ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT:

CONCISE DESCRIPTION OF THE ASSESSMENT RESULTS

Prepared by:
ENVIRON

Date:
October 2014

Contract No:	RU1100052
Issue:	2
Authors	Jonathan Hancox, Ivan Senchenya,
Project Manager/Director (signature, stamp)	Ivan Senchenya
(signature):	
Date:	October 2014

This report has been prepared by ENVIRON with all reasonable skill, care and diligence, and taking account of the Services and the Terms agreed between ENVIRON and the Client. This report is confidential to the client, and ENVIRON accepts no responsibility whatsoever to third parties to whom this report, or any part thereof, is made known, unless formally agreed by ENVIRON beforehand. Any such party relies upon the report at their own risk.

ENVIRON disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the Services.

Version Control Record

Issue	Description of Status	Date	Reviewer Initials	Author Initials
A	First Internal Draft	05/09/2014	IS	IS,JH
1	First Draft Issued to the Client	27/09/2014	IS	IS,JH
2	Final Report Issued to the Client	22/10/14	IS	IS,JH

TABLE OF CONTENTS

1 INTRODUCTION

JSC Yamal LNG (the “Company” or “Yamal LNG”) is developing the Yamal LNG Project (the “Project”), which is an integrated upstream natural gas and gas condensate production and liquefaction plant development project located on the Yamal Peninsula in northern Russia. The Project will exploit the South Tambey Gas Condensate Field in the north-east of the Yamal Peninsula near Sabetta (see Figure 1.1).

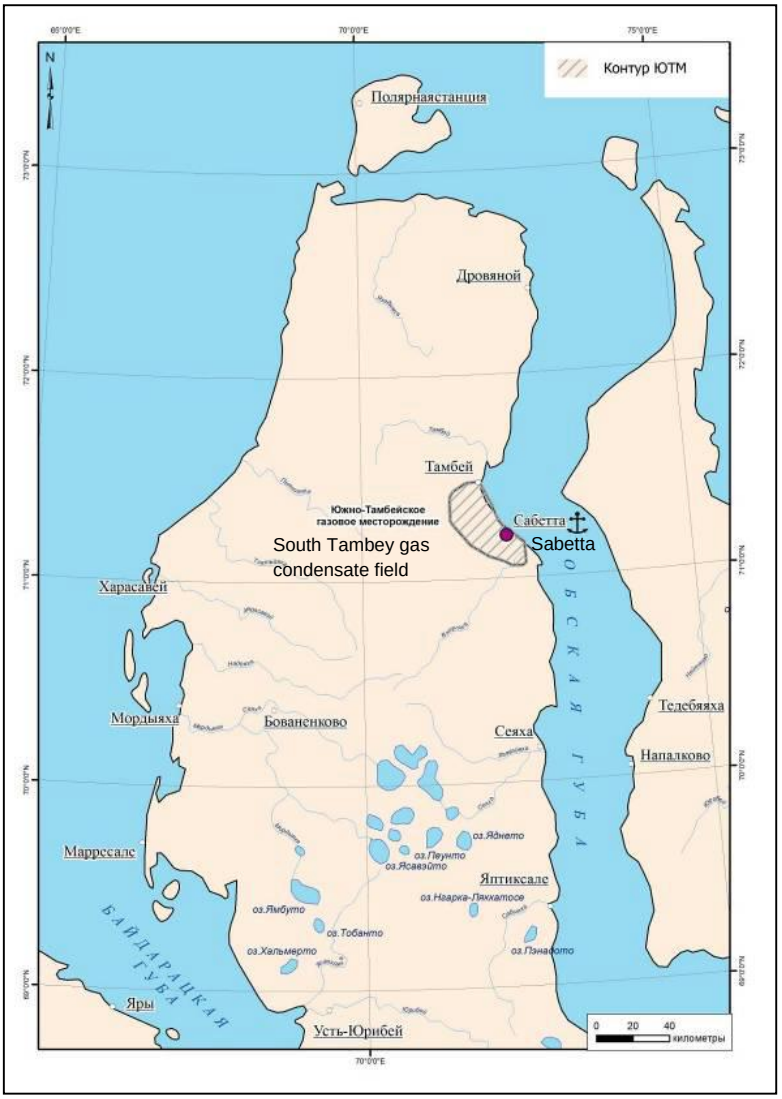


Figure 1.1 Location of Project

The Company owns the hydrocarbon production rights with respect to the Field[1] and will operate as a project company for the purposes of implementing the Project, i.e. designing, developing, constructing, operating, managing and decommissioning the Project.

The Company comprises the following shareholder parties:

[1] The Company holds a 30 year concession.

- JSC Novatek – Russia's major independent producer of natural gas that undertakes exploration, production, processing and marketing of gas and liquid hydrocarbons[2].
- Total Exploration & Production – a branch of Total involved in prospecting, exploratory drilling, and production of liquid and natural gas[3].
- China National Oil and Gas Exploration and Development Corporation (CNODC) - a wholly owned subsidiary of China National Petroleum Corporation ("CNPC")[4]

The Company is seeking to procure project financing for the Project and funding is expected to be raised from a range of international finance institutions (collectively the "Lenders"). In line with this financing strategy, the Project is being developed in compliance with the following environmental and social requirements:

- Russian law, codes and standards.
- All applicable international laws and conventions to which the Russian Federation is a signatory and which have been ratified into law in the Russian Federation.
- Applicable international Lender requirements, including:
  - The Equator Principles (2013)
  - The Organisation for Economic Cooperation and Development (OECD) Common Approaches (2012)
  - The World Bank/IFC Environmental, Health and Safety Guidelines (April 2007) including the General EHS guidelines and applicable Industry Sector Guidelines.
  - The IFC Performance Standards (January 2012).

Yamal LNG has developed an Environment and Social Impact Assessment (ESIA) in line with international Lender standards. The ESIA has been prepared to identify and assess potential environmental and social impacts of the Project on the biophysical and human environments and to set out measures to avoid, minimise, mitigate and manage adverse impacts to acceptable levels as defined by Russian regulatory requirements and international good practice as defined by the applicable international Lender requirements. This document provides a non-technical summary (NTS) for the ESIA.

[2] http://www.novatek.ru/

[3] http://www.total.com/

[4] cnodc.cnpc.com.cn

2 PROJECT DESCRIPTION

2.1 GENERAL INFORMATION

The Yamal LNG Project is an integrated complex for production, processing, liquefaction, and export of liquefied natural gas and gas condensate from the South Tambey Gas Condensate Field.

The South Tambey Gas Condensate Field is an onshore field situated in the north-east of the Yamal Peninsula, some 540 km north-east of the regional center of Salekhard city (see Figure 2.1).

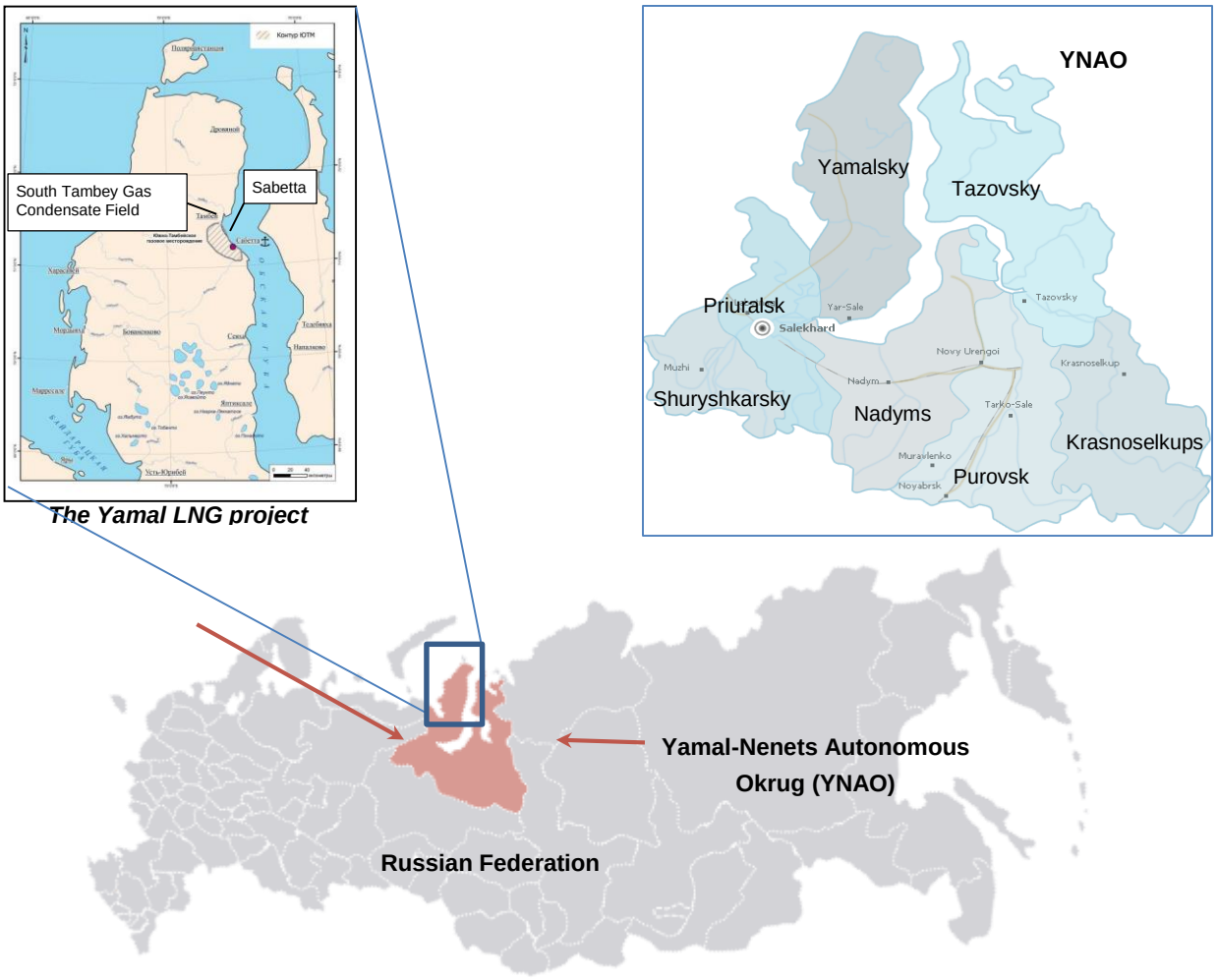


Figure 2.1 Yamal Peninsula and Project Location

The Project is located within the Arctic Circle and climatic conditions are extreme, winter daylight is very limited and population densities are very low. The Project's location presents a number of challenges both in terms of working conditions, availability of labour, access to gas markets and environmental and socio-economic sensitivities including protected flora and fauna, the presence of permafrost and indigenous people. A large workforce will be required, particularly during the construction phase, which will be transported to site by air.

In view of its objectives, the Company has opted to develop the South Tambey Gas Condensate Field on the basis of natural gas liquefaction technology, which will further enable the export of liquefied gas via sea to the markets of Europe, North America and the Asia-Pacific region.

The main facilities necessary to realise the Project are as follows:

- Gas (and condensate) gathering network, including a network of production wells and gathering pipelines;
- Gas pre-processing treatment facilities and a methanol unit (for treatment prior to liquefaction);
- The LNG plant (for the liquefaction of natural gas) including 3 process trains;
- A 380MW power plant;
- LNG and condensate storage tanks;
- An airport (primarily for transportation of workers);
- Supporting infrastructure in the form of local roads (no roads, including winter ice roads, outside of the Licence will be used), bridges (for stream and river crossings) aerial electrical transmission lines, workshops, waste management facilities and workers' facilities;
- Workers' accommodation (for construction and operation phases) and auxiliary infrastructure facilities;
- Waste management facility
- A seaport including:
  - early seaport facilities consisting of a Materials Offloading Facility (MOF)/berths for the delivery of equipment, heavy plant and construction materials during the construction phase; and
  - main seaport facilities, including two jetties, a trestle and two ice breakers, for the shipment of LNG and gas condensate during operations.
- A fleet of diesel-powered double-hulled LNG carriers and condensate tankers for year round operation in the Eastern Barents and Kara Seas as well as in the Gulf of Ob and summer navigation along the Northern Sea Route.

An overview of the main facilities is shown in Figure 2.2 below.

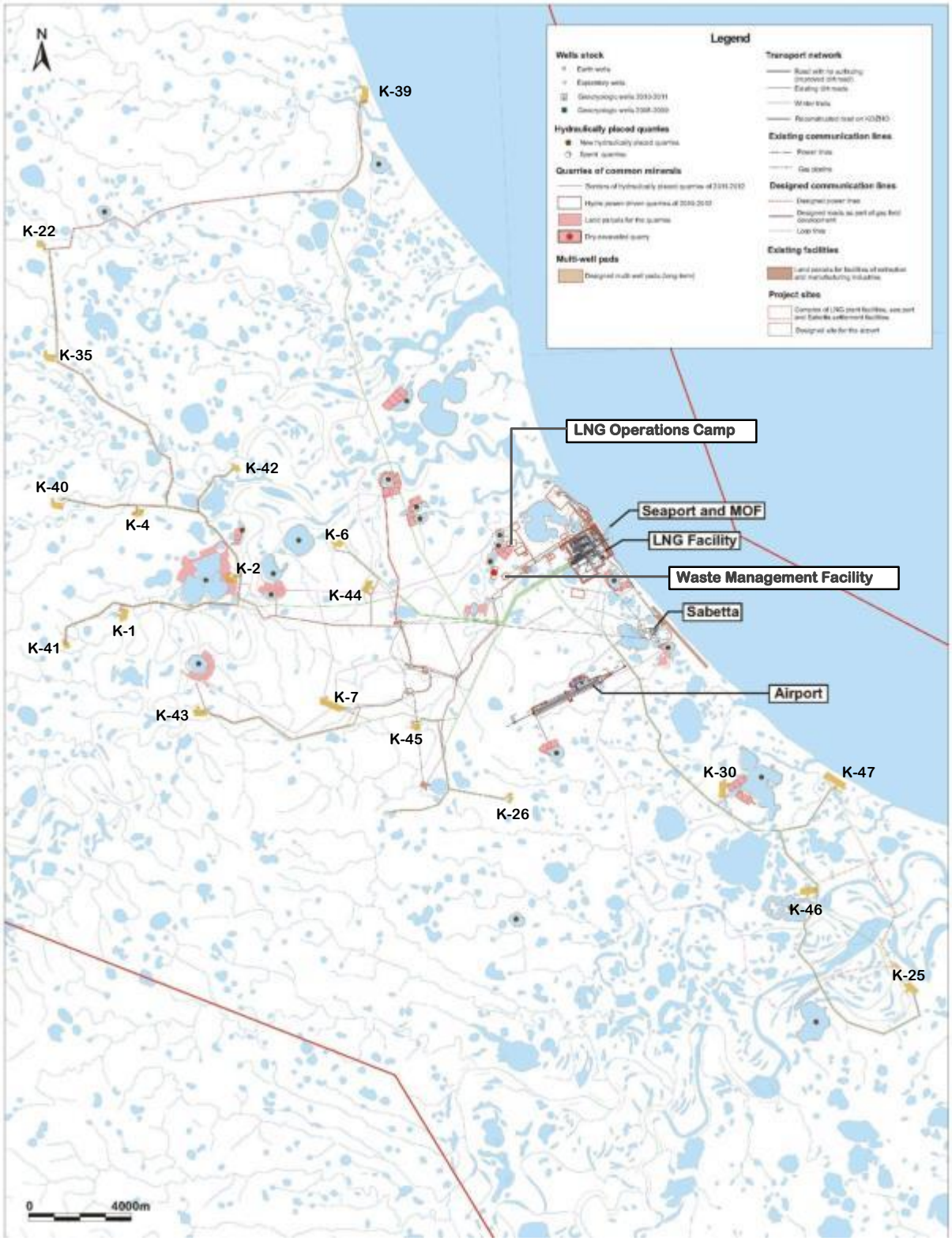


Figure 2.2 Plan of the Project Licence Area and Key Facilities

Figure 2.3 shows the summer and winter routes for LNG export, which follow the Northern Shipping Route shipping lane between the Atlantic and Pacific oceans.

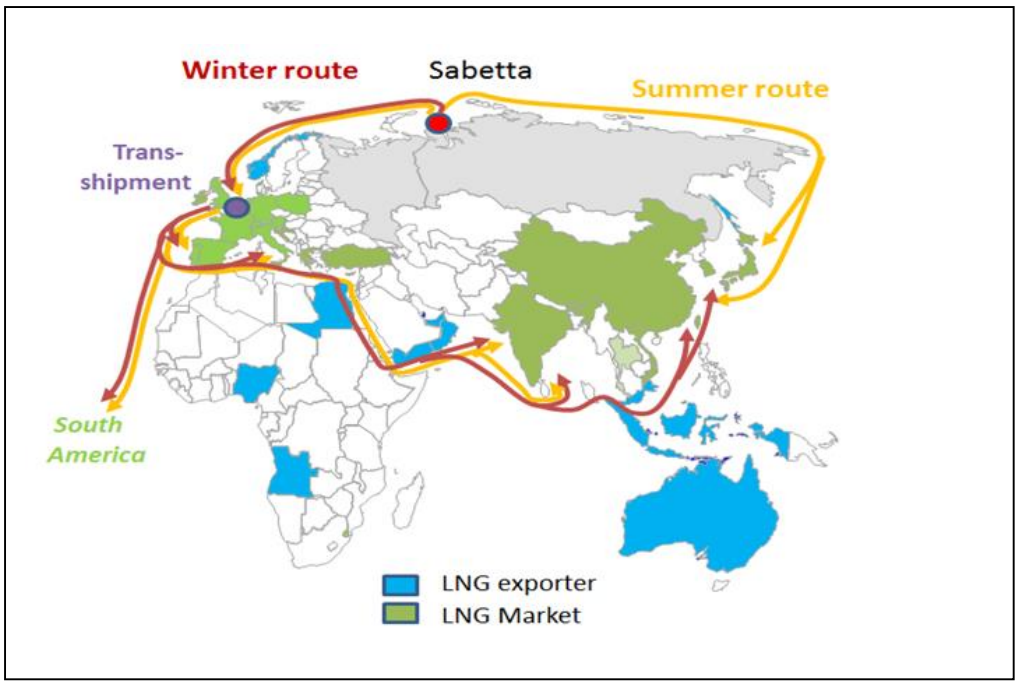


Figure 2.3 Indicative shipping routes

2.2 PROJECT TIMEFRAMES

Based on current assessment of the available reserves the Project is expected to achieve constant gas production for about 25 years (the subsoil use licence held by Yamal LNG expires at the end of 2045). LNG production will ramp up over a three year period as production wells and LNG trains are commissioned in 2016, 2017 and 2018.

Yamal LNG has been conducting geological and environmental surveys since 2009 in order to facilitate development of the field. Preparatory construction works commenced in 2012 to set up engineering utilities and infrastructure facilities, including accommodation and administrative facilities in Sabetta, a fuel depot, the inter-field roads, the MOF and the airport runway.

2.3 MAJOR FACILITIES DESCRIPTION

A substantial number of facilities will be required for production, processing and transportation of the gas and condensate prior to liquefaction, storage and export of both gas and condensate. Other facilities and infrastructure will also be required to support the main production facilities. A brief description of these major facilities/activities is given below.

2.3.1 WELL DRILLING

Over the lifetime of the Project it is planned to drill 208 wells from 19 well pads within the South Tambey Gas Condensate Field. The well pads have the following identifier names, and their locations are shown on Figure 2.2:

K-1	K-2	K-4	K-6	K-7	K-22	K-25	K-26	K-30	K-35
K-39	K-40	K-41	K-42	K-43	K-44	K-45	K-46	K-47	

Multiple wells will be drilled from each pad in order to minimize the footprint associated with the drilling operations. Drill muds (a 'clay fluid' required for drilling operations) will be predominately water-based, and will be re-circulated in order to minimise the volumes of mud utilised. The drill cuttings will be disposed to appropriately engineered pits at the well pads for further remediation.

When performing well testing studies, hydrocarbons will be burnt at an appropriately lined flare pit (one per well pad).

2.3.2 GAS COLLECTION – GATHERING PIPELINES

A network of small diameter gas pipelines will be required to transport gas from each well pad to the LNG plant. Figure 2.2 shows the 19 well pads located within a 20km radius of the main LNG facility and the connecting pipeline network. The total length of the gathering pipeline system is 312km. To protect the permafrost from the warm gas the pipelines will typically be above ground, suspended by stanchions (supports). Reindeer crossings will also be installed at strategic locations to allow unimpeded passage.

2.3.3 LNG PLANT

The Project will use air-cooled APCI C3MR liquefaction technology for each of the three 5.5 Mtpa LNG trains. The following process facilities comprise the LNG plant when complete:

- LNG inlet structures, including the gas treatment units to separate gaseous and liquid phases and to separate produced water from condensate and stabilize the condensate.
- Acid gas removal unit to remove CO_2 and small amounts of methanol from the raw gas in order to prevent solid CO_2 build up inside the cryogenic equipment (the low sulphur content of the feed gas negates the need for sulphur removal).
- Gas drier and mercury removal unit.
- Gas liquefaction and cooling unit.
- Methanol regeneration unit designed to recover methanol from the water-methanol mixture in order to re-use it.
- Various storage units including three tanks each of 50,000m^3 capacity for condensate.
- Four full containment LNG storage tanks each with a capacity of 160,000m^3.
- Compressed air system to feed air to the nitrogen producing units, the utility air system and instrumentation section.
- Nitrogen system for production of gaseous and liquid nitrogen and to purge the gas flare system.
- Flare system, used for the emergency release of gas and liquids in abnormal conditions and for gas venting during the maintenance and start-up/shut down periods.

The key LNG units from the list above are described in more detail below.

LNG Processing – The LNG liquefaction process is designed to produce LNG by removing heat from the gas after it has been dried and treated to remove mercury. A two-phase coolant system is used in the liquefaction process:

- Pre-cooling using a propane coolant system
- Final cooling using a mixed refrigerant (nitrogen, methane, ethane and propane) system.

The process also removes heavy and aromatic hydrocarbons by freezing at cryogenic temperatures. Each process train will be fitted with two Frame 7 gas turbines (GT) generators. These GT will utilise "Dry Low NOx" technology in order to reduce emission of air quality pollutants. The main source of fuel gas for the turbines will be Boil Off Gas (BOG) generated from the LNG storage and loading systems (see below), and this increases the overall energy efficiency of the plant.

LNG Storage and Loading Facilities - LNG storage and loading facilities are designed to provide safe storage of the produced LNG and periodic loading of LNG carriers.

LNG storage is provided by four full containment storage tanks each with a capacity of 160,000m^3. A compressor system will be installed to recover BOG from LNG tank storage, loading facilities and carrier vapour returns, and the recovered BOG will be supplied to the fuel gas system.

Condensate Storage and Loading Facilities – Condensate storage is provided by three 50,000m^3 capacity tanks. Each tank will be provided with 110% secondary containment and will be installed with a floating roof to reduce fugitive emissions due to working and breathing losses. Vapour from the loading operations will be recovered onto the condensate tanker in order to reduce greenhