chapter indicated that residual waste impacts would generally be **Not Significant** to **Low Adverse** following the preparation and implementation of a comprehensive integrated Waste Management Plan (described in **Chapter 22 Environmental and Social Management**). However, **Chapter 18 Waste Management** indicates that the main regional landfill site (Alfa landfill) is not designed or operated as an engineered landfill in accordance with GIIP, and hence has been identified as being a sub-optimal waste disposal facility. As a result, any Project waste disposed of at the Alfa landfill would result in a Moderate Adverse impact (due to waste disposal in an unlined landfill). Alfa landfill is due to be replaced once it ceases operation in 2016, and thereafter the replacement landfill would be used by the Project. This is expected to be an engineered facility (although its location is yet to be confirmed by the local government).

In the event that any Project wastes are deposited at Alfa landfill, the impacts are not expected to be environmentally significant. This is the case since the Project wastes that require landfill disposal are non-hazardous, whilst the waste quantities arising from the Project are relatively small (typically less than 1,000 tonnes per waste stream – refer to **Chapter 18 Waste Management**) and would form only a very small proportion of the overall waste disposed of at Alfa, such that they would not significantly increase any existing environmental impacts associated with the landfill site.

Of the developments scoped into the CIA (see Table 20.4), only the Russkaya CS is considered to be able to generate waste volumes that may add pressure on local waste storage and disposal facilities in the area. The Russkaya CS EIA (Ref. 20.3 and 20.4) indicates that during the construction phase some 502,484 tons of waste will be generated, and of this 27,734 tons will be subject to re-use or recycling at third-party enterprises, whilst 474,750 tons will be transferred to a specialized waste disposal enterprise. Assuming that the Alfa landfill is being used by Russkaya CS developers, waste disposal practices may be adding to existing capacity issues at the landfill.

Given that the quantities of hazardous and non-hazardous waste arisings from the Project are so small when compared to total regional arisings, it is considered that the Project is not able to contribute to a significant cumulative waste management impact. Although large quantities of uncontaminated soil and rock will be generated by the Project, this is not expected to give rise to significant cumulative impacts since such materials will be used for backfill or restoration purposes at quarry or landfill sites in the region; and since the material is inert, it is unlikely to give rise to significant environmental impacts. South Stream Transport will seek to engage with Gazprom Invest to investigate the potential beneficial use of inert materials (soils or rock) generated by the Project and the Russkaya CS development.

20.7.11 Land-based Traffic and Transportation

The sections above present an evaluation of the potential cumulative impacts upon identified VECs that may occur as a result of Project interactions with various development proposals. This analysis has not identified any potentially significant cumulative environmental or social impacts with regard to land-based traffic and transportation during any Project phases (e.g. air quality, noise and vibration, cultural heritage etc.).

However, Appendix 9.1: Traffic and Transport Study indicates that the Project has the potential to increase traffic flows on some transportation links during the Construction and Pre-Commissioning Phase. Once the Pipeline is operational, traffic will be limited to servicing and maintenance vehicles - such low levels of traffic will not have a traffic impact.

Appendix 9.1 indicates that during the Construction Phase, the Project will generate traffic arising from the transportation of materials from a Russian Black Sea port. Pipes and equipment that are required for the landfall section will be delivered by existing roads to a point north of Gai Kodzor. A temporary bypass has been constructed for heavy construction vehicles to avoid this community and this will be used both by the vehicles related to the construction of the Russkaya CS development and Project vehicles. Workers may also have to be transferred to and from Anapa on a daily basis if they are accommodated in Anapa. There will also be a need to export excavated material that is not suitable as fill material, and to import suitable fill material to make up the shortfall in suitable material. The construction traffic has been estimated for a range of activities which indicates that over the predicted 25 month duration of the contract, there will be a total of over 110,000 traffic movements which averages at approximately 4,500 movements per month or 189 per day.

In terms of vehicle kilometres travelled by construction related traffic, a significant portion of trips will occur on the M25 either west or east of Rassvet. The geometry of the M25 and the current traffic flows are such that it is a satisfactory route to be used by construction traffic. Traffic flow impacts associated with construction traffic travelling between the junction on the M25 at Rassvet and the landfall site will be partially negated by the provision of the bypass to Gai Kodzor and the proposed link from the south of that settlement to the landfall site, which means that to the south of Rassvet the heavy construction traffic will avoid locations where there may be sensitive receptors.

The section of the road between Rassvet and the northern end of the temporary construction bypass of Gai Kodzor could experience increases in traffic flow of up to 30% with an increase in the number of heavy construction vehicles approaching 200%.

It is noted that the road through Rassvet already carries appreciable levels of heavy goods vehicles associated with the construction works of the Russkaya CS development. Therefore, the traffic associated with the Project will be an extension of an existing impact, rather than the introduction of a new impact. The traffic assessment concludes that with the provision of the construction traffic bypasses, the highway network is capable of accommodating the additional traffic without there being any perceptible impact on other road users with the exception of the section of route through Rassvet.

Given the details presented above, it is considered that Project construction will result in increases in traffic on some transportation links that are currently being used by Russkaya CS construction traffic. The Project will thus contribute to a potential cumulative increase in traffic flows through Rassvet. The Project includes a range of mitigation measures that aim to minimise the environmental and social consequences of traffic flow increases through Rassvet (refer to **Chapter 15 Community Health, Safety and Security**). However, there is also a commitment to further assessment of potential impacts and investigation of additional mitigation measures, if needed. South Stream Transport will liaise with Gazprom Invest with the aim of developing aligned and coordinated construction traffic management plans.

20.8 Cumulative Impact Mitigation, Monitoring and Management

The CIA has not identified any cumulative environmental or social impacts that are considered to be significant and in need of specific mitigation measures, monitoring or management beyond those already being undertaken for the Project (see **Chapter 22 Environmental and Social Management**). However, the assessment has made a number of recommendations with regard to the alignment of mitigation strategies with local developers – this includes the following:

- South Stream Transport will seek to engage with Gazprom Invest with the aim of aligning Gazprom Invest's ecological mitigation strategy and mitigation measures as related to the Russkaya CS development with those of the Project. Of particular importance should be the avoidance of impacts through the sensitive timings of works (including the herpetiles hibernation period), implementation of herpetile fencing and a programme of translocation, and adherence to good industry practice as well as to develop measures that would enhance biodiversity management within the wider area;
- South Stream Transport will seek to engage with Gazprom Invest to investigate the potential beneficial use of inert materials (soils or rock) generated by the Project and the Russkaya CS development;
- South Stream Transport will liaise with Gazprom Invest with the aim of developing aligned and coordinated traffic management plans;
- South Stream Transport will engage with the Anapolis and the Club Village Chateau developers with the aim of aligning the developers' mitigation measures with those of the

Project. Furthermore, in developing their BAP, South Stream Transport will engage with these developers with an aim to develop measures that would enhance biodiversity management within the wider area;

- South Stream Transport will liaise with Gazprom Invest with the aim of developing aligned and coordinated mitigation approaches to minimise the potential for cumulative public health and security impacts as associated with the influx of construction workers and construction activities; and
- South Stream Transport will seek to further liaise with Rosneft with the aim of minimising the potential for any cumulative marine environmental impacts that might result from any simultaneous activities.

20.9 Assumptions and Limitations

This CIA has been undertaken based upon the available information contained within this ESIA Report. Key assumptions and limitations are detailed below:

- The CIA is restricted to Russian VECs and only concerns potential cumulative impacts associated with the Project (i.e. within Russia);
- The assessment only considers residual impacts after the implementation of mitigation measures as detailed in this ESIA Report;
- The assessment has not considered unplanned events as discussed in **Chapter 19 Unplanned Events**;
- Details regarding some land development projects within the vicinity of the Project are limited, whilst several have not been subject to any formal environmental impact assessment process. This has limited the CIA to only consider potential cumulative impacts on a qualitative basis in some cases; and
- The CIA excludes potential cumulative impacts during the Decommissioning Phase given that the decommissioning programme is uncertain and will only be developed during the Operational Phase of the Project, whilst other developments that may be taking place at the same time as decommissioning activities are also unknown.

20.10 Conclusions

Whilst there are a number of developments in the near vicinity of the Project, such as the Russkaya CS development and various residential developments, this CIA has not identified any adverse environmental or social cumulative impacts that are considered to be significant and in need of specific mitigation measures, monitoring or management by the Project, although various recommendations are made with regard to the alignment of local developers’ mitigation strategies with those of Project.

References

Number	Reference
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Chapter 21: Transboundary Impact Assessment

URS-EIA-REP-204635

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21 Transboundary Impact Assessment

21.1 Introduction

Transboundary impacts may be considered as "*impacts that extend to multiple countries, beyond the host country of the project, but are not global in nature. Examples include air pollution extending to multiple countries, use or pollution of international waterways, and transboundary epidemic disease transmission*" (Ref. 21.1).

As the South Stream Offshore Pipeline spans multiple countries and is being constructed across a dynamic marine environment, there is the potential for some Project activities to generate transboundary impacts. Such impacts may arise from Project activities which traverse country boundaries, or impacts that originate within one country, but have the ability to extend across national borders.

This chapter considers the potential for transboundary impacts resulting from the Project. Where applicable, the chapter draws upon the impact assessments conducted in each of the technical discipline sections of this Environmental and Social Impact Assessment (ESIA) Report (Chapters 8 - 18).

Given that greenhouse gas emissions are a global issue as opposed to a transboundary concern, this chapter does not include a Project-related greenhouse gas assessment – details regarding greenhouse gas emissions as associated with Project activities are provided in **Chapter 9 Air Quality**.

21.2 Frameworks for Considering Transboundary Impacts

21.2.1 International Finance Corporation (IFC)

IFC Performance Standard (PS) 1 Assessment and Management of Environmental and Social Risks and Impacts (Ref. 21.2) recognises the need to consider transboundary impacts. PS 1 states that the risks and impacts identification process needs to consider "*potential transboundary effects, such as pollution of air, or use or pollution of international waterways*".

21.2.2 Espoo Convention

As detailed in **Chapter 2 Policy, Regulatory and Administrative Framework**, the Convention on Environmental Impact Assessment (EIA) in a Transboundary Context, 1991 (Espoo Convention) came into force internationally on 10 September 1997 (Ref. 21.3). The Russian Federation signed the Espoo Convention in 1991; however, the Espoo Convention has not been ratified by Russia. The Federal Government is currently planning transposition of the Convention requirements into Russian legislation.

The main objective of the Espoo Convention is to promote environmentally sustainable economic development, as a preventative measure against transboundary environmental degradation. The Espoo Convention stipulates obligations of parties to assess the transboundary environmental impacts of a project in the early planning stages.

The Espoo Convention specifies the obligation of Parties of Origin to notify and consult Affected Parties when a project in their territory is likely to have a significant adverse transboundary impact. Parties of Origin can ask the developer to undertake further public consultation, in addition to normal EIA requirements.

Bulgaria is the only host country of the South Stream Offshore Pipeline to have ratified the Espoo Convention. The Bulgarian government notified Romania during the Bulgarian Scoping Stage of the Project as the only other country signatory to the Espoo convention of all the Black Sea littoral countries potentially affected by the Project; Romania decided not to participate in accordance with the Convention.

21.3 Potential for Transboundary Impacts

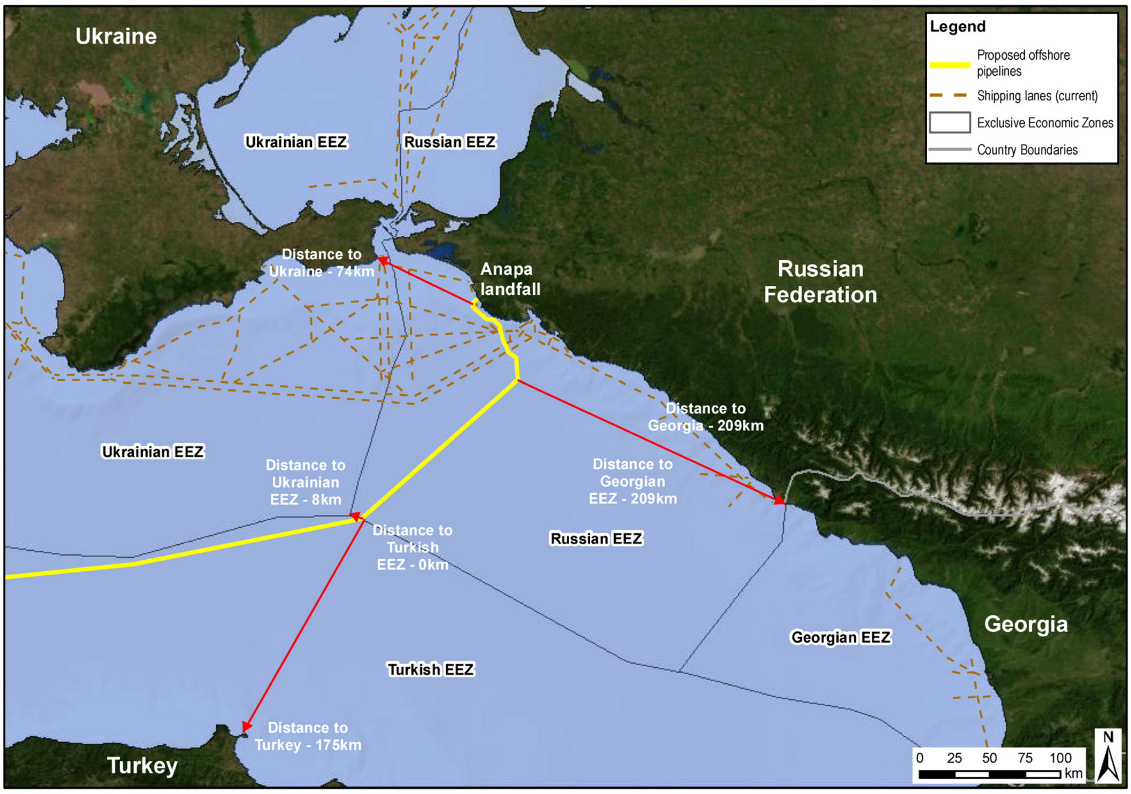
In order to generate a transboundary impact, activities from the Project would need to generate an impact that has the potential to cross national jurisdictions as defined by the Exclusive Economic Zone (EEZ) boundaries and land borders of the Black Sea countries. Figure 21.1 illustrates the closest points of the Project to these boundaries and to land territories of nearby countries.

It is acknowledged that some Project activities will be located closer to EEZ boundaries and Black Sea country land borders than indicated in Table 21.1. This includes Project-related vehicle movements from the selected ports, as well as marine supply vessel movements. With regard to marine supply vessels, these are likely to use existing international shipping routes to and from the selected ports (as shown on Figure 21.2).

Table 21.1 Closest Points of the Project to Turkey, Georgia and Ukraine EEZ Boundaries

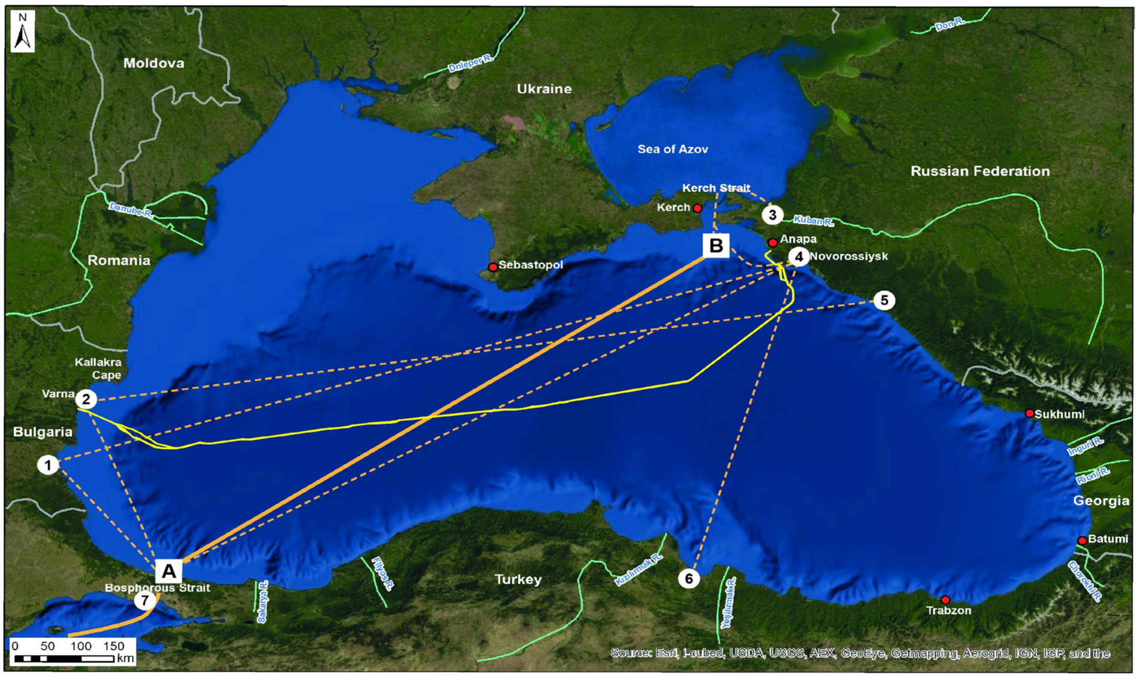
Country	Closest Distance of Project to Land Territory (km)	Closest Distance of Project to EEZ Waters (km)
Turkey	175	Located directly adjacent to the EEZ boundary
Georgia	209	209
Ukraine	74	8

Figure 21.1 Distances from the Project to Turkey, Georgia and Ukraine EEZ Boundaries



All geographic boundaries depicted in maps in this ESIA Report relate to February 2014.

Figure 21.2 Shipping and Navigational Routes in the Black Sea which Potentially Interact with the Project Pipelines



Key:

A: Bosporus shipping junction (Istanbul)
B: Kerch Strait shipping junction

river
existing shipping route
main shipping route

1: Burgas	**3:** Temryuk	**5:** Tuapse	**7:** Istanbul
2: Varna	**4:** Novorossiysk	**6:** Samsun	

21.4 Impact Assessment Methodology

The various technical assessments as presented within this ESIA Report (Chapters 8 - 18) have used defined impact assessment methodologies to quantify Project impacts upon defined sensitive receptors. In undertaking this task, these assessments have considered the potential for identified impacts during the various Project phases (Construction and Pre-Commissioning Phase, Operational (including Commissioning) Phase and Decommissioning Phase) to traverse international borders. This chapter captures the findings of the earlier chapters in so far as they relate to transboundary impacts and considers both planned activities and unplanned events.

In general, potential impacts generated by planned activities during the Construction and Pre-Commissioning Phase of the Project will typically be temporary in nature and localised in extent. Similarly impacts generated from planned activities during the Operational Phase will also be localised. However, during the various Project Phases there is the potential for unplanned events which are those events that are unintended and that may pose risks to human health and/or the environment, including its socio-economic components (**Chapter 19 Unplanned Events**) that may result in wider transboundary impacts. Unplanned events include the accidental release of hydrocarbons (e.g. spills of fuel from vessels) to the marine environment during the Construction and Pre-Commissioning Phase and the accidental release of natural gas to the atmosphere in the event that the Pipeline is damaged during the Operational Phase. Such events have a low risk of occurrence and strict management measures will be put in place to ensure that risks are minimised and any resultant impacts are also minimised (**Chapter 19 Unplanned Events**).

The sections below consider the potential for transboundary impacts from both planned and unplanned events during the Construction and Pre-Commissioning Phase and Operational Phases of the Project. The activities to be undertaken during the Decommissioning Phase are uncertain, as decommissioning proposals will be developed during the Operational Phase of the Project. Current Good International Industry Practice (GIIP) is to decommission pipelines in place, with few resultant environmental impacts. However, should a decision be made to remove the pipelines and the associated infrastructure, it is expected that the potential transboundary impacts and mitigation measures will be similar in nature to some of those as described herein for the Construction and Pre-Commissioning Phase of the Project. As such, the Decommissioning Phase is not specifically covered in this chapter.

21.5 Potential Terrestrial Transboundary Impacts

21.5.1 Planned Activities

Chapters 8 to 18 have predicted potential impacts on terrestrial sensitive receptors during the various Project Phases. These assessments have identified that due to the distances between planned Project activities and the land territories of Turkey, Georgia and Ukraine (i.e. greater than 74 km), predicted impacts do not have the potential to cross territorial borders and have a transboundary environmental impact. This includes potential transboundary air quality impacts as associated with the transportation of resources to and from the construction sites during the Construction and Pre-Commissioning Phase of the Project. **Chapter 11 Terrestrial Ecology** also considers and concludes that there will not be transboundary impacts upon migratory birds given that the Project will not have significant adverse direct or indirect impacts upon migratory bird species during planned activities.

21.5.2 Unplanned Events

Chapter 19 Unplanned Events considers the various unplanned events that could occur during the different Project Phases and the actions that are to be taken to minimise the occurrence of such events and their associated environmental and socio-economic consequences. A review of these unplanned events indicates that the only potential terrestrial unplanned event that could have a transboundary environmental impact results from the release of non-combusted gas either following pipeline rupture or due to the unplanned need to vent gas from the pipeline (depressurise) to ensure overall system safety. However, **Chapter 9 Air Quality** indicates that such events would not pose a risk to the health of residents at nearby receptors and that any impacts would be localised – it thus follows that such unplanned events would not be able to generate a transboundary air quality impact given the distance from the pipeline to the land territories of Turkey, Georgia and Ukraine.

21.6 Potential Marine Transboundary Impacts

21.6.1 Planned Activities

It is anticipated that some planned Project activities (e.g. operation of plant and equipment) have the potential to result in marine transboundary environmental impacts given that such Project activities will be taking place close to and across EEZ boundaries. A number of marine activities and environmental aspects with the potential to cause adverse transboundary impacts have been identified and are discussed below:

- Impacts on air quality;
- Impacts from waste generation;
- Impacts from underwater noise upon fish and marine mammals;
- Impacts on migratory birds; and
- Impacts on fish migration and fisheries.

21.6.1.1 Air Quality

It may be necessary to source materials (such as rock material) and fuel from outside Russia for Project use within Russia and Russian waters (**Chapter 5 Project Description**). The sources for these materials have not yet been confirmed.

Chapter 9 Air Quality indicates that air emissions from marine vessels have the ability to affect air quality due to the emission of carbon monoxide (CO), nitrogen dioxide (NO_2), particulate matter (PM), and sulphur dioxide (SO_2), although such vessel emissions will not result in an environmental impact offshore where there are no relevant sensitive receptors. Marine vessel usage in the vicinity of EEZ borders is thus not able to exert an air quality related transboundary impact given the absence of sensitive receptors. In addition, low intensity vessel usage for material delivery and fuel transportation via other countries is not anticipated to result in any significant air quality impacts upon any transboundary sensitive receptors. Similarly, transnational marine vessel use during the Operational Phase of the Project as associated with material supply and maintenance activities are not anticipated to result in any transboundary air quality impacts given the low volume of marine vessels involved in such activities.

21.6.1.2 Waste Generation

Waste material will be generated on board the pipe-laying and other vessels throughout the Construction and Pre-Commissioning Phase and to a lesser extent during the Operational Phase (**Chapter 18 Waste Management**). Materials will be transported to the pipe-laying vessel by supply vessels, which will also be responsible for the removal of any waste material and its subsequent transportation to the shore (e.g. using existing port waste reception facilities at selected ports).

Supply vessels may originate from several countries and not just from Russia and in some circumstances waste may be temporarily stored on board pipe-lay vessels, prior to subsequent transportation for disposal via a port outside of Russia. It is normal practice in the shipping industry for port waste reception facilities to receive waste from vessels using that port, where the waste has been generated during the ship's voyage including transit outside of the waters of the receiving country. The amount of waste that will be generated within Russian waters and transported to ports in other countries is uncertain and is dependent upon which ports are selected by the Project.

Irrespective of the location and quantity of waste generated, the Project will comply with the International Convention for the Prevention of Pollution from Ships (MARPOL) Annexes 1, IV and V (Ref. 21.4 and Ref. 21.5), each of which includes specific waste management provisions, as well as the national requirements of the recipient country. All hazardous waste will be disposed of at licenced facilities. Waste mitigation measures to be applied are detailed in **Chapter 18 Waste Management**.

Adherence to MARPOL will enable significant adverse transboundary impacts associated with Project waste to be avoided.

21.6.1.3 Underwater Noise Impacts upon Fish and Marine Mammals

An increase in maritime traffic and other Project activities such as micro-tunnelling, rock placement and pipe-laying, will result in an increase in underwater noise levels during the Project Construction and Pre-Commissioning Phase which may impact upon ecological receptors (e.g. fish and marine mammals).

The acoustically sensitive receptors in the Black Sea are the fish species categorised as 'hearing specialists' and marine mammals. None of the sensitive fish species are protected, but all marine mammal species such as the bottlenose dolphin, common dolphin and harbour porpoise that are found in the Black Sea are of conservation concern (**Chapter 12 Marine Ecology**). The potential for Project construction activities in Russian waters to impact upon acoustically sensitive ecological receptors located across EEZ boundaries (principally in Turkish waters) thus needs to be considered. As reported in **Chapter 12 Marine Ecology**, some Project activities such as pipe-laying and trenching will increase underwater noise levels. The noise levels associated with such activities are most likely to cause mild avoidance or harassment reactions rather than strong behavioural reactions and injury. Project activities that generate underwater noise resulting in mild avoidance or harassment reactions means that the fish or marine mammals may be aware of the sound, but does not imply that they will move or be impacted. **Chapter 12 Marine Ecology** indicates that no impacts are predicted to hearing generalist species. Hearing specialist fish are generally more sensitive to underwater noise and behavioural effects may be apparent in some species such as sprat or kilka in some situations (though not shad or anchovy). The maximum predicted range for behavioural effects in hearing specialist fish is 260 m. **Chapter 12 Marine Ecology** also reports that underwater noise arising from several vessels simultaneously were insufficient to give rise to mortality in marine mammals. The injury footprint of proposed construction operations is estimated to be very limited. Porpoise in close proximity to pipe-laying (20 – 60 m) may experience permanent threshold shift (PTS)[1] although in reality it is unlikely that cetaceans will approach loud sound sources. Based on audiogram weighted criteria, mild behavioural effect ranges for individual vessel operations are only estimated to be significant for dolphins and porpoises, to a maximum range of 0.72 km for dolphins and 1.5 km for porpoise at any modelled location.

Whilst Project construction activities have the potential to generate underwater noise, and thus impact upon fish and marine mammal behaviour, the limited spatial extent of strong avoidance reactions is such that significant transboundary impacts would be avoided. For example, given that construction activities would be located at least 8 km from the Ukrainian EEZ boundary (see Table 21.1), Project construction activities are not anticipated to be able to impact upon fish or marine mammals in Ukrainian waters. Similarly, there would be no impacts upon fish or marine mammals in Georgian waters. Construction activities close to the Turkish EEZ boundary would be able to generate avoidance reactions (fish and marine mammals) as per the limited distances as detailed above, noting that such impacts would be less than those as associated with project construction activities that will be undertaken within Turkish waters.

During the Operational Phase, given that underwater noise levels will be lower than those experienced during the Construction Phase, significant transboundary ecological impacts are not anticipated.

21.6.1.4 Birds

The Black Sea coastline is a major migratory route for birds (**Chapter 12 Marine Ecology**). There are two periods for migration in the north-eastern Black Sea region; one during the spring (mid-February to early-June) and one in the autumn (early-August to end-November). The pipeline construction corridor in the offshore sections is approximately 2 to 3 km wide, and will cross only a small part of the migratory route (as migratory routes run in a north to south direction). In addition, the Construction and Pre-Commissioning Phase is temporary in nature and the scale of the construction corridor is very small. This means that the Project will not result in the formation of any barriers that could result in a change to bird migration patterns (**Chapter 12 Marine Ecology**). As a result, Construction and Pre-Commissioning Phase activities will not cause long term levels of disturbance to migratory birds or the ecological features upon which they depend. Similarly, Operational Phase activities are not anticipated to impact upon bird migration. Overall, no significant adverse impacts to the transboundary activities of migratory birds are expected as a result of planned Project activities.

21.6.1.5 Fisheries

The fish stock in the Black Sea has been drastically reduced as a consequence of eutrophication, overfishing and plankton reduction (**Chapter 14 Socio-Economics**). Nevertheless, fishing is still a substantial source of revenue for Black Sea countries.

[1] Defined as the onset of permanent threshold shift (PTS) which is the point at which hearing may become impaired and from which the animal cannot recover

The majority of Project activities will take place in areas where only pelagic fishing can take place, because of the absence of any species at depths in excess of approximately 150 m, below which the Black Sea is anoxic. Pelagic fishing involves commercial species such as the European anchovy (*Engraulis encrasicolus*), sprat (*Sprattus sprattus*), and Black Sea horse mackerel (*Trachurus mediterraneus ponticus*). Given this distribution, it is the activities in the shallower parts of the offshore section and in the nearshore section of the Project that are more likely to interact with both fish populations and commercial fishing in Russian waters.

Any impacts upon migratory fish species, such as anchovy, would have the potential to influence fisheries in other Black Sea countries. Potential impacts could occur as a result of construction activities such as pipe-laying, dredging and post lay trenching which result in underwater noise, generation of suspended sediments and the loss of habitat. Anchoring, pipe-laying, dredging and post lay trenching will generate sediment plumes, which will be of limited duration and dimension. These plumes will not occupy a significant proportion of the local water column and it is anticipated that fish will avoid them. The loss of habitat from pipe-laying is considered insignificant in the context of the wider Black Sea environment and is thus not expected to result in an impact on either migratory or non-migratory fish.

Given the limited area the offshore and nearshore sections of the Project will occupy, and the temporary nature of the Construction and Commissioning Phase, no significant transboundary impacts to fish stocks and fisheries are expected.

21.6.2 Unplanned Events

Unplanned events are considered separately from planned activities as they would only arise as a result of a technical failure, human error or as a result of natural phenomena such as a seismic event (**Chapter 19 Unplanned Events**). Unplanned events that are considered to have the potential to generate a transboundary marine impact include (with each being discussed in the sections below):

- Disruption or damage to non-Project subsea infrastructure (principally during the Construction Phase);
- Increase on maritime traffic causing accidents;
- Hydrocarbon spillages (as a result of maritime accident/collision) (principally during the Construction and Pre-Commissioning Phase);
- Vessel operations have the potential to inadvertently introduce invasive alien species, either in ballast water, on the biofilm inside ballast tanks or carried as fouling organisms on the hull; and
- Large scale release of gas (during the Operational Phase).

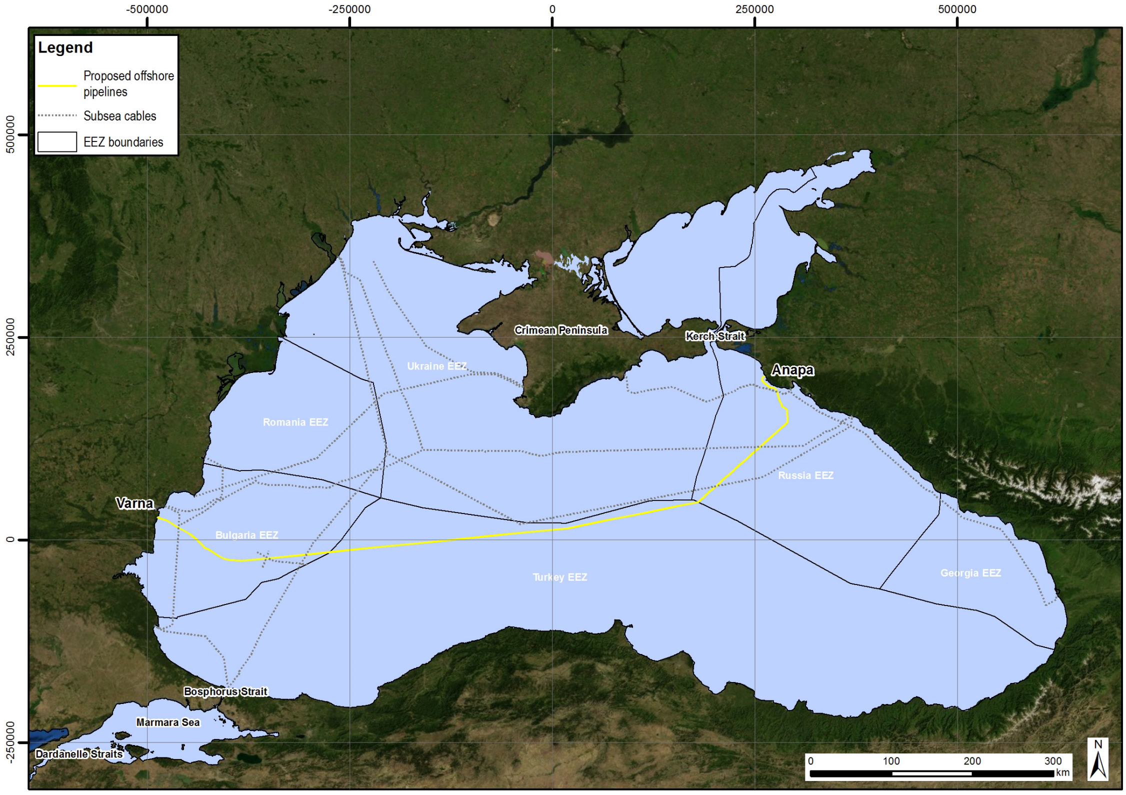
21.6.2.1 Disruption to Subsea Infrastructure

As shown in Figure 21.3, existing subsea infrastructure cables cross the Black Sea (including three subsea infrastructure cables which pass through the Russian EEZ). Consequently, there is a risk that during the Construction Phase pipe-laying activities that a cable could be damaged which would have a potential adverse transboundary impacts upon other Black Sea countries due to service interruption.

To mitigate the potential damage to subsea infrastructure cables, it will be necessary to install structures above the existing cables to ensure their protection. Such protective structures could include concrete or rock mattresses. South Stream Transport will contact known cable owners prior to pipe-laying and agree technical and commercial aspects of any such cable crossings.

With the implementation of the defined mitigation approach, the risks of damaging subsea infrastructure cables and associated transboundary impacts (i.e. disruption to communication networks) will be minimised.

Figure 21.3 Location of Subsea Cables



21.6.2.2 Increase in Marine Traffic

Project related maritime traffic and navigation restrictions have the potential to increase the risk of marine vessel collisions or obstruct other vessels traversing the Black Sea (originating from or en route to ports outside of Russian Federation territory). However, the pipe-laying spreads (pipe-laying and supporting vessels (**Chapter 5 Project Description**)) will move at very low speeds (i.e. around two nautical miles a day), which means that they can effectively be considered to be stationary objects rather than moving vessels. Consequently non-Project vessels can be notified of the spread's daily position to minimise the risk of vessel collisions. In addition, the Project will comply with all international mandatory requirements (e.g. MARPOL - Ref. 21.4 and Ref. 21.5), including the following measures:

- Prior to and during construction, liaise with the appropriate maritime authorities and ports to ensure suitable navigational warnings are issued; and
- Radio communications and other safety devices (such as navigational lights and maritime warnings) to communicate the location and extent of the exclusion zone around the Project construction activities.

With the implementation of such measures, the risk of third party vessel collisions is minimal and the Project's activities are not expected to result in a significant impact on transboundary marine vessel movements. In avoiding the pipeline spread, non-Project vessels may be required to deviate from their preferred course, however, such deviations would not significantly disrupt vessels undertaking long range transnational journeys.

21.6.2.3 Maritime Accidents Leading to Oil Spills

Chapter 19 Unplanned Events considers the risks of Project vessel accidents and collisions and the potential environmental impacts from any resultant hydrocarbon spillages. The assessment was supported by a maritime risk assessment and hydrodynamic modelling of various oil spill scenarios. The maritime risk assessment indicates that the probability of vessel collisions (and vessel grounding in nearshore areas) occurring is considered to be very low. The probability that such incidents would result in an oil spill is even lower, as a high-energy collision would be required to damage a vessel to such an extent that marine diesel was spilled into the sea.

Hydrodynamic modelling has been undertaken for various oil spillage scenarios (Ref. 21.6), some of which can be used to illustrate the potential for transboundary impacts. Oil spillage modelling has been undertaken for an oil spillage along the Pipeline route very close to the Russian and Turkish EEZ border (spillage of 2,000 m^3 of Marine Diesel Oil (MDO)).

Whilst the oil spillage release location for the modelling scenario as detailed above was located just outside the Russian EEZ border (see Figure 19.2), it is considered that the modelling results can be used to illustrate the potential for spillages within the Russian EEZ to generate potential transboundary impacts. Hydrodynamic modelling results illustrate the following (**Chapter 19 Unplanned Events**):

- **2,000 m^3 MDO spillage on the Turkish / Russian EEZ border:** Hydrodynamic modelling predicts a moderate area of the Black Sea would be affected with a surface slick of thicknesses > 1 µm visible for up to 96 km from the release location. Thus an oil spillage along the Pipeline route close to the Russian EEZ border would have the potential to impact upon the marine waters of the Ukraine and Turkey within in a matter of hours. Dissolved water column concentrations of greater than 50 ppb are predicted a maximum of 68 km away from the release site, with concentrations taking up to 1.5 days to fall below this threshold in localised areas (oil is not expected to have acute toxic effects at water column concentrations less than 50 ppb). The risk of the oil spill reaching any shorelines is predicted to be low (up to 13%) due to the central location of the oil release and limited shoreward transport by prevailing currents. The minimum coastal arrival time for dissolved oil is predicted to be around three days with a total mass onshore of approximately 85 tonnes - this quantity would be spread across a large coastal area such that concentrations would be likely to be very low - the majority of oil would arrive as fine droplets which are not expected to be visible. Russian and Ukrainian coastal locations would have the greatest exposure, although there may be very small quantities reaching Turkey and perhaps Georgia depending on tidal and weather conditions. Beaching after three days across a wide area of coastline suggests that any dissolved oil arriving onshore at the countries specified above would arrive in a weathered and dispersed state, only being noticeable in isolated areas. This modelling does not take into consideration oil spill response procedures being in place during the spill.

Chapter 19 Unplanned Events illustrates that the severity of the consequences of an oil spill depends on several factors including (a) type of oil spilled, (b) the amount of oil spilled and, perhaps most importantly, (c) the proximity of the oil spill to oil-sensitive resources. Whilst the probability of oil spillages is inherently low, the hydrodynamic modelling results as presented above indicates that such spillages in Russian waters have the potential to generate transboundary environmental impacts in other Black Sea countries (principally the marine waters of the Ukraine, Turkey and Georgia), with the significance of the impact being dependent upon the spillage volume and sensitivity of the release location.

Given that such hydrocarbon spillages have the potential to generate a transboundary marine environmental impact, the Project will implement a range of measures that aim to reduce the probability of such events occurring, as well as definition of actions to be taken following spillages to reduce potential environmental impacts (applicable to all Project phases). The oil spill prevention and mitigation strategy has been defined taking into account the findings of the hydrodynamic modelling (refer to **Chapter 19 Unplanned Events**) and includes:

- Marine diesel will be transported by supply Project vessels and vessels deployed in the Project Area will, where practical, use Marine Gas Oil (MGO) or MDO, commonly referred to as 'marine diesel' and conforming to ISO-8217:2010 Marine Distillate Fuel Grades DMA, DMB or DMZ. Therefore, any accidental spillages of fuel would have less adverse consequences than a spill that involved heavier fuels;
- Contractors working on behalf of South Stream Transport will be required to develop and implement an Oil Spill Prevention and Response Plan. South Stream Transport will ensure that contractor Oil Spill Prevention and Response Plans are appropriately aligned with the Black Sea Contingency Plan (Ref. 21.7);
- Contractors and operators of vessels working on behalf of South Stream Transport will operate in compliance with MARPOL regulations on oil spill prevention and response and are required to prepare Shipboard Oil Pollution Emergency Plans (SOPEP) and Shipboard Marine Pollution Emergency Plans (SMPEP) as applicable for each vessel (Ref. 21.8; Ref. 21.9). The SOPEPs will specify the control and response measures that have to be available on board every vessel in order to respond to a spill that does not require external intervention; and
- All marine vessel crews will have the appropriate training, qualification and certification to undertake the tasks required during the construction of the pipelines.

21.6.2.4 Invasive Species

Some of the vessels used by the Project will originate from locations outside of the Black Sea. Depending on the previous location of marine vessels (including the pipe-lay, support and supply vessels), there is a possibility that some vessels could introduce invasive species to the Black Sea via ballast water or fouling organisms on the vessel hulls. To mitigate against this risk, the following measures will be put in place where possible and practicable (also refer to **Chapter 19 Unplanned Events**):

- Where relevant and practical these measures will be based on those identified in the IPIECA (Global Oil and Gas Industry Association for Environmental and Social Issues) document Alien Invasive Species and the Oil and Gas Industry, Guidance for Prevention and Management and the International Maritime Organization (IMO) Ballast Water Management Convention and Guidelines. They will be applied to all marine plant and equipment that is used on the Project and which has the potential to be a vector of live organisms, spores, larvae and young and will include ballast water management, use of antifouling coatings, cleaning of equipment prior to deployment and the change of cooling water;
- Where practicable use anti-fouling coatings (non-TBT) or sealing coatings to minimise inadvertent transport of organisms;
- Where practicable, careful cleaning of hulls and tanks before use and prior to entering the Black Sea; and
- Vessels entering the Black Sea using ballast water exchange will, whenever possible, conduct ballast water exchange as far from the nearest land as possible, and in all cases at least 50 nautical miles (nm) from the nearest land and in water at least 200 m in depth.

With the implementation of such measures, no significant adverse impacts associated with transboundary invasive species are expected as a result of Project activities (applicable to all Project Phases).

21.6.2.5 Release of Gas

The only possible sources of large scale releases of gas into the atmosphere would be the result of a pipeline rupture or an unplanned need to vent gas from the pipeline (depressurise) to ensure overall system safety during the Operational Phase. Statistically a pipeline rupture is a very rare event and the probability of such an extreme situation is very low. Such events have been too infrequent for a meaningful analysis of frequency as based on historic industry data. As detailed in **Chapter 19 Unplanned Events**, the Project pipelines will be designed in compliance with national and internationally recognised standards, whilst the Project has developed specific design criteria taking into account Russian Federation design standards and international pipeline industry standards that aim to minimise the risks of pipeline failures which could result in large scale gas releases.

In the unlikely event of rupture of one of the pipelines during their operation, a shutdown sequence would be initiated via the emergency shutdown (ESD) valves at the landfall facilities or via from the central control room (CCR) in Amsterdam as soon as practicable (**Chapter 5 Project Description**). This would lead to closing of ESD valves at the Russian and Bulgarian landfall facilities. The shutdown sequence is part of the detailed process design of the pipeline system and is currently under development. After shut down, the pipeline may require depressurisation and gas may be vented at landfall facilities in Russia or Bulgaria to allow repairs to take place (see Section 21.5.2).

Gas will be trapped within the isolated pipeline with the exception of the point of rupture from which gas could escape. Any gas escaping the pipeline will partially dissolve in the water column and mainly flow to the surface, expanding during the ascent towards the surface of the sea. On contact with the water surface, gas will vent to the atmosphere. Depending on the volume of gas escaping the Pipeline, adverse effects to fish and marine life in general could occur. All impacts would, however, be localised within the area of rupture of the Pipeline because of the vertical route that any escaping gas would take after being released from the pipeline.

Given the above, unplanned releases of gas are not anticipated to have a transboundary environmental impact given that such events would only have localised impacts. However, pipeline shut down would result in the interruption to gas supplies in countries as serviced by the South Stream Offshore Pipeline.

Chapter 19 Unplanned Events details the design controls that have been included to reduce the likelihood of pipeline gas leakages.

21.7 Conclusions

21.7.1 Terrestrial Transboundary Impacts

Due to the distances between the Project and the land territories of Turkey, Georgia and Ukraine, planned activities and unplanned events do not have the potential to result in impacts that cross territorial borders and thus significant transboundary environmental impacts are not anticipated.

21.7.2 Marine Transboundary Impacts

Some planned Project activities have the potential to result in adverse marine transboundary environmental impacts given that Project activities will be taking place close to EEZ boundaries. However, defined mitigation strategies will mean that significant impacts on transboundary marine vessel movements, air quality, waste generation, invasive species, acoustically sensitive marine species, migratory birds, fish and fisheries would be avoided.

Some unplanned events involving the disruption or damage to subsea infrastructure , invasive species and hydrocarbon spillages (as a result of maritime accidents or collisions) have the potential to result in adverse marine transboundary environmental and socio-economic (e.g. disruption to telecommunications and gas supply) impacts. As such, the Project will implement a range of measures that aim to reduce the probability of such events occurring in the first instance, and define actions to be taken to reduce potential environmental and socio-economic impacts in the unlikely event of an unplanned marine incident.

References

Number	Reference
Ref. 21.1	IFC Guidance Note 1: Assessment and Management of Environmental and Social Risks and Impacts. January 2012.
Ref. 21.2	IFC (2012) Performance Standard 1 - Assessment and Management of Environmental and Social Risks and Impacts. Accessed at: http://www.ifc.org/wps/wcm/connect/3be1a68049a78dc8b7e4f7a8c6a8312a/PS1_English_2012.pdf?MOD=AJPERES Accessed on 20 September 2013.
Ref. 21.3	Convention on Environmental Impact Assessment in Transboundary Context (Espoo Convention), 1991 available from: http://www.unece.org/env/eia/eia.html. Accessed on 18 June 2013.
Ref. 21.4	International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 (MARPOL Convention) Annex I – VI.
Ref. 21.5	Amendments to the Annex of the Protocol of 1978 relating to the International Convention for the Prevention of Pollution from Ships, 1973. Revised MARPOL Annex V Prevention of Pollution by Garbage from Ships, adopted on 15 July 2011 in resolution MEPC.201(62), which entered into force on 1 January 2013.
Ref. 21.6	Black Sea Diesel and Fuel Release Modelling: South Stream Development. Genesis: Technical Note August 2013.
Ref. 21.7	Black Sea Contingency Plan 2002. To the Protocol on Cooperation in Combating Pollution of the Black Sea by Oil and Other Harmful Substances in Emergency Situations – Volume 1 Response to Oil Spills. AG ESAS 8.4d.
Ref. 21.8	"Guidelines for the development of the Shipboard Oil Pollution Emergency Plans", [IMO Resolution MEPC.54(32); adopted on March 6, 1992; and Resolution MEPC.86(44), adopted on 13 March 2000].
Ref. 21.9	IMO IB586E – Shipboard Oil Pollution Emergency Plans (SOPEP), 2010 Edition.

Chapter 22: Environmental and Social Management

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Figures

22 Environmental and Social Management

22.1 Introduction

South Stream Transport is committed to develop and operate the South Stream Offshore Pipeline in an environmentally and socially responsible manner.

Further, South Stream Transport is seeking international financing for the Project, and consequently must meet the legal and other requirements of all countries through which it passes (i.e. the Russian Federation, Bulgaria and Turkey), plus adopted standards and guidelines for international financing[1].

As the South Stream Offshore Pipeline will be constructed and operated as a single, coherent development across three countries, it will be managed by means of an overarching corporate management system. A Health, Safety, Security and Environmental Integrated Management System (HSSE-IMS) will form an important part of the corporate management system. Key elements of the HSSE-IMS relating to environmental and social management are described in more detail in Section 22.5.

This chapter explains how commitments identified during planning stages (i.e. during national and international impact assessments) are captured in Environmental and Social Management Plans (ESMPs) that in turn form an important element of the HSSE-IMS.

22.2 Environmental and Social Commitments

Commitments in the form of design controls, safeguards, mitigation measures and monitoring requirements that aim to avoid, prevent, minimise or where this is not possible, offset potential adverse impacts and enhance positive impacts, have been identified or developed during the planning stages of the South Stream Offshore Pipeline. Figure 22.1 describes the key sources of environmental and social commitments, and their incorporation via a Master Commitments Register into ESMPs.

Thus, the Master Commitments Register represents the principal link and provides coherence between various source documents (including this ESIA Report) and the South Stream Offshore Pipeline ESMPs. As such, a single Master Commitments Register is compiled from sources from all three countries – Russia, Turkey and Bulgaria.

22.3 Environmental and Social Aspects and Impacts Register

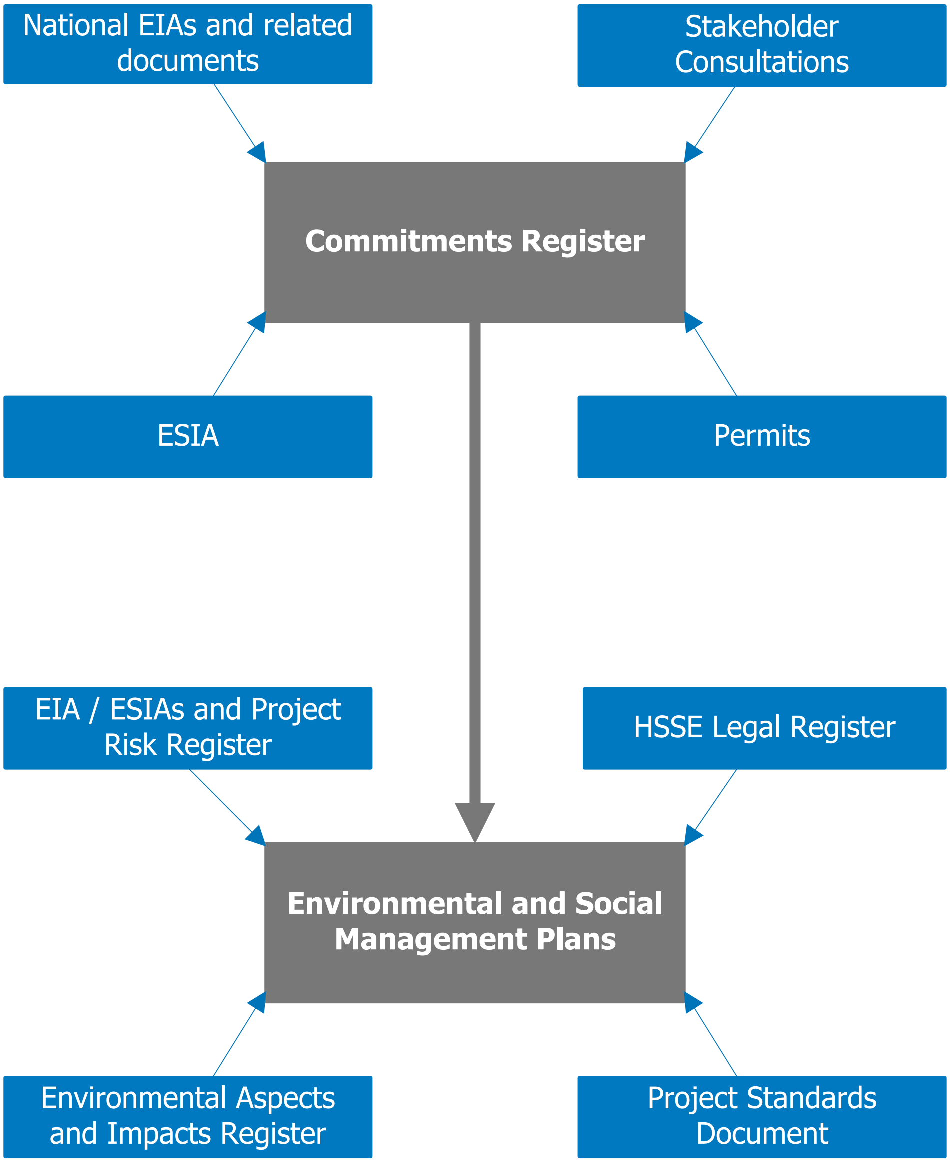
South Stream Transport has evaluated environmental and social aspects for the South Stream Offshore Pipeline (i.e. for all three countries – Russia, Turkey and Bulgaria), and as a result has

[1] Including the Equator Principles, OECD Common Approaches and IFC Performance Standards as outlined in **Chapter 2 Policy, Regulatory and Administrative Framework** of this ESIA.

prepared an Aspects and Impacts Register. This register lists environmental and social aspects and impacts based upon ENVIID, ESIA and Environmental Due Diligence Assessments, and identifies those that constitute a significant risk. These are subsequently transferred to the EIA/ESIA and Project Risk Register.

The purpose of ESMPs is to ensure that appropriate mitigation and monitoring measures are in place to deal with all significant potential environmental and social impacts of a project. The Aspects and Impacts Register therefore provides a focus for environmental and social management and development of the management plans for the Project and the overall South Stream Offshore Pipeline as shown in Figure 22.1.

Figure 22.1 Inputs to Environmental and Social Management Plans



22.4 Environmental and Social Management Plans

ESMPs are the principal means by which environmental and social impacts are managed and compliance with Project Standards is assured. ESMPs will be subject to regular review to determine adequacy and effectiveness and therefore, may be adjusted in line with the model described by ISO14001:2004 in order to improve future performance.

The ESMPs will form the basis for subsequent, more detailed management plans to be prepared and/or implemented by construction and operations contractors (see Section 22.5.4), who will be contractually obliged to comply with the relevant environmental and social requirements, specifications, and procedures set out in South Stream Transport ESMPs.

Consultation with stakeholders has been ongoing and will continue, including for disclosure of the ESMPs, as outlined in **Chapter 6 Stakeholder Engagement**.

22.4.1 ESMP Structure

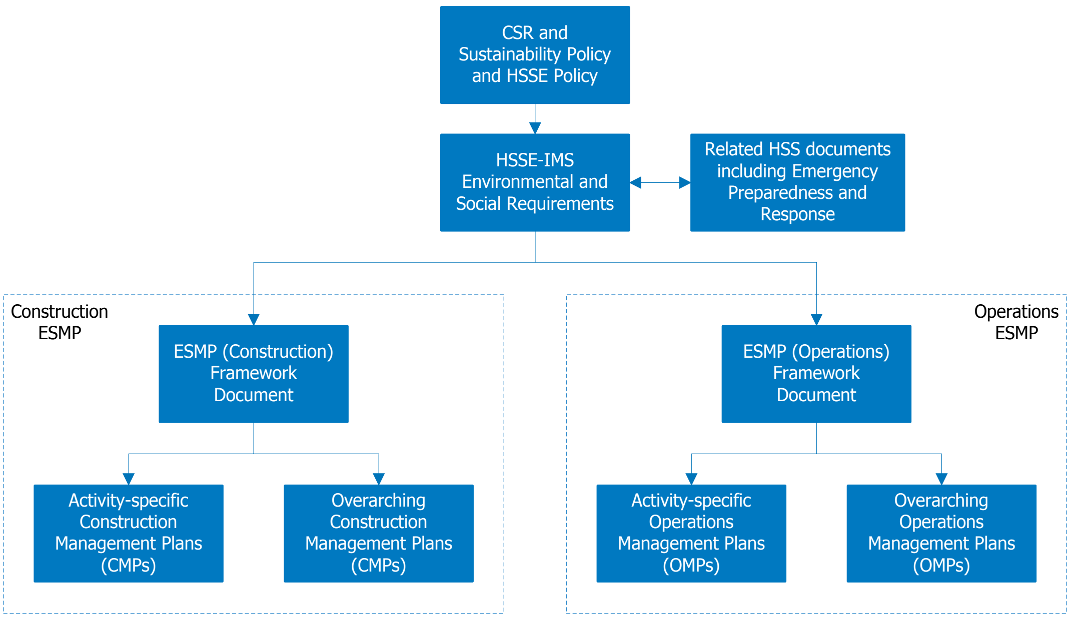
The potential impacts are markedly different between Project phases, with many construction-related impacts ceasing during the Operational Phase. The HSSE-IMS will therefore include the development of phase-specific ESMPs:

- Construction Phase ESMP; and
- Operational Phase ESMP.

The Construction ESMP and the Operations ESMP will each comprise a suite of documents including a Framework Document and a set of management plans.

The document structure is shown in Figure 22.2.

Figure 22.2 South Stream Offshore Pipeline HSSE-IMS and ESMP Structure



22.4.1.1 Construction ESMP

The Construction ESMP will comprise an "ESMP (Construction) Framework Document", a suite of activity-specific CMPs, and overarching CMPs. Between them, these documents will capture all relevant South Stream Offshore Pipeline commitments in terms of mitigation, management and monitoring actions defined in this ESIA and other documentation.

The ESMP (Construction) Framework Document will describe the Construction ESMP including its constituents and key linkages to other elements of the HSSE-IMS. In particular, it will set out the context and purpose of the activity-specific and overarching CMPs and will describe the rationale behind their development and how they will be implemented. This document will also include:

- A summary of the policies, legal and regulatory requirements and other applicable standards relevant to construction;
- Construction ESMP roles and responsibilities;
- Training requirements and standards;
- Performance indicators adopted;
- Inspection, audit and reporting strategies; and
- General instructions as to how the Construction ESMP should be used.

Activity-specific CMPs will be designed for identifiable discrete Project Activities (e.g. Russian Landfall activities). These plans will address environmental and social impacts that are likely to occur as a result of the relevant activities (e.g. noise emissions, air quality emissions, modification of ground conditions etc.).

As an example, the Russian Landfall CMP will address South Stream Offshore Pipeline commitments (mitigation, management and monitoring) applicable to all Russian onshore construction activities. It will cover microtunnelling works, onshore pipeline installation (as well as the permanent landfall facilities comprising a metering facility), pipeline inspection gauge (PIG) launch and trap facilities and emergency shut-down valve stations. It will also cover access roads, road transport to and from the landfall site and the Project's interaction with Local Communities.

The activity-specific CMPs will contain activity-specific requirements to be met by both South Stream Transport and appointed contractors (and sub-contractors). The activity-specific CMPs will be developed for contractors as the primary users (as opposed to South Stream Transport personnel).

Figure 22.3 presents the activity-specific CMPs and overarching CMPs.

Figure 22.3 Activity-Specific and Overarching CMPs[2]

Activity-Specific Construction Management Plans	Overarching Construction Management Plans
• Vessels and Marine Transport • Seabed Intervention • Russian Landfall • Bulgarian Landfall* • Bulgarian Marshalling Yards* • Pre-Commissioning	• Labour and Working Conditions • Compensation • Cultural Heritage • Biodiversity • Stakeholder Engagement

* Indicates plans that are not relevant to the Project (i.e. Russian Sector)

In addition to the activity-specific CMPs, it is recognised that some Project Activities are applicable to the South Stream Offshore Pipeline, independent of the location or nature of the activity in question.

The overarching CMPs, as shown in Figure 22.3, will address the South Stream Offshore Pipeline requirements, the majority of which will primarily be the responsibility of South Stream Transport.

22.4.1.2 Operations ESMP

The Operations ESMP will follow the same structure as the Construction ESMP, including both the development of an ESMP (Operations) Framework Document to describe the ESMP and key linkages to other elements of the HSSE-IMS, as well as a suite of activity-specific Operations Management Plans (OMPs) and overarching OMPs. The anticipated OMPs for the Operations ESMP are presented in Figure 22.4.

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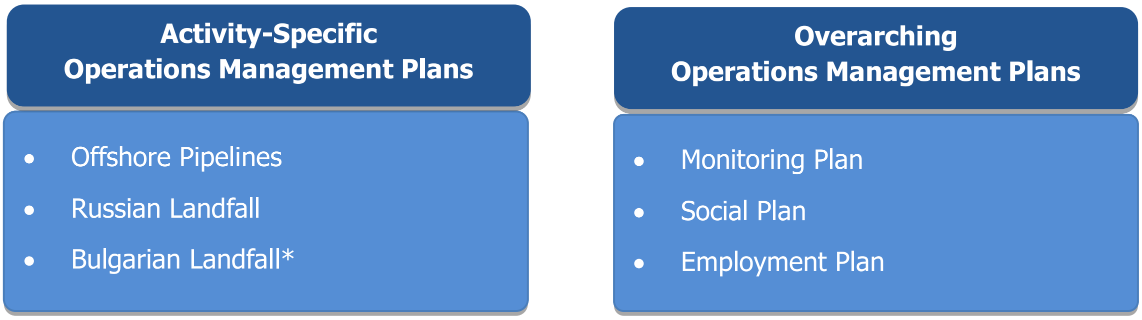
[2] The overarching Stakeholder Engagement CMP is supplementary to the country Stakeholder Engagement Plans (SEPs) (see **Chapter 6 Stakeholder Engagement**) and will be implemented primarily by contractors. In particular it aims to ensure that any stakeholder engagement undertaken by contractors is aligned with South Stream Transport procedures.

Figure 22.4 Activity-Specific and Overarching OMPs



* Identifies plans that are not relevant to the Project (i.e. Russian Sector)

Each OMP describes environmental and social mitigation, management and monitoring requirements and actions in relation to normal operating conditions and planned maintenance, minor repairs and minor incidents. Unscheduled major repair work relating to the offshore pipelines will be subject to permitting and impact assessment activities and development of bespoke management plans and procedures. Emergency situations will be covered by the separate emergency response plans and procedures described in **Chapter 19 Unplanned Events**.

Decommissioning activities will be covered by specific management plans to be developed during the Operational Phase.

22.4.2 ESMP Content

Each of the individual management plans within the ESMPs consists of two main components:

- Management and Mitigation Plan; and
- Monitoring Plan.

These two components are contained within the Appendices to each of the management plans. The main body of the management plans contains supporting information specific to the topic of the management plan including scope, responsibilities, linkages to other documents, implementation and verification and a summary policies and standards (including legal requirements).

22.4.2.1 Management and Mitigation Plan of ESMP

The Management and Mitigation Plan component captures all management and mitigation measures outlined in the source documents described in Figure 22.1. Those measures play a vital role in reducing the potential impacts associated with activities, and include:

- Design Controls: As part of the Project design process, measures to avoid or minimise impacts were identified and incorporated into the design. These are referred to as design controls and include design features and management measures. They are based on Good International Industry Practice (GIIP) and are intended to avoid or control unacceptable impacts. Specific design controls are described in greater detail in **Chapter 5 Project**

Description. Their role in controlling impacts on environmental and social impacts is discussed more in **Chapter 3 Impact Assessment Methodology**; and

- Management and Mitigation Measures: Where the outcome of the ESIA indicates that design controls are insufficient to manage an impacts to an acceptable level, further measures have been identified. These measures have been termed "mitigation measures" and are described in respective chapters and detailed in Environmental and Social Management Plans.

Management and Mitigation Actions

The ESMPs provide a detailed list of mitigation measures and actions that are required to reduce to acceptable standards the adverse environmental and social impacts and enhance the positive impacts of the Project as presented in Section 22.4.

The management and mitigation measures are presented in a tabular format in the ESMPs (and associated CMPs) setting out the location and impact that each mitigation measure or action relates to, the entity responsible for implementing each measure or action, details of the mechanisms that will be used to monitor each measure or action and the performance criteria to be utilised in order to define or measure the success or failure of the measure or action.

22.4.2.2 Monitoring Plan of ESMP

The Monitoring Plan component of the ESMPs details the monitoring requirements based on the findings of this ESIA and other source documents (Figure 22.1) as applicable to the specific phase and activity or overarching topic.

For each of these monitoring requirements, the management plans specify:

- The parameters to be assessed as part of the monitoring;
- The proposed scheduling of monitoring activities;
- The proposed location of monitoring activities;
- The means of verification; and
- The roles and responsibilities for the monitoring activity.

In addition, South Stream Transport is developing a detailed overarching Environmental and Social Monitoring Programme for the South Stream Offshore Pipeline Project which will detail all monitoring requirements applicable to the South Stream Offshore Pipeline.

Monitoring is required in order to both demonstrate compliance with legal limits and South Stream Transport's Project Standards as well as provide verification of the overall design and effectiveness of the implemented mitigation and management measures. The key objectives of South Stream Transport's proposed monitoring activities are as follows:

- To monitor compliance with relevant standards and South Stream Transport's environmental and social objectives;
- To provide an early indication of any mitigation and management measures or practices that are failing to achieve objectives;

- To determine whether environmental and social changes are attributable to Construction and Operational activities; and
- To provide a basis for continuous review of, and improvement to, the monitoring activities.

Overarching Environmental and Social Monitoring Programme

The monitoring plan requirements outlined in the ESMPs are defined in more detail in the overarching Environmental and Social Monitoring Programme. The overarching Monitoring Programme takes the monitoring requirements described in the ESMP monitoring plans and provides greater specificity and instruction on the monitoring locations, parameters to be monitored, sampling and storage methodologies, sampling frequency, analytical techniques and reporting.

In developing the overarching Environmental and Social Monitoring Programme, the following factors have been considered:

- Significance of environmental and social aspects identified through impact assessment;
- National legislative requirements;
- Good International Industry Practice (GIIP);
- Responsiveness to the detection of environmental and social changes or trends;
- Logistical practicality; and
- Cost effectiveness.

The following monitoring activities are likely to be included in the overarching Monitoring Programme for the South Stream Offshore Pipeline:

- Air Quality Monitoring;
- Noise Monitoring;
- Vibration and Seismicity Monitoring;
- Terrestrial Soils, Groundwater, and Surface Water Monitoring;
- Seabed Sediments and Marine Water Quality Monitoring;
- Biodiversity, Ecological and Natural Resources Monitoring;
- Solid and Liquid Wastes Monitoring (Onshore and Offshore);
- Landscape and Visual Amenity Monitoring;
- Land Use and Ownership Monitoring;
- Community, Local Economy and Traffic Monitoring;
- Cultural Heritage Monitoring; and
- Unplanned Events Monitoring.

22.4.3 ESMP Responsibilities and Implementation

South Stream Transport holds ultimate responsibility for the environmental and social performance of the overall South Stream Offshore Pipeline, including the performance of its contractors. Construction ESMPs will be implemented primarily via construction contracts and as appropriate will be issued to contractors who will be required to demonstrate how they will comply with the ESMPs through the development of their own contract-specific HSSE plans and procedures. These will be reviewed by South Stream Transport.

22.5 South Stream Offshore Pipeline HSSE-IMS

22.5.1 Introduction

As already described under the preceding sections of this chapter, the ESMPs – based on commitments raised in EIAs, ESIAs and other documents – form an important part of South Stream Transport's HSSE-IMS. The HSSE-IMS, which provides the framework for implementation of the ESMPs, has been developed to align with the requirements of the two relevant international standards:

- ISO 14001:2004: Environmental management systems – requirements with guidance for use; and
- OHSAS 18001:2007: Occupational health and safety management systems – requirements.

In addition, the system has been developed to meet the requirements of an Environmental and Social Management System (ESMS) defined in International Finance Corporation (IFC) Performance Standard 1: Assessment and management of environmental and social risks and impacts (Ref. 22.1).

The main objective of the HSSE-IMS is to provide a robust framework for meeting the Project's HSSE objectives during the entire Project lifecycle, from development to decommissioning. More specifically, the system has been designed to:

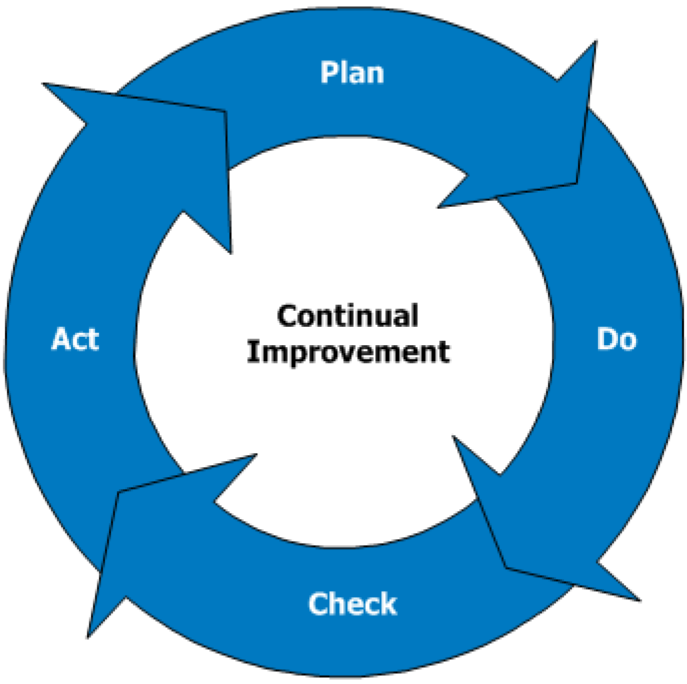
- Manage health, safety, security and environmental issues in an integrated manner;
- Clearly define the interface with other South Stream Transport management systems (e.g. quality assurance, corporate management system);
- Ensure high standards of management;
- Provide a mechanism to ensure that contractors meet South Stream Transport HSSE performance requirements;
- Establish procedures to allow South Stream Transport to monitor its HSSE performance and to report such information to its stakeholders;
- Provide South Stream Transport with a mechanism to meet its HSSE policy and associated corporate social responsibility (CSR) and sustainability goals; and
- Allow South Stream Transport to demonstrate to its stakeholders that it is committed to effective HSSE management through adopting the requirements of the relevant international standards.

The HSSE-IMS covers all persons employed directly and indirectly by South Stream Transport, including contractor and sub-contractor personnel.

The HSSE-IMS draws on the elements of the established business management process, outlined in IFC PS 1, of "plan, do, check, and act," which provides a methodological approach to managing environmental and social risks and impacts in a structured way on an ongoing basis. (Figure 22.5):

- Plan – Establish the objectives, and design the processes necessary to achieve those objectives and their associated targets;
- Do – Implement the plan and execute the processes;
- Check – Monitor implementation (usually through regular monitoring procedures or through audit), and analyse data against targets and requirements. Determine root causes of non-conformity where necessary, and design and implement corrective actions where required in order to achieve objectives and targets; and
- Act – Management Review of system performance to determine if policy, objectives and targets have been met, and where necessary to adapt these to reflect changing circumstances. The requirements of the system (e.g. organisational structure, resources and competence) that will enable it to achieve policy, objectives and targets, are also reviewed. The Management Review process concludes on the suitability, adequacy, and effectiveness of the management system, and decisions are made in order to improve the overall system.

Figure 22.5 The Plan-Do-Check-Act Cycle



The following sections provide a brief description of some of the key elements of the HSSE-IMS that are necessary to meet the HSSE objectives listed above and ensure implementation of the ESMPs.

22.5.2 Strategic Objectives and Targets

The approach to setting strategic HSSE goals by Senior Management is to define:

1. Annual strategic objectives and targets;
2. Performance Indicators (including Key Performance Indicators (KPIs)); and
3. Injury and other statistics to benchmark performance.

Annual strategic objectives are set by Senior Management, with associated targets determined at the expert-level as appropriate. The objectives and targets support the CSR Policy and HSSE Policy, and are connected to significant aspects and impacts, and/or risks, related to the Project.

Performance indicators are defined to provide proactive and leading measures of HSSE performance over time. They act as a positive incentive for the delivery of the intended management tasks dictated by the HSSE-IMS to prevent incidents and adverse outcomes, and measure how well the HSSE-IMS is being applied.

A limited subset of the performance indicators related to key HSSE risk areas are selected as key performance indicators (KPIs). KPIs are limited in number in order to optimise performance monitoring, analysis and reporting by South Stream Transport and its contractors and to allow Senior Management to track headline HSSE performance in an effective and efficient manner.

Injury and other safety statistics are used to benchmark Project performance against industry or sector statistics for similar activities, e.g. oil and gas industry, offshore pipeline construction, etc.

22.5.3 Management System Structure

An overview of the HSSE-IMS document structure is shown in Figure 22.6.

Figure 22.6 HSSE-IMS Document Structure

22.5.4 Contract Management

South Stream Transport has developed a Contract Management Procedure. The procedure stipulates that contractors are held responsible as a condition of contract for the compliance of their workers and any subcontractors with the requirements of the HSSE-IMS and other relevant commitments defined in their tender. All contractors are required to provide their workers and subcontractors with the means to ensure compliance, e.g. information, instruction and training, work equipment and personal protective equipment.

The ESMPs, or relevant parts thereof, will be issued to contractors who will be required to demonstrate how they will comply with the ESMPs through the development of their own contract-specific plans and procedures.

Compliance will be assured through a range of means, including HSSE audits and inspections (pre-contract, pre-mobilisation, and during contract execution).

The contractors will develop an overarching HSSE Plan that describes how the CMP requirements will be met and provide cross-references to more detailed supporting plans prepared by the Contractor, or bridges to existing company or vessel plans and/or procedures.

Examples of detailed supporting plans, which contractors may develop or bridge to in order to meet the requirements of the CMPs include, but are not limited to:

- Reinstatement Plan;
- Chemicals and Hazardous Substances Management Plan;
- Integrated Waste Management Plan;
- Environmental Monitoring Plan;
- Traffic Management Plan;
- Fuel Delivery, Storage and Handling Plan;
- Emergency Response Plan;
- Spill Prevention and Response Plan;
- Training Plan;
- Dredging Management Plan;
- Anchor Management Plan;
- UXO Clearance Plan;
- Contamination Contingency Plan; and
- Ballast Water and Sediment Management Plan.

22.5.5 Emergency Response

South Stream Transport will prepare an Emergency Response Plan (ERP) for the South Stream Offshore Pipeline. South Stream Transport will work with its construction contractors to ensure that South Stream Transport and contractor plans are integrated with regional contingency plans. Emergency Response Plans are discussed in more detail within **Chapter 19 Unplanned** Events.

22.5.6 Interface Management Procedure

South Stream Transport will interface with those companies responsible for the management of the Project's associated facilities in order to coordinate and cooperate where possible on HSSE matters.

The Project's associated facilities are described in **Chapter 1 Introduction** and comprise:

- Russkaya compressor station and the four pipelines connecting the compressor station with the Project, which are located immediately upstream of the Project in Russia and are being developed and managed by Gazprom Invest (GPI); and
- Designated existing quarries for sourcing material / aggregates, where those existing quarries would require significant expansion for the sole purpose of supplying the Project.

The most significant associated facility for the Project is the Russkaya compressor station and the pipeline linking the compressor station to the Project. South Stream Transport will use its best endeavours to influence GPI's management of HSSE matters, encouraging compliance with the Project Standards of the South Stream Offshore Pipeline. To facilitate interaction with GPI, South Stream Transport has developed a HSSE Interface Procedure for the Russkaya compressor station which identifies parties within South Stream Transport and their counterparts in GPI with responsibility for management of HSSE and further establishes communication protocols between these parties in order to facilitate cooperation.

Where South Stream Transport has some level of control of environmental and social matters of an associated facility, South Stream Transport's management measures will be detailed in the Project ESMP. Details of agreements between South Stream Transport and those entities that have management control of the associated facility will be documented in the Interface Management Procedure.

22.5.7 Management of Change

During the different phases of the Project, there may be a requirement to amend design elements or processes which results in a deviation from that presented in **Chapter 5 Project Description**. Accordingly, South Stream Transport has a management of change process to manage and track any such amendments which includes a screening process to identify potential environmental and social consequences.

Where a change has the potential to result in significant environmental and/or social impact it will be subject to a health, safety, security and environmental evaluation as part of the change management process, including review and revision of:

- Health, safety and environmental hazards and risks;
- Environmental aspects and impacts;
- Environmental and Social Management Plans;

- HSSE risk assessments, including updating of risk registers;
- HSSE mitigation measures and operational controls;
- Competency and training;
- Emergency preparedness and response; and
- Regulatory compliance.

For changes where a significant environmental and social impact is likely to arise, South Stream Transport will inform and consult with relevant parties on the nature of the impact and on proposed mitigation measures, where practical and appropriate.

All design changes will be added to a register of changes, which will summarise the change, the assessment, and the justification for South Stream Transport actions.

22.5.8 Performance Management

22.5.8.1 Audits and Inspections

HSSE performance will be assessed by a number of inspections and audits that are designed to identify positive implementation and also missing elements or non-compliance with the HSSE-IMS. Periodic inspections and audits will include:

- Marine vessel inspections;
- Site inspections and walkovers; and
- Internal (South Stream Transport) and external (third party) audits.

This will provide assurance that the requirements of the HSSE-IMS, including the ESMPs, have been met.

22.5.8.2 Corrective Action Procedures

Corrective actions are necessary to address new hazards or changes to hazards, inadequate implementation of control and mitigation measures, and non-compliances or non-conformances with the performance standards and requirements defined for the Project.

Corrective actions are identified from any of:

- Examinations, inspections and walkovers;
- Environmental and social monitoring;
- Meetings;
- Performance reviews and analysis;
- Observations made by workers or other parties;
- Incidents (and subsequent investigations);
- Near-miss or unsafe conditions;

- Emergency drills and exercises;
- Internal and external audits;
- Management Review of the HSSE-IMS; and
- Other communications.

All corrective actions that are not possible to implement immediately will be managed by a Corrective Action Procedure. The procedure is supported by a Corrective Action Tracking Register (CATR), through which appropriate corrective and preventative actions are documented, tracked and closed-out.

22.5.9 HSSE Reporting

The format and protocols for HSSE reporting is specified by the HSSE-IMS, which requires periodic internal and external reporting. Reports will be prepared for a range of stakeholders, including Project Lenders, and will range from weekly contractor HSSE reports to annual Project HSSE reports (in which the findings of more frequent reports are consolidated). Reports necessary to satisfy applicable law, regulations and permits will also be produced.

Annual Project HSSE reports will provide an annualised summary of HSSE performance against objectives and targets, performance indicators and industry benchmarks, together with supporting information on the implementation of the HSSE-IMS.

22.5.10 Management Review

The HSSE-IMS is subject to an annual review to comprehensively assess HSSE performance and the continued effectiveness and relevance of the HSSE-IMS to the Project, and to encourage continual improvement in the management system and HSSE performance overall. The management review is carried out by Senior Management in consultation with the Project HSSE Manager and based largely on the findings of monitoring, inspections and audits described in Section 22.5.8.

References

Number	Reference
Ref. 22.1	IFC 2012. Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts. http://www1.ifc.org. Accessed on 21 January 2013.

Chapter 23: Conclusions

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23 Conclusions

This chapter summarises the conclusions of the impact assessment undertaken for the Project. It provides a holistic view of how the ESIA was undertaken, how the Project has committed to avoiding, mitigating and managing risks and impacts so that development opportunities are enhanced, and provides a summary of impact assessment conclusions for each technical discipline.

23.1 Meeting ESIA Objectives

South Stream Transport is committed to implementing Good International Industry Practice (GIIP) in relation to environmental and social performance during Project Construction and Pre-commissioning, Operational and Decommissioning Phases. The Project is being carried out in accordance with standards and guidelines for international financing, including those for Environmental and Social Impact Assessment (ESIA). As described in **Chapter 2 Policy, Regulatory and Administrative Framework** (Section 2.7), applicable standards and guidelines include: the International Finance Corporation (IFC) Performance Standards (PS), Equator Principles (EP) III, the OECD Common Approaches, and the Japan Bank for International Cooperation (JBIC) Guidelines for Confirmation of Environmental and Social Consideration. In accordance with these standards and guidelines, this ESIA has met the necessary requirements for an assessment and management of environmental and social risks.

Chapter 1 Introduction demonstrates that the South Stream Offshore Pipeline will respond to the increased European demand for foreign natural gas by providing an overall export capacity of 63 bcm/year, which will be directed to the European supply network. This additional capacity, which is the primary benefit of the Project, is estimated to be between 11% and 18% of total projected European imports in 2035[1]. Without the Project, this positive benefit to society may not be met.

Chapter 4 Analysis of Alternatives presents an analysis undertaken of technically and financially feasible alternatives, which were analysed in the context of the engineering, environmental, socio-economic and cultural heritage constraints carried out during the Feasibility and Development Phases of the Project. The requirement to provide flexibility to construction contractors in determining the most efficient and cost-effective construction methods whilst ensuring compliance with Project standards and Project commitments drove this process. To some extent, the nature and location of the Project was determined by factors beyond the control of South Stream Transport, particularly in respect of the location of the landfall section which was constrained by the selection and siting of the Russkaya compressor station (CS). Due to the fact that a majority of the Project is located offshore, the water depth and the physical characteristics of the Black Sea present a challenge for the Project and have influenced a number of key technical decisions, including the routing of the pipelines.

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[1] Based on Wood Mackenzie (2013) estimates. International Energy Authority (2013) estimates suggest this could be between 14 – 22% of the EU's demand for natural gas in 2035.

Chapter 5 Project Description provides a detailed description of the Project, and has formed the basis for the assessment of Project Activities. Baseline information is presented in each technical chapter (Chapters 8 - 18) of this ESIA Report. Key receptors within each technical Study Area are identified and their characteristics described in each technical chapter also.

This ESIA Report has been prepared taking into consideration the definition of Project Area of Influence provided by IFC Performance Standard 1. The Project Area of Influence includes those areas likely to be affected by the main Project Facilities and Associated Facilities, and in the case of cumulative impacts, incremental impacts from other developments unrelated to the Project that will take place within the vicinity of the Project Area and within the Project timescale of implementation.

23.2 Stakeholder Engagement

Stakeholder engagement (including dialogue, consultation and the disclosure of information) is a key element of project planning, development and implementation. Effective stakeholder engagement assists good design, builds relationships with local communities, and reduces the potential for delays through the early identification of risks and issues.

South Stream Transport is committed to a transparent and respectful dialogue with stakeholders throughout the life of the Project. Within each phase of the Project, a range of engagement activities have been and will be undertaken to address the needs of different stakeholders and stakeholder groups.

Chapter 6 Stakeholder Engagement describes South Stream Transport's approach to stakeholder engagement, its purpose, and the regulatory context in which it occurs. It provides information about engagement activities undertaken to date for the EIA and ESIA processes and those that are planned for the future. The chapter also summarises the comments that have been made by stakeholders to date and how these comments are addressed within the relevant chapters of this ESIA Report.

A Stakeholder Engagement Plan (SEP) has been developed and a Grievance Procedure will be implemented by South Stream Transport in partnership with its contractors to ensure that grievances are brought to the attention of the appropriate Project staff and addressed in an appropriate and timely way. The Grievance Procedure describes the process by which a grievance is received, recorded and managed so that it can be tracked from its original submission through to a resolution with the affected stakeholders.

The Project's approach to stakeholder engagement considers both regulatory requirements and principles of GIIP, and seeks to:

- Meet the legal requirements of the Russian Federation for public consultation and disclosure during the EIA process (described in Chapter 6 - Section 6.2.1);
- Align with international standards and guidelines for financing (and GIIP), as related to ESIA, that provide a framework for public consultation and disclosure during the ESIA process (described in Chapter 6 - Section 6.2.2); and

- Align with international conventions and protocols relevant to stakeholder engagement for the Project (described in Chapter 6 - Section 6.2.3).

Effective engagement has facilitated the establishment of an active and positive relationship between stakeholders and the Project proponent, South Stream Transport. The most common topics raised during consultations to date included:

- Concerns about the Project's potentially negative impact on the natural environment including marine environment, the coastline and onshore habitat area;
- Local residents felt that gas transported by the Project should be supplied to the Local Communities located near the proposed Pipeline;
- Concerns about the safety of the Project and what measures would be put in place in an emergency situation;
- Various social related issues including anticipated Project impacts on Local Communities and visiting tourists;
- Concerns about the potential impacts of the Project in relation to increased traffic and on the quality of roads and access routes;
- Questions about the Project location, pipeline routing and alternative options considered;
- Queries about the EIA and ESIA processes;
- Questions about how the Project is engaging with stakeholders and ensuring issues and concerns are being taken into consideration; and
- Enquiries about whether local jobs would be created by the Project and how people could apply.

23.3 Impact Assessment Conclusion

The ESIA process is a systematic approach to identifying the potential environmental and social impacts of a development proposal, and to describing the mitigation, management and monitoring measures that will be implemented to address those impacts. Ultimately, it allows relevant parties to make informed decisions about a development proposal, and allows potentially affected stakeholders to participate in the process. The impact assessment has been based on the methodology presented in **Chapter 3 Impact Assessment Methodology.** Credible impacts to the key receptors were in general assessed using an impact significance matrix approach that considers the sensitivity of the receptors and the magnitude of the impacts. Impacts due to unplanned events, and due to cumulative and transboundary impacts, were also considered.

Impact significance was assessed with and without mitigation measures in place. The assessment of impact significance without mitigation measures in place took into consideration Project design controls. It is pertinent to note that impacts without mitigation measures in place are not representative of the Project's actual extent of impact, and are described in this ESIA Report to facilitate understanding of how and why mitigation measures were identified.

The residual impact is what remains following the application of mitigation and management measures, and thus represents the final level of predicted impact associated with the development of the Project. A summary of the residual impacts is presented below.

23.3.1 Overview

After implementation of design controls, management and mitigation measures, the residual environmental and social impacts of the Project, are generally of **Not Significant** to **Low** significance. The three exceptions which are above **Low** significance are presented in Table 23.1 below.

Table 23.1 Summary Table of Residual Impacts Above Low Significance

Discipline	Phase	Activity and Receptors	Residual Impact Significance	Duration / Frequency
Landscape and Visual	Construction	Impacts upon the Undulating Plateau LCA, and impacts to visual amenity for Visitors to the Russian Orthodox and Armenian cemetery at Varvarovka, residents living at North-East Varvarovka, walkers on the coastal path along the cliff top, recreational visitors to the seashore and recreational boat users.	Moderate	Permanent and direct for Visitors to the Russian Orthodox and Armenian cemetery at Varvarovka, residents living at North-East Varvarovka and walkers on the coastal path along the cliff top. Short term and temporary for recreational visitors to the seashore and recreational boat users.

Continued...

Discipline	Phase	Activity and Receptors	Residual Impact Significance	Duration / Frequency
Socio-economics	Construction	Reduced residential amenity for residents of north-eastern Varvarovka due to noise impacts from Varvarovka Bypass Road; noise impacts from Pre-Commissioning of the whole pipeline; and views of the acoustic barrier along the access road and limited views of construction work on the landfall section.	Moderate	Short term and temporary.
Community Health Safety and Security	Construction	Increased traffic safety risks for the residents of Rassvet due to construction traffic loads on the main road through the community. Mitigation will include traffic calming measures and traffic safety, driver training and speed controls as part of the Traffic Management Component of the Landfall Construction CMP.	Low/Moderate	Short term and temporary
Cultural Heritage	Construction	One marine cultural heritage object will be impacted - Amphora RU-MCH-003 will be recovered by lifting it to the surface prior to the start of construction. In addition marine site RU-MCH-004 (shipwreck) will be avoided by approximately 70 m (due to geotechnical constraints) and not the Project committed buffer of 150 m as.	Moderate	Permanent (RU-MCH-003) / Short-term (RU-MCH-004)

Complete.

The following sections provide additional detail.

23.3.2 Soils, Ground Water, and Surface Water

Impacts to soil may result through the use and storage of materials, land clearance and earthworks. With mitigation measures in place, including standard soil and erosion control measures and the provision of adequate spill prevention, the residual impact to soils is concluded to be of **Low** significance. This applies to the Construction and Pre-Commissioning Phase, and to the Operational Phase of the Project, and includes Landfall Section of the Project Area.

Impacts to groundwater quality and dynamics may result through use and storage of materials, groundwater control, the mobilisation of existing contamination due to earthworks, and hydro-testing. Through mitigation, including the implementation of a Spill Prevention and Response Plan, residual impacts to groundwater are considered to be of **Low** significance. This applies to the Construction and Pre-Commissioning Phase, to the Operational Phase, and to the Decommissioning Phase of the Project.

Impacts to surface water in the landfall section of the Project Area may result through use and storage of materials, surface water run-off across disturbed soils and river crossings (by the pipeline and access road). Impacts during the Operational Phase are not anticipated. Through mitigation, the residual significance of the impacts is reduced to **Not Significant** to **Low.**

23.3.3 Air Quality

Project emissions will result from a number of area, point and mobile sources. These include emissions of combustion gases from construction vehicles and plant, diesel generators and marine vessels. There will also be dust generated from earth works and vehicles movements. Emissions from other sources e.g. small releases from vents during maintenance are also likely during the Operational phase of the Project, although such emissions will be minimal and/or infrequent. Consequently, the impacts during operation are anticipated to be of negligible magnitude, resulting in an impact that is **Not Significant**.

The air quality assessment has therefore focussed on Construction Phase impacts utilising established air quality modelling techniques and conservative assumptions to estimate Project derived air quality impacts. The assessment studies, taking account of potentially affected receptors and existing baseline conditions, concluded that air quality impacts associated with the Project are typically of **Not Significant** or **Low** significance for all pollutants.

Despite the Project's minor impact on air quality, a number of good practice mitigation measures will be implemented to minimise air emissions. Monitoring will also be undertaken during the Construction Phase to confirm that ambient air quality remains within applicable limits for the protection of human health.

During the Construction Phase the Project may emit significant quantities of greenhouse gases (GHG). South Stream Transport will therefore put in place a monitoring plan to quantify the Project's GHG emissions during the Construction Phase.

23.3.4 Noise and Vibration

An assessment of the worst case noise and vibration impacts associated with construction has been undertaken. The results predict that noise and vibration impacts will be **Not Significant** at existing sensitive receptors neighbouring the Project, with the exception of Receptor 4 (a cluster of residential dwellings on the north-eastern part of Varvarovka), where a **High** impact is predicted. The Receptor 4 location is mainly affected by road traffic noise using the Varvarovka Bypass Road, and the **High** impact significance is only predicted to occur during periods when the greatest vehicle movements will occur. Mitigation in the way of a noise screen is proposed along the boundary of the Varvarovka Bypass Road. Post mitigation noise impacts are predicted to be of **Low** significance.

The assessment at a proposed residential site (Receptor 5 – known as the Lesnaya Polyana Development Site and described in **Chapter 14 Socio-Economics**), has indicated that noise impacts may be **High**. It is however, anticipated that this location will not be developed and occupied by residents before the Construction Phase has been completed. Therefore, the impact significance at this location is also considered to be **Not Significant**. If occupation occurs during the Construction Phase, adequate mitigation measures will be investigated to reduce noise levels to meet the identified criteria.

Assessment of the cleaning, gauging and drying pre-commissioning activities has concluded that that the majority of receptors would experience a **High** impact during the pre-packing period when the booster compressors are used. By selection of inherently quiet plant, careful siting, and the use of acoustic bunds/barriers it is feasible to reduce noise impacts to **Low** impact significance. These impacts would be temporary and short term in nature.

Vibrations impact significance was assessed to be **Not Significant** during the Construction Phase.

The assessment of the Operational Phase concluded that noise and vibration impacts will be **Not Significant**.

An assessment of decommissioning activities will be undertaken during the Operational Phase of the Project when conditions and receptors at that time are known. However, it is anticipated that decommissioning works can be suitably mitigated so that the impacts are of **Not Significant** to **Low** significance.

23.3.5 Terrestrial Ecology

The Project has the potential to affect designated sites (Utrish State Nature Reserve, Kuban River Delta Ramsar Site, and the Delta of the Kuban River Important Bird Area – although the footprint of the Project does not intercept any of these), natural habitats (as defined by IFC PS6), and a number of species listed on the IUCN Red List, the Red Data Books of the Russian Federation and Krasnodar Krai (including notably, *Testudo nikolskii* or Nikolski's tortoise, an internationally Critically Endangered species).

Impacts which have been identified as likely to occur at the Construction and Pre-commissioning Phase include habitat loss and degradation, direct mortality, injury, and disturbance to individuals of species, and habitat fragmentation or severance. Impacts are however anticipated to be either avoided, through consideration of ecological receptors in the Project's design and/or, where appropriate, through implementation of mitigation measures (including provision of a Biodiversity Action Plan (BAP)) which will reduce the magnitude of all impacts to low – negligible levels. The residual effects on all receptors, regardless of their sensitivity, will therefore be either **Not Significant** or of **Low** significance.

The assessment also considered the potential for the Project to affect terrestrial ecology receptors during the Commissioning and Operational Phase of the Project. Although impacts during this phase are anticipated to be relatively limited, there is the potential for the Project to have impacts of up to moderate significance, in the absence of mitigation. This is due to the potential for routine maintenance activities to cause mortality or injury to Nikolski's tortoise and other herpetiles. Mitigation measures have been proposed which will reduce the magnitude of all impacts at the Operational Phase on all receptors to either **Not Significant** or **Low** significance.

While it is not possible now to fully assess the effect of decommissioning the Project, the ESIA has considered two scenarios in this regard: in situ abandonment and pipe recovery, considering that the former generates impacts broadly similar to those of the Operational Phase, while the latter generates impacts broadly similar to the Construction Phase. It is, therefore, assumed that if mitigation measures are implemented which are broadly similar to those proposed for the Construction and Operational Phases of the Project, the residual effect on all receptors for decommissioning will be **Not Significant**.

Consideration has been given to the requirements of the IFC's PS6, particularly in relation to the identification and consideration of critical habitat. A Critical Habitat Assessment has been undertaken which has identified a number of ecological receptors which qualify as components of critical habitat. In accordance with IFC PS6, mitigation measures (including provision of a BAP) have been proposed and will be implemented to achieve a net biodiversity gain for these receptors.

23.3.6 Marine Ecology

The Black Sea is the world's largest anoxic basin. This condition is due to the presence of a permanent pycnocline at around 150 to 200 m water depth that limits the vertical exchange of water between oxic surface waters and anoxic deeper waters creating a unique chemical and biological environment. Waters with hypoxic or entirely anoxic conditions are typically incapable of sustaining permanent populations of species dependant on aerobic respiration.

The ESIA considered potential impacts to main habitat types (viz. soft substrate benthic habitats and seaweed stands in oxic and suboxic waters of the shelf, and microbial communities mainly in the anoxic waters of the abyssal plain), and to species grouped according to plankton, benthic communities, fish, seabirds, and marine mammals, and included the conservation status of designated areas and species. Construction and Pre-Commissioning activities have the greatest potential to impact marine ecological receptors, particularly benthic communities. Residual impacts to benthos are reduced to **Low** or **Not Significant** through various project design controls and mitigation measures, including strict adherence to relevant environmental standards, the choice of technology and comprehensive environmental management. Noise impacts associated with construction activities are very short term and unlikely to cause mortality or injury to marine mammals and so have a **Low** significance.

Potential impacts during the Operational Phase relate to the presence of the pipeline on the seabed directly and indirectly affecting habitat structure, as well as disturbance due to inspection and maintenance activities. These predominately have the potential to be moderate impacts prior to mitigation. Operational impacts are largely mitigated through ensuring the stability of the pipe on the seabed and through control of vessel activities during inspection and maintenance. These mitigation measures will reduce operational and commissioning impacts to marine ecological receptors to **Low**. Decommissioning impacts are anticipated to be similar to those in the Construction Phase.

The occurrence of critical habitat was determined in accordance with IFC guidance. The Project Area lies within some Tier 2 critical habitat, which was identified according to IFC criteria for endangered, migratory and congregatory species (namely certain pelagic fish, seabirds and cetaceans). It should be noted that the Project Area does not, per se, represent particular habitat that is not replicated elsewhere in the Russian Black Sea; it is merely part of a wider zone that meets the requisite criteria. Because the Project does not have the scope or scale to impact such extended areas, the assessment of impacts relating to critical habitats has focussed on the species for which that habitat is considered critical rather than the habitat itself. After mitigation measures are in place, a monitoring and research programme will enable the Project to meet IFC PS6 requirements for net gain.

23.3.7 Landscape and Visual

The landscape and visual impact assessment concluded that during the Construction and Pre-Commissioning Phase of the Project the residual effects on the Undulating Plateau landscape character area (CA) will be **Moderate**, and on the Black Sea Coastal seascape CA will be **Low**. There will be five **Moderate** adverse residual effects, seven **Low** adverse effects and one **Not Significant** effect on potential visual receptor groups.

The five visual receptor groups identified with significant (Moderate or above) residual effects are visitors to the Russian Orthodox and Armenian cemetery at Varvarovka, residents living at North-East Varvarovka, walkers on the coastal path along the cliff top, recreational visitors to the seashore and recreational boat users.

These impacts will typically be short-term and indirect, during the Construction Phase, which could be further reduced by consultation with the affected parties to better assess the receptor sensitivity and more accurately gauge the magnitude of the potential impacts.

During Construction and Pre-Commissioning Phase, it is considered that visitors to the Russian Orthodox and Armenian cemetery at Varvarovka, and residents living at North-East Varvarovka, will potentially experience the major impacts associated with the Project. These impacts are direct and permanent but could potentially reduce with the establishment of the proposed mitigation planting vegetation.

The residual impacts for landscape character and visual amenity during the Operational Phase will be **Not Significant** to **Low** following the implementation of design controls and mitigation measures. No significant impacts are expected during the Decommissioning Phase.

23.3.8 Socio-Economics

In terms of economic related impacts, the assessment has identified that the Project will result in limited temporary beneficial economic impacts as a result of the additional employment and increased demand for goods and services during the Construction and Pre-Commissioning Phase. In the longer term, it has also identified beneficial economic impacts at a national level associated with an increase in revenues for both the Russian gas industry and the Russian Federal government, due to the increase in Russian gas exports that the Project will enable.

During the Construction and Commissioning phases, there is the potential for **Low** adverse economic impacts prior to mitigation on Shingari and Don Holiday Complexes, and the Anapa Resort Town tourism sector, due primarily to impacts on the coastal area amenity that may affect customers of these two businesses, and thereby potentially reduce revenues for the businesses. A Fisheries Study (see Appendix 14.1 Fisheries Study) has concluded that it is unlikely that there will be any distinguishable impact on fish stocks or on the fishing industry in general (individual employment or local business impacts) due to construction of the Project in the nearshore and offshore sections. Accordingly, the impact on the fishing industry would be **Not Significant**. The requirement by the Project for land on both a temporary and permanent basis will also result in **Low** adverse impacts due to the take up of Agrifirm Kavkaz (Fond Yug) vineyards and associated potential economic displacement of vineyard workforce activity.

The application of mitigation, including ongoing stakeholder consultation, the Grievance Procedure and, if applicable, access to the Compensation Framework would result in a **Not Significant** residual impact on Shingari and Don holiday complexes and also on the Anapa Resort Town tourism sector. The Grievance Procedure (and, if applicable) the Compensation Framework would also apply in terms of the fishing industry and the workforce of Agrifirm Kavkaz (Fond Yug) vineyards as a result of the take up of land. Additionally, a Livelihood Restoration Framework would also apply as mitigation. Given the potential for impacts on livelihoods, it has been considered that the residual impact magnitude would remain **Low**.

There is also the potential for a moderate adverse pre-mitigation impact on the Varvarovka Horse Riding Business, in a worst-case scenario if that businesses' access to a riding route is interrupted or severed. However if the worst-case scenario does occur, the application of mitigation including the Compensation Management Framework and Livelihood Restoration Framework, would reduce the impact significance to **Low** adverse. With regard to community-related impacts, the construction of the Project may also result in **Low** significance adverse residual impacts on Sukko beach and Shingari beach users, and also on the amenity experienced by visitors to the Varvarovka village cemetery. During the Construction and Pre-Commissioning Phase, there is the potential for amenity-related impacts on residents as a result of noise and visual impacts. With the application of mitigation, as set out in noise and visual impact assessments, these impacts can be partially mitigated. However, **Moderate** adverse residual amenity-related impacts are still expected to be experienced by residents in the North East of Varvarovka for a short period of time.

During the Operational Phase, there would be beneficial economic impacts at a national level in terms of increased demand for Russian goods and services (gas) and increased government revenues, taxes and royalties. There would not be any adverse residual socio-economic impacts associated with the Project during the operational phase.

With regard to Human Rights, there were no significant adverse potential impacts identified that cannot be mitigated through adherence to policies, plans and procedures, as well as through community engagement. Furthermore, the Due Diligence process recognises that the Human Rights risks may change over time as the Project evolves from the Construction and Pre-Commissioning Phase into the Decommissioning Phase. As such, the Project's Human Rights Due Diligence is an iterative process whereby business operations and operating context will be examined on a regular basis.

23.3.9 Community Health, Safety and Security

The Construction and Pre-Commissioning Phase of the Project will bring direct employment opportunities to Local Communities at the landfall facilities. Procurement of goods and services will also give rise to indirect employment across a wider area. This local employment is relatively small in number and while the effects will also be small they will be beneficial. The people who are employed and their families and dependents could enjoy improvements to their health and wellbeing through increased wealth and socio-economic status.

The infrastructure and logistics requirements of the Project mean that there are inevitably some adverse effects for certain population groups. Large construction sites and busy transport corridors can be disruptive for Local Communities and can contribute to negative health outcomes.

South Stream Transport will take appropriate measures to reduce disruption through design controls and other mitigation measures that will govern the movement of transport, noise from Project vehicles and noise from Project plant. The Project will also maintain communication with Local Communities to ensure that any grievances are addressed promptly.

The community health, safety and security assessment identified that following the implementation of design controls and mitigation measures, one residual impact of **Low** to **Moderate** significance remained during the Construction and Pre-Commissioning Phase: road safety impacts due to increased traffic as a result of construction on the main road running through the community of Rassvet.

Noise impacts on residential dwellings in parts of Varvarovka due to traffic on the proposed Varvarovka Bypass Road and from the use of the compressor spread are considered to have a Low significance of health effect.

No significant impacts were identified during the Operational Phase of the Project which will bring economic benefits to the Russian Federation, which could translate into greater expenditure on infrastructure and initiatives that directly or indirectly improve health across the nation. South Stream Transport's commitment to ongoing consultation with local communities is expected to provide reassurance regarding Project operations, with potential anxieties decreasing as the Project's track record for safety becomes established and is publicised.

23.3.10 Cultural Heritage

The Construction and Pre-Commissioning Phase of the Project has the potential to impact the terrestrial cultural heritage receptor RU-TCH-02, RU-TCH-06 (Varvarovka village cemetery, Armenian and Russian cemetery). Through the use and application of mitigation measures such as the Cultural Heritage Management Plan and an Archaeological Watching Brief, the residual impacts will reduce to **Not Significant** to **Low**. No residual impacts on terrestrial receptors are expected during the Operational or Decommissioning Phases of the Project.

The Construction and Pre-Commissioning Phase has the greatest potential to impact marine cultural heritage receptors. However, with the implementation of Project design controls and mitigation measures, including careful routing to avoid and minimise impacts on sensitive marine cultural heritage, many impacts are reduced to **Not Significant** to **Low** with the exception of two Cultural Heritage Objects which will have **Moderate** residual impacts due to the fact the 150 m minimum distance cannot be met and one CHO will need to be relocated.

The exception is disturbance to currently unknown marine archaeology which remains at having the potential for not significant to high adverse impacts. However, with implementation of the Archaeological Chance Finds Procedure, the residual impact will minimise impact significance.

Operational and Commissioning Phase impacts relate to offshore and nearshore sections. Prior to mitigation, these are potentially moderate to high impacts. However, operational impacts are largely mitigated through avoidance by protective buffering, tether management, minimising propeller or thruster washing and avoiding ROV strikes by careful piloting. These mitigation measures will reduce residual impacts to marine cultural heritage receptors to **Not Significant.**

23.3.11 Ecosystem Services

The values which ecosystem service beneficiaries attached to ecosystem goods and services are appropriately considered and addressed throughout the ESIA process.

The assessment identified five priority services which the Project is likely to impact during the Construction and Pre-Commissioning Phase: crops; soil quality regulation; tourism and recreational values; cultural and spiritual values; and wild species diversity. No priority services were identified for the Operational Phase.

Mitigation measures are identified and are intended to anticipate and avoid, or where avoidance is not possible, minimise impacts on receptors. Assuming that the mitigation measures are successfully implemented, it will be possible for the Project to mitigate all potential adverse effects associated with the Project to the degree that residual impacts would be of **Not Significant** to **Low** significance.

Hazard regulation was identified as an additional priority service during the Decommissioning Phase if the second option for decommissioning (i.e. removing the pipeline) is selected. However, as the approach has not yet been decided and due to the large degree of uncertainty of assessing impacts over this timeframe, appropriate mitigation will be determined based on a survey of the risks nearer the time of decommissioning. The combined effects of the Project and other developments are not expected to result in any significant cumulative impacts on ecosystem service beneficiaries.

23.3.12 Waste

The assessment identified the waste streams that are anticipated to be produced during the Construction and Pre-Commissioning Phase and during the Operational Phase, and identified the availability and suitability of existing waste management facilities to manage those wastes. Mitigation measures have been recommended in order to minimise the impacts as far as possible, including an Integrated Waste Management Plan for the entire Project.

Moderate impacts are estimated in the event that the existing Alfa landfill is used for disposal of non-hazardous wastes from the Project. It is expected that this landfill will be closed and a replacement, engineered facility may be available by 2016. Even in the absence of such a facility, the relatively small amounts of non-hazardous waste requiring landfill means that the impacts of using Alfa Landfill would be **Not Significant**.

Provided that all of the mitigation measures are implemented, the overall waste management impacts from the development will be **Not Significant**.

23.3.13 Unplanned Events

Unplanned events are episodes that are not expected to occur during the Project's normal construction and operational phase activities, such as accidents. As such, the environmental and social consequences of an unplanned event, should it occur, can often be significant.

This ESIA has followed a systematic approach to identify a number of unplanned events, primarily related to marine accidents and loss of pipeline integrity, with the potential to cause significant environmental and social impacts. In order to manage unplanned events efforts must be made to minimise the likelihood of an unplanned event occurring in the first instance. The Project has, therefore, adopted the following approach:

- Use design controls based on GIIP to minimise the likelihood of an incident; and
- Develop response measures in case of an unplanned event.

This ESIA details a number of modelling studies undertaken to predict the likelihood of unplanned events (marine spills, pipeline rupture, fires) and concludes that the probability of such significant events is low and below the levels specified by industry acceptance criteria. Nevertheless, a suite of emergency response plans is being developed by South Stream Transport and its contractors to enable a rapid response in the unlikely event of an incident with the potential to result in adverse environmental and/or socio-economic impacts. The plans will contain measures to minimise the impacts of unplanned events including: measures for oil spill prevention and response; medical provisions; fire-fighting and; the use of pipeline exclusion zones and measures designed to enhance workers' well-being and thereby minimise potential worker or civil conflicts. The Project's emergency response plans will be integrated with regional and national plans as necessary.

23.3.14 Cumulative Impact Assessment

Chapter 20 Cumulative Impact Assessment provides an assessment of potential cumulative impacts. The assessment follows recent IFC guidance to determine the potential for the Project's impacts to interact with those of other projects/developments (spatially and/or temporally) in a manner that could result in significant cumulative impacts. The cumulative impact assessment (CIA) includes consideration of the Russkaya CS (which is defined as an associated facility) and a number of residential and mixed use developments that are reasonably defined and in the vicinity of the Project.

The Project has relatively few and/or minor impacts during the Operational Phase of the Project, whilst the other developments scoped into the CIA are almost exclusively onshore. Consequently the CIA largely focusses on the potential for cumulative impacts associated with the Project's onshore construction activities. Where possible the CIA draws from existing development plans and impact assessment studies, notably the EIA prepared for the expansion of the United Gas Supply System which includes an assessment of the Russkaya CS.

The CIA considered the potential for cumulative impacts in each of the technical disciplines where the Project has the ability to generate impacts and therefore could contribute to a cumulative impact. Consequently the CIA considered potential cumulative impacts upon soils, groundwater and surface water; air quality; noise; terrestrial and marine biodiversity; landscape and visual receptors; socio-economic impacts (including beneficial impacts); ecosystem services; cultural heritage; waste; and land-based traffic.

The results of the CIA did not identify any adverse environmental or social cumulative impacts that are considered to be significant, principally due to the degree of mitigation being proposed by South Stream Transport for the Project.

In addition to the above, given that the Russkaya CS development is defined as an associated facility, a separate collective appraisal was undertaken which considered the potential impacts of the Project and the Russkaya CS development as though they were one development. This collective appraisal highlighted a number of areas where the alignment of mitigation approaches and the integration of mitigation and management plans would be advantageous with regard to reducing potential collective environmental and social impacts. South Stream Transport will use the findings of the collective appraisal to discuss opportunities for the aligning the mitigation and management approaches with Gazprom Invest.

23.3.15 Transboundary Impact Assessment

The potential for the Project to generate potential transboundary impacts during planned activities has been assessed. This included an assessment of the implications on air quality due transportation activities, impacts due to waste generation, impacts due to the propagation of underwater noise on fish and marine mammals, and impacts on migratory birds and fish. **Chapter 21 Transboundary Impact Assessment** discusses each of these in turn and does not identify any significant transboundary impacts associated with these planned activities.

An assessment has also been undertaken of the potential for transboundary impacts due to unplanned events, including the severance of transnational subsea infrastructure, marine accidents resulting in oil spills that could affect Russia's neighbouring Black Sea countries, the inadvertently introduction of invasive alien species into the marine environment and potential unplanned gas releases. Some unplanned events (e.g. oil spills) do have the potential to cause significant transboundary impacts, however the risks are considered to be acceptable because of the measures in place to minimise the likelihood and consequence of such incidents. The Project will also apply applicable international guidelines designed to prevent the transboundary movement of invasive marine species.

In addition, the Project pipelines will be designed in compliance with national and internationally recognised standards, whilst the Project has developed specific design criteria taking into account Russian Federation design standards and international pipeline industry standards that aim to minimise the risks of pipeline failures which could result in large scale gas releases.

23.4 Environmental and Social Management

As described in **Chapter 22 Environmental and Social Management**, a Health, Safety, Security and Environmental Integrated Management System (HSSE-IMS) will form an important part of South Stream Transport's corporate management system. The potential impacts are markedly different between Project phases, with many construction-related impacts ceasing during the Operational Phase. The HSSE-IMS will therefore include phase-specific management plans. Environmental and Social Management Plans (ESMPs) have been developed to capture design controls, safeguards, mitigation measures and monitoring commitments made within the ESIA. Adherence to these plans will be a condition of any Project construction and operation contracts awarded.

23.5 Summary

As set out in South Stream Transport's Health and Safety, Security and Environmental Policy, South Stream Transport is committed to environmentally and socially responsible management, in accordance with applicable national, international (including EU legislation), and internationally recognised standards for health and safety, security and environmental and social performance. This corporate policy applies to all staff and across all business activities, it guides strategy, management, decisions and actions, it is incorporated into the documents governing relationships with suppliers and contractors, and guides relationships with joint venture and other business partners.

The Corporate Social Responsibility and Sustainability Policy further expresses South Stream Transport's commitment to integrating social, economic, environmental and governance considerations into the everyday conduct of business during the design, build and operation of the South Stream Offshore Pipeline.

These policies thus underpin South Stream Transport's commitments to systematically avoid and reduce the potential for adverse environmental and social impacts associated with the Project, or where this is not possible to compensate and offset impacts on receptors. South Stream Transport is committed to ensuring appropriate monitoring and management plans are in place to address these impacts and this will be done through the HSSE-IMS and ESMP processes, as well as continual stakeholder engagement through the life of the Project. Assuming that the mitigation measures identified in this assessment are successfully implemented, it will be possible for the Project to mitigate most adverse effects associated with the Project to the degree that the majority of impacts after mitigation would be **Not Significant** or **Low**.