South Stream
Offshore Pipeline
ENERGISING EUROPE

Appendix 11.3: Herpetile Mitigation Strategy

Table of Contents

Tables

Figures

1 Introduction

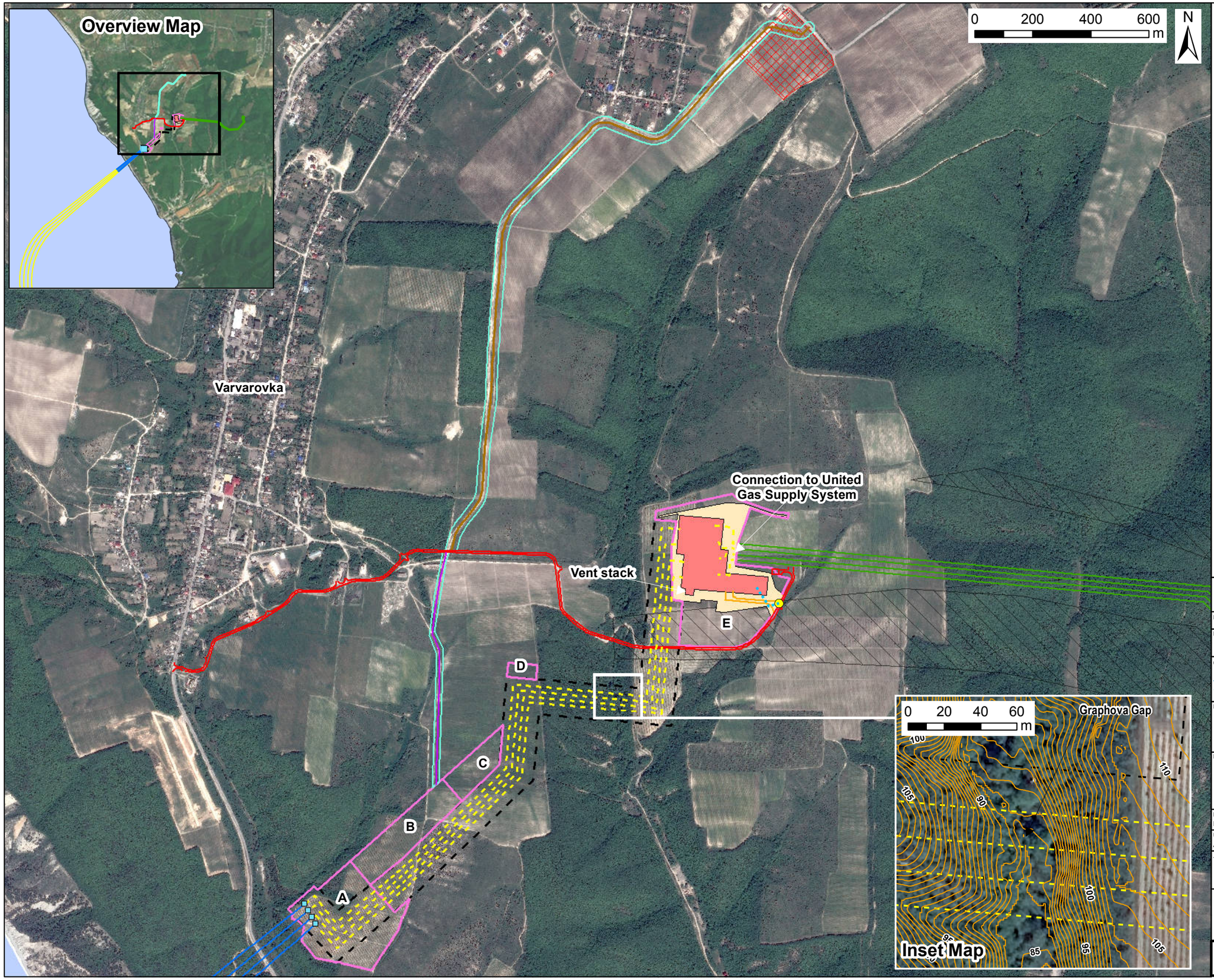
This mitigation strategy forms an appendix to **Chapter 11 Terrestrial Ecology** of the Environmental and Social Impact Assessment (ESIA) for the Russian Landfall section of the South Stream gas pipeline (the Project) (Figure 1). The focus of the mitigation strategy is Nikolski's tortoise *Testudo graeca nikolski*, as well as other threatened amphibian and reptile species present in the construction zone of the landfall site. In particular, the mitigation strategy addresses potential impacts arising from the construction phase of the development[1].

As well as forming an appendix to the ESIA, it is envisaged that this mitigation strategy will be supplied to the Project contractor to be implemented as part of the contracted works.

The objectives of this mitigation strategy are to:

- Avoid harm and direct mortality of Nikolski's tortoise, as well as other threatened amphibian and reptile species during the construction phase of the project;
- Help meet national legislative and lender requirements in relation to protected and threatened species; and
- Provide a method statement for the project contractors to implement.

[1] This mitigation strategy does not specify the reinstatement of habitats post-construction or the long-term management of restored habitats. Post-construction mitigation requirements will be detailed in a habitat restoration and management plan. This mitigation strategy also does not provide a specification for a long-term monitoring strategy, which will be set out in a Biodiversity Action Plan (BAP).



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	08 May 2014

URS Internal Project No.	Scale @ A3
46369082	1:12,500

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 1

Rev:

Plot Date: 08 May 2014
File Name:I:\15004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Appendix - Ecology\Figure 1 Location of Temporary Facilities.mxd

2 Background

Baseline ecology surveys of the Landfall Study Area were completed in 2011, 2012 and 2013. During the field surveys a total of four amphibian and 13 species of reptile were recorded (Table 1). Two amphibian species and eight reptile species recorded during the field surveys are threatened at the regional, national or international level. In addition, meadow lizard is assessed as Near Threatened by the IUCN. The locations of Red Data Book amphibians and Reptiles recorded during the 2011, 2012, and 2013 are presented on Figure 2.

In autumn 2013, a targeted Nikolski's tortoise population size class survey was undertaken. The aim of the survey was to gather additional information to inform the mitigation strategy for herpetofauna (and Nikolski's tortoise in particular) and to provide a baseline for a long-term monitoring strategy for the Project.

The population size class survey area covered the Pipeline footprint and associated access road plus a 300 m buffer and associated access road. Over the course of the survey, surveyors walked a series of transects which covered a large proportions of the survey area. Where noted, the location of tortoises 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, size was recorded, as well as a description of the habitat within which it was observed.

Table 1 Amphibian and Reptile species recorded in the Project 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		VU	1	1B, EN

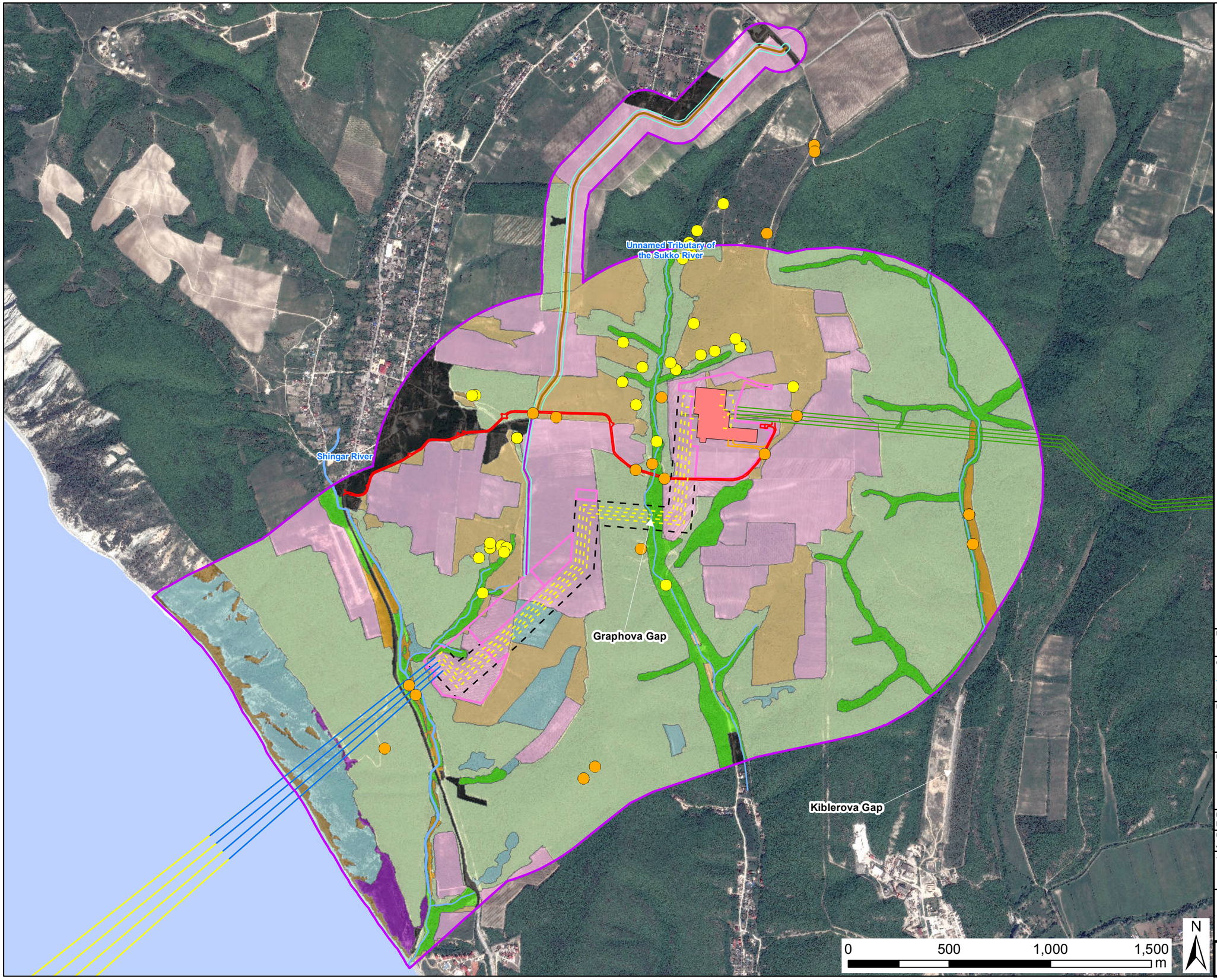
Continued…

Species	Latin Name	Conservation Status		
		IUCN	RDB RF	RDB KK
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
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 population size class survey, undertaken during October and November 2013 by Dr. Olga Leontyeva, recorded a total of 51 individual Nikolski's tortoises within the survey area (see Figure 2). The majority of individuals were recorded within the interface between the steppefied

secondary meadow, shiblyak and mesophilic forest, located in the vicinity of the Graphova Gap and the tributary feeding into Shingar River valley. A few individuals were also recorded within the shiblyak woodland in the vicinity of the town of Varvarovka. According to Dr. Olga Leontyeva, due to the fact the hibernation for the tortoises was imminent at the time of survey, the location and distribution of the species in the vicinity of the ecotone between the valleys and the meadow suggests that individuals favour and are moving into these areas to hibernate over the winter period (Dr. Olga Leontyeva pers. comm.).



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
- 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 / South Stream Energising Europe

Project Title: SOUTH STREAM OFFSHORE PIPELINE

Drawing Title: STUDY AREA FAUNA SURVEY RESULTS NIKOLSKI'S TORTOISE RECORDS

Drawn	Checked	Approved	Date
DH	RW	MW	08 May 2014

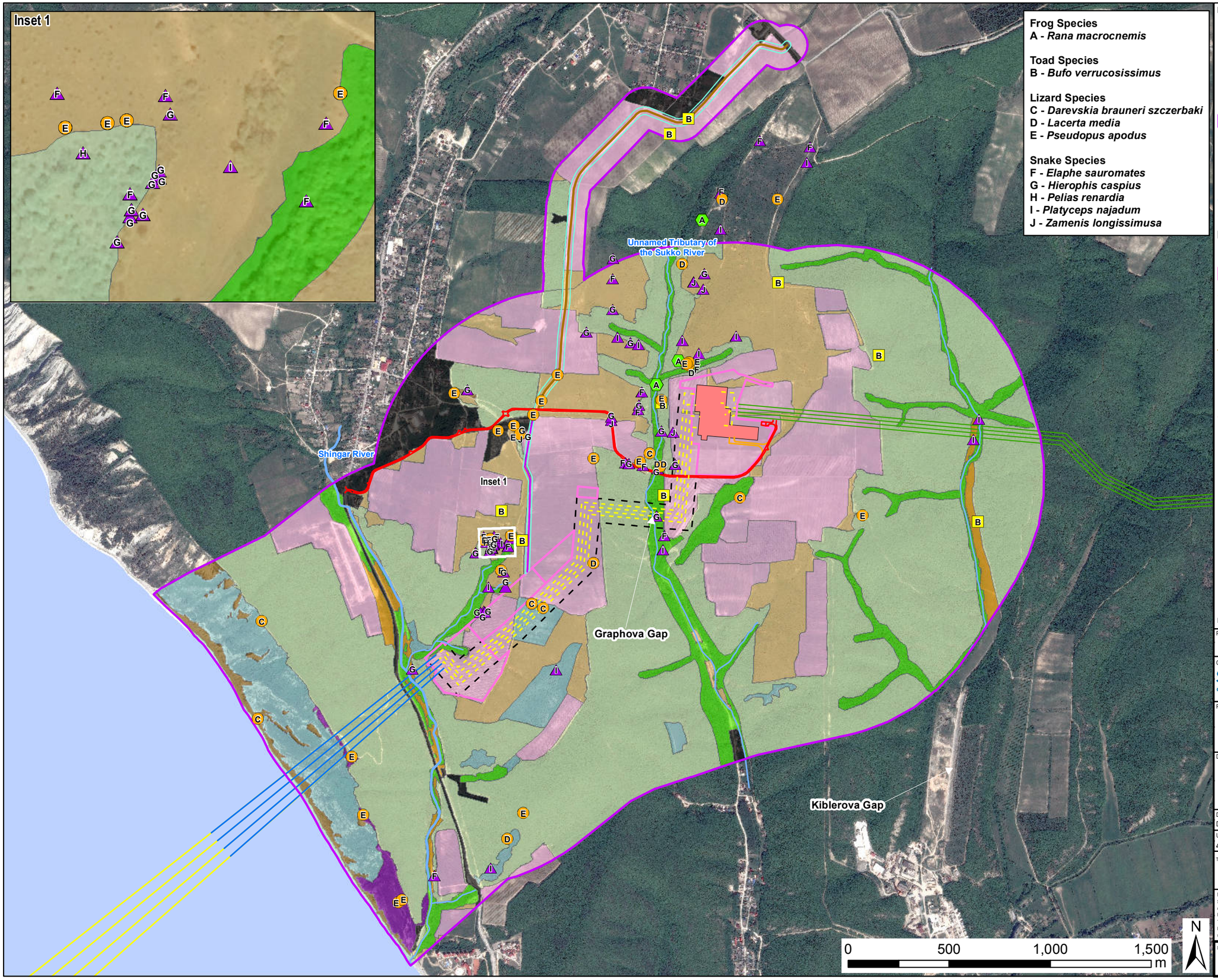
URS Internal Project No.	Scale @ A3
46369082	1:18,000

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 2

Rev:

Plot Date: 08 May 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Appendix - Ecology\Figure 2 Landfal Study Area Nikolskis Tortoise Records.mxd



Frog Species
A - *Rana macrocnemis*

Toad Species
B - *Bufo verrucosissimus*

Lizard Species
C - *Darevskia brauneri szczerbaki*
D - *Lacerta media*
E - *Pseudopus apodus*

Snake Species
F - *Elaphe sauromates*
G - *Hierophis caspius*
H - *Pelias renardia*
I - *Platyceps najadum*
J - *Zamenis longissimusa*

LEGEND

Fauna survey results
- Frogs
- Toads
- Lizards
- Snakes
- Study area
- 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 / South Stream Energising Europe

Project Title: SOUTH STREAM OFFSHORE PIPELINE

Drawing Title: LANDFALL STUDY AREA FAUNA SURVEY RESULTS RED DATA BOOK HERPETILES

Drawn	Checked	Approved	Date
DH	RW	MW	08 May 2014

URS Internal Project No.: 46369082
Scale @ A3: 1:18,000

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 3

Rev:

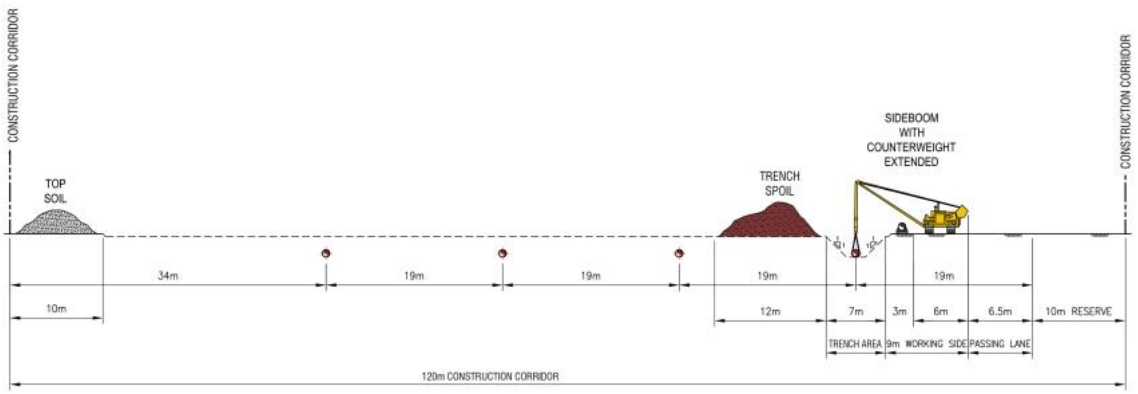
Plot Date: 08 May 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Appendix - Ecology\Figure 3 Landfall Study Area Red Book Herptiles.mxd

3 Project Description

A detailed project description is provided in **Chapter 5 Project Description**. In summary, the Project Area is subdivided into the landfall, nearshore and offshore sections of the Pipeline. The nearshore and offshore sections of the Project are both located out to sea and therefore not included in this mitigation strategy, which focuses on terrestrial amphibian and reptile species.

The landfall section is approximately 4 km in length (Figure 1). 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 the remaining 1.4 km, the pipelines will be housed in microtunnels which that will terminate approximately 400 m from the coast offshore. The permanent onshore landfall facilities (approximately 142 m wide) are also included within the landfall section, as are the access tracks and temporary transfer stations required during the construction phase of the development. There are three main access tracks being constructed. A permanent access track that will only be used during construction (the Varvarovka bypass road), a permanent access track that will only be used post-construction (to be constructed by Gazprom Invest) and a temporary access track that leads to the microtunnel site. The width of the access tracks is likely to be approximately 7 metres, excluding associated gutters, drainage ditches and lighting infrastructure (the land take will be larger than this on slopes and corners) and the total working area of the microtunnel site, landfall facilities and associated infrastructure is approximately 60 ha. The cross section of the four gas pipes is shown in Figure 4 and will be 120 m wide.

Figure 4 Working Area Cross Section



Potential Impacts

The potential impacts to amphibians and reptiles from the Project are described fully in **Chapter 11 Terrestrial Ecology**. In summary potential impacts on amphibians and reptiles during the construction and pre-commissioning phase include the loss and fragmentation of habitats, direct mortality or injury to individuals, and obstruction of movement.

Legislative and Lender Requirements

All applicable standards relevant to the Project are presented in **Chapter 2 Policy, Regulatory, and Administrative Framework**, as well as the South Stream Health, Safety, Security, Environmental and Social (HSSE) Legal Register. A summary of Russian laws of particular relevance to ecology and biodiversity are summarised in **Chapter 11 Terrestrial Ecology**.

Species listed on the Russian Federation Red Data Book are protected by Russian law and any actions which may cause death to these animals, decrease their population size or damage their habitat are prohibited. The capture of red data book species requires a permit to be issued by the Russian Nature Supervision Agency (Rosprirodnadzor, RPN). Species listed on the Red Data book of the Krasnodar Krai are also protected by state laws. A separate permit may be required from the Department for Natural Resources and State Ecological Supervision of Krasnodar Territory.

The Project is undertaken in accordance with the standards and guidelines of the International Financial Institutions, including the International Finance Corporation (IFC) Performance Standards (PS). IFC PS6 Biodiversity Conservation and Sustainable Management of Living Natural Resources, sets out an approach to protect and conserve biodiversity including threatened and endemic species. It also sets out definitions of natural, modified and critical habitat types. The Project is situated in Tier 2 Critical Habitat due to the presence of Nikolski's tortoise (see appendix A of the ESIA). According to paragraph 17 of IFC PS 6:

"In areas of critical habitat, the client will not implement any project activities unless all of the following are demonstrated:

- *No other viable alternatives within the region exist for development of the project on modified or natural habitats that are not critical;*
- *The project does not lead to measurable adverse impacts on those biodiversity values for which the critical habitat was designated, and on the ecological processes supporting those biodiversity values;*
- *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; and*
- *A robust, appropriately designed, and long-term biodiversity monitoring and evaluation program is integrated into the client's management program."*

4 Mitigation Strategy

The following mitigation strategy will be implemented to avoid and reduce negative impact on Nikolski's Tortoise and other species of reptile and amphibian during the construction phase of the Project. This strategy is formed by a combination of the following measures:

- Timing of works;
- Careful clearance of vegetation;
- Installation of barrier fences;
- Capture and any required placement;
- Supervision of works;
- On-site Contractor Responsibilities;
- Mitigation measures incorporated into the detailed design of roads; and
- Installation of under-road passes (tunnels).

Detailed descriptions of each of the measures are provided in the following sections. In addition, a Biodiversity Action Plan will be developed to address residual negatives impacts as well as to deliver net gains in biodiversity.

Timing of works

Careful timing of works is essential to avoid sensitive periods of the year when Nikolski's tortoise and other herpetile species are vulnerable to disturbance. In particular, site clearance works should aim to avoid the winter months (October to mid-April) when many species are hibernating underground.

It is understood that the respective construction start dates for different phases of the Project are provisionally planned as follows: Varvarovka bypass road in April to May 2014, the microtunnels in May 2014, the landfall facility in June 2014 and the main linear pipeline in September 2014.

Table 2 provides an indicative overview of the recommended timetable of mitigation works in respect to construction schedule (length of capture effort to be updated with respect to weather conditions and numbers of animals caught). If this schedule changes, the timings would need to be revised accordingly in liaison with specialist ecologists.

Table 2 Timing of Works

Varvarovka Bypass Access Road	
Date	*Works*
April – Early May	Survey and mark protected plant species Install exclusion fencing and hand clearance of vegetation within remainder of work area
Mid April – May	Capture and placement Re-positioning of Protected Plants and start of construction.
Microtunnel	
April – Early May	Survey and mark protected plant species. Install exclusion fencing and hand clearance of vegetation within remainder of work area
Mid April – May	Capture and placement
May	Re-positioning of Protected Plants
Landfall Facility	
May - June	Survey and mark protected plant species. Install exclusion fencing and hand clearance of vegetation within remainder of work area
June	Capture and placement Re-positioning of Protected Plants
Linear Section	
September	Survey and mark protected plant species Install exclusion fencing and hand clearance of vegetation within remainder of work area
October	Capture and placement Re-positioning of Protected Plants

Vegetation Clearance

Vegetation clearance will take place immediately ahead of the installation of fences. Vegetation clearance will involve the removal of the majority of terrestrial habitat by hand-held machinery

(i.e. chain-saws and brush cutters) to a height of 100 mm above ground level. Larger protected species of plant that will require re-positioning will be left intact until following completion of reptile trapping[2]. Protected species of plants will be identified and clearly marked by a botanist prior to vegetation clearance works. Vegetation will be cleared from the centre-line outwards to encourage active animals to move into surrounding vegetation of their own accord. No ground breaking works (other than the fence trenches) are to be completed at this stage of works. Access to the working area should be along existing tracks. This work will be completed under the supervision of an ecologist. All cut material (arisings) from the habitat clearance works should be carefully placed (i.e. carried not dragged) in piles outside the working area so as not to create refuges within the placement area. These piles should either be established in areas where they can remain indefinitely, post construction, or disposed of off-site in an appropriate manner. Under no circumstances should the arisings be burnt on-site.

In the event that tractors or other machinery is to be used for vegetation clearance, then the following should be observed[3]:

- On-site access and works routes should be planned and kept to a logical minimum with advance clearance of such routes checked by ecologists;
- Inspect all brash and vegetation immediately prior to clearance works;
- Where possible, use a chipper or equivalent to prevent brash piles accumulating; and
- Incentivise the local helpers to find tortoises on site for capture and placement.

Barrier Fences

To prevent amphibians and reptiles from entering the construction area, stiff plastic one way reptile fencing (e.g. Herpetosure) will be installed around the outside of the working area. In addition, temporary drift fences will be installed inside the perimeter fence to demark trapping / working areas. Fences will be installed under an ecological watching brief. The internal drift fences will allow targeted trapping to take place to meet the proposed construction plan and should increase the efficiency of the trapping programme.

The one-way nature of the fencing will allow larger reptiles, with the exception of the Nikolski's Tortoise, to escape from the working area and will prevent them getting back in. The Nikolski's Tortoise will have to be picked up and placed over the fence. Pit-fall traps will be placed along all fence lines (external and internal) to catch smaller amphibians and reptiles which will also be placed over the fence.

The design of the external one-way fence is shown in Figure 5 and the internal fence is shown in Figure 6. The locations of the external and internal fences are shown on Figure 7. Both fencing types will be installed prior to soil stripping. On completion of the fencing works there will be a period of capture and placement of all animals caught within the fenced areas. The

[2] Smaller protected plants (e.g. Iris pumila) that can be re-positioned without extensive soil disturbance can be moved during the capture period.

[3] These measures were utilised effectively by South Stream in Bulgaria during a preliminary Cultural Heritage survey.

exact length of the capture and placement will depend on the number and timing of animals caught, but is likely to be a minimum of 14 days.

The external fence is to be dug in to the ground to a depth of 300 mm. This is critically important as tortoises can dig and they need to be permanently excluded from the working area. The fencing panel will be placed in to the 300 mm trench and joined together to form a continuous barrier. The panel is then set at a 135^{o} angle to allow animals to walk up the textured surface of the panel and drop over the edge in to the non-working area. The reverse of the panel is a smooth texture which, together with the angle, prevents animals from climbing back in to the working area. The external fence is a permanent fence and will remain *in situ* for the duration of the works programme. This fence will be removed on completion of all works including final landscaping and end of works re-planting / habitat reinstatement.

Figure 5 External One-Way Fence Design

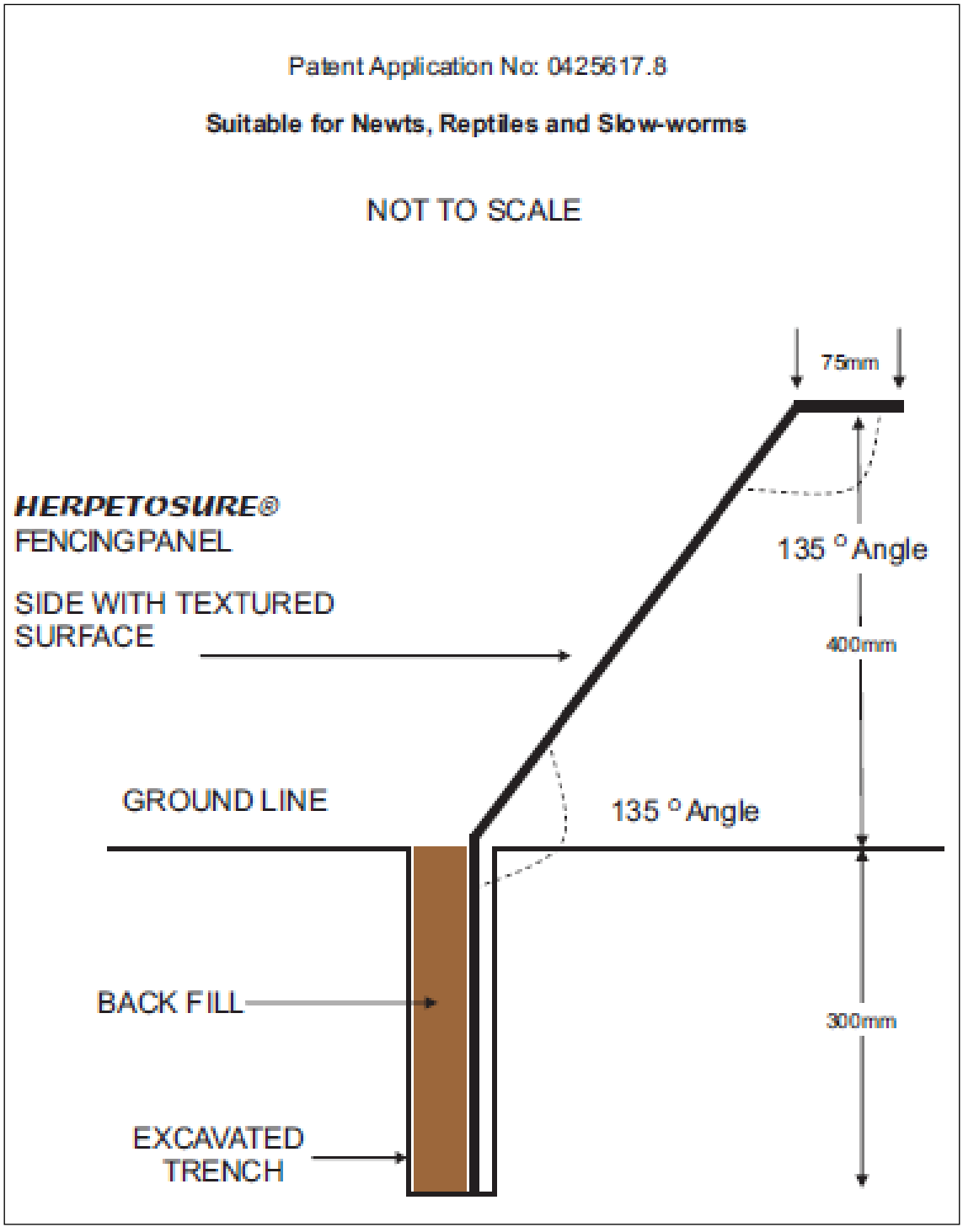
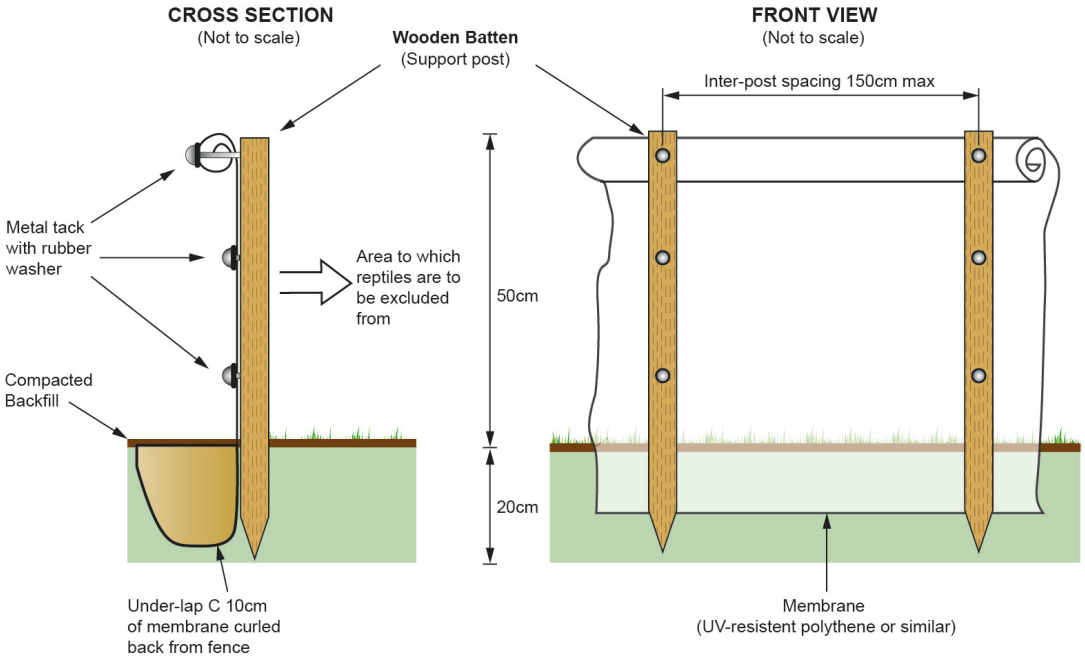
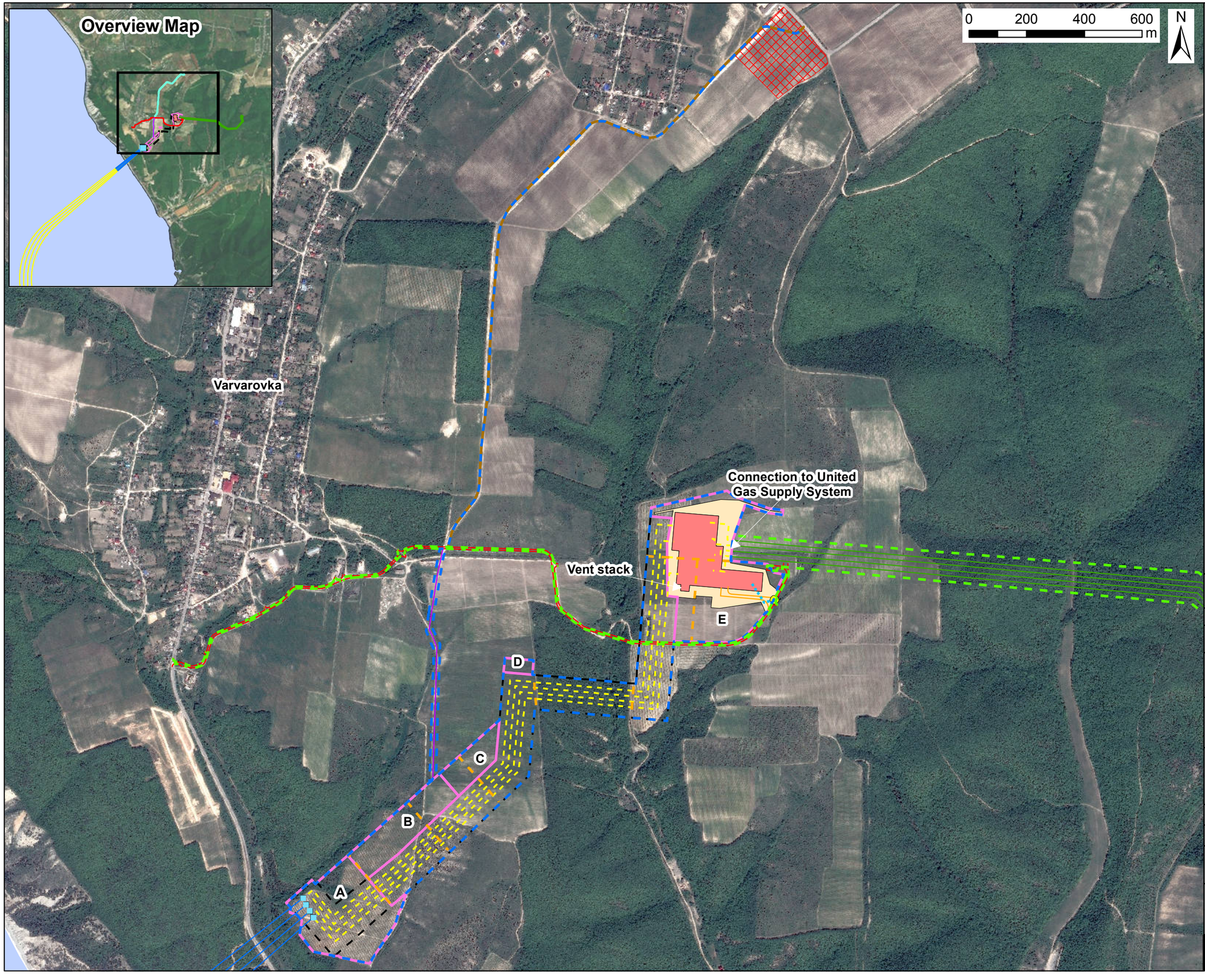


Figure 6 Internal Temporary Fence Design





LEGEND

- Drift fencing
- GazProm reptile fencing
- South Stream reptile fencing

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
- 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

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: REPTILE FENCING

Drawn	Checked	Approved	Date
DH	RW	MW	08 May 2014

URS Internal Project No.	Scale @ A3
46369082	1:12,500

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 7 — Rev:

Plot Date: 08 May 2014
File Name:I:\5004 - Information Systems\46369082_South_Stream\MXDs\Report Maps - Russia\Russian ESIA v2\Appendix - Ecology\Figure 7 Reptile Fencing.mxd

A barrier tape or orange netting fence will be installed 300 mm inside the external one-way fence. This fence will need to have at least 300 mm ground clearance to prevent tortoises getting trapped in it. The orange fence is needed to demark the working area as well as highlighting the presence of the external one-way fence to on-site contractors as this fence must remain intact during the construction period. The presence, function and importance of this fence will be included within the on-site induction process. All on-site contractors will receive a toolbox talk to explain the fence and their responsibilities. In addition during this toolbox talk the importance of the tortoise and other animal species will also be highlighted and the on-site contractors will be informed of the protocol of what to do if they see an animal within the working area.

The internal drift fence is to be dug in to the ground to a depth of 200 mm and will consist of temporary plastic (e.g. polythene sheeting) fencing which will be removed at the end of the capture and placement exercise.

Pit-fall traps (plastic tubs) will also be dug in to the working area side of the external one-way fence and along the inside of all the internal temporary fencing at a density of one tub every 15 m. The tubs should be dug in so the lip is at ground level allowing animals to drop into the tub. Each tub will need to be provisioned with a mammal ladder (stick) allowing small mammals to get out of the trap. In addition, they will have material placed at the bottom of each trap (bark, vegetation etc.) to allow amphibians and reptiles to hide under.

Methods of Capture and placement

The capture will commence in once night-time temperatures have been above 10^{o}C for five consecutive nights. This is considered to be the trigger temperature for tortoises and other reptiles and amphibians to stop hibernation and become active. Between the completion of vegetation clearance and the start of trapping, an ecologist will monitor night time temperatures and make daily checks of the fenced area for active tortoises.

Once animals have become active the capture and placement can be completed and as a result of the areas being cleared of vegetation tortoises should be very obvious and easily caught. Other species of reptile and amphibian will move out of the cleared areas or will get caught in the pit-fall traps.

At the start of the capture and placement, pit-fall traps will have their lids removed and will be subject to three checks per day by the ecologists (first thing in the morning, middle of the day and late afternoon). Any animals caught inside the traps will be carefully removed from the trap and placed on the non-working side of the external one way fences in areas of suitable habitat. Records of all animals caught will be made using GPS locators.

All tortoises found during the capture and placement will have full bio-metric details recorded by ecologists and will be checked for temporary markers, which were placed on all tortoises caught during the autumn 2013 surveys. Tortoises will be marked to enable identification during future encounters. The data collected will also allow additional information to be collected regarding movements and the ecology of this species to be collected. Tagging type and marking methods will be detailed within a separate research programme strategy document and will only be completed by licensed and trained ecologists.

The minimum trapping effort for each compartment will be at least 14 suitable trapping days with trapping finishing on day 14 if three clear days of no caught tortoises have been recorded (i.e. no tortoises caught from day 12 – 14). If animals are being caught after 14 days trapping effort, trapping will finish after there have been three days of no tortoises in the trapping compartment (i.e. tortoise caught on day 14 trapping will finish on day 17 (as long as no tortoises caught on days 15, 16 and 17).

On completion of the capture effort, protected plant re-positioning can be completed and construction activities can commence in all areas. It is recommended that ground clearance works are completed from the centre of the working area out towards the fence. Although animals should at this time be absent from the working area, this will allow any remaining reptiles and amphibians to move out to the fence where they will be able to exit the working area over the one-way fence. Pit-fall traps will remain open and be checked three times a day by ecologists during the first week of ground clearance. After this time all pit-fall traps will be removed and holes back filled.

Supervision of Works

Supervision of works by suitably qualified ecologists will be required during many of the initial stages of the construction phase and in particular any of the following:

- Vegetation clearance;
- Installation of barrier fences; and
- Soil strip.

Following the initial stages of the construction phase, a full time Ecological Clerk of Works (ECoW) should be retained to respond to any ecological issues arising during construction and to make weekly checks of the barrier fences.

On-site Contractor Responsibilities

During the construction phase, if an on-site contractor observes a tortoise or other reptiles or amphibians within the fenced area the following procedure should be completed:

- Stop all works within the vicinity of the animal;
- Contact the on-site ecologist who will be responsible for moving the animal from the working area;
- Once removed the on-site ecologist will complete a check of the immediate working area for other animals; and
- Once the on-site ecologist or ECoW is satisfied that no other animals are present works can continue.

At no point should the on-site contractors attempt to pick up the animal and remove it out of the immediate working area. This is to ensure that there are no human / wildlife conflicts with venomous animals and to ensure that the on-site ecologist has had the chance to properly catalogue the animal and move the animal without causing it any harm.

Contractors are responsible for ensuring no damage to the exclusion fencing and should report immediately to the site manager if a fence has been hit and / or damaged. It will then be the responsibility of the site manager to ensure that the fence is immediately repaired. Immediate repair of the fence will negate the need for capture period to be carried out again with work stopped.

The above also applies to contractors that are delivering materials to site and speed limits must be observed on all access tracks / working areas. Contractors must also be made aware that it is against the site rules to collect or deliberately kill or injure wild animals.

Under-road passes (Tunnels)

Nikolski's tortoise and other Red Data Book species occurs throughout the Project Area at relatively high densities (Figures 2 and 3). It is also known that Nikolski's tortoise require different habitat types at different times of year. During hibernation, the species seems to prefer the valley bottom mesophylic forest. During the peak spring activity season, the tortoise favours open habitats such as the edges of vineyards, the areas of meadow / scrub mosaic and Juniperous forest. During the heat of the summer, the tortoise is found more often in the areas of woodland where it is shaded. This creates a seasonal migration pattern between habitat types. Although relatively sedentary compared to more mobile species groups, tortoises can move up to 50-300 metres in a day. Male tortoises may move over 1 km in search for mates. The movements of immature tortoises are not understood, but many species groups undergo a dispersal life stage where juveniles or sub-adults disperse to colonise new areas. In the long-term, a species continued existence is dependent on the ability to colonise new areas (e.g. in response to habitat and climate change), to re-colonise areas where local extinction has taken place and also to maintain genetic mixing.

For these reasons, linear developments such as roads can cause both direct mortality and also long-term population decline[4]. Wildlife underpasses (or tunnels) are now widely used on roads to allow animals to cross linear developments unharmed. The combination of fencing and tunnels has been demonstrated elsewhere to be successful for protecting tortoise species[5].

There are published international guidelines[6,7,8] that provide detailed recommendations for the use of underpasses and tunnels to reduce to habitat fragmentation caused by linear

[4] Iosif, R., L. Rozylowicz and V.D. Popescu (2013) Modelling road mortality hotspots for Eastern Hermann's tortoise in Romania. Amphibia-Reptilia 34:163-172.

[5] Boarman, W.I. and Sazaki, M. (1993) Highway Mortality in Desert Tortoises and Small Vertebrates: Success of Barrier Fences and Culverts'. Highways and Movement of Wildlife: Improving Habitat Connections and Wildlife Passageways Across Highway Corridors: Proceedings of the Florida Department of Transportation

Federal Highway Administration Transportation-Related Wildlife Mortality Seminar. Orlando Florida.

[6] Trocmé, M., Cahill, S., de Vries, H.J.G., Farrall, H., Folkeson, L., Fry, G., Hicks, C. and Peymen, J. (Eds.). 2003. COST 341. Habitat Fragmentation due to Transportation Infrastructure. The European Review. Office for Official Publications of the European Communities. Luxembourg. 253 pp.

[7] Huijser, M.P., McGowen, P., Clevenger, A.P. and Ament R. (2008) Wildlife–vehicle Collision Reduction Study: Best Practices Manual. Wildlife–vehicle Collision Reduction Study: Best Practices Manual

development. The detailed design and location of tunnels are to be developed in conjunction with the Contractor.

The floor of the tunnels needs to be as natural as possible and be free of water. The entrances to the tunnels need to be at soil level to allow the animals to enter and exit the tunnels. Where the barrier fencing crosses the tunnel locations, the fence needs to be located to act as a guide for animals to find the tunnel entrance. The fence needs to be carefully joined to the tunnel entrance so that gaps are not left and that the fence does not block the entrance.

Mitigation measures incorporated into detailed design of roads

The permanent access roads will require permanent exclusion measures to avoid tortoises entering the road where they are at risk of harm from traffic. The construction of the permanent exclusion measures (e.g. fence) should be carefully considered. A problem with fencing is that it needs to be maintained indefinitely, as any gaps that appear can increase mortality. Ideally, the road would be bordered by a permanent and robust barrier, which prevents tortoises from crossing. This could take a number of forms such as concrete curbs raised to a height of approximately 0.4 m, which would prevent tortoises from accessing the road and prevent those that do from becoming trapped. Another solution could utilise roadside drainage features such as ditches or concrete culverts. However, careful design of ditches or culverts would be required to ensure that the present a barrier to tortoises entering the road without them becoming trapped within. This may require the installation or regular ramps to allow tortoises to exit the ditch or culvert away from the road. The final design solution needs to be agreed between the Contractor and specialist ecologists.

[8] Clevenger A.P. and Huijser M.P. (2011) Wildlife Crossing Structure Handbook - Design and Evaluation in North America. Publication No. FHWA-CFL/TD-11-003. Central Federal Lands Highway Division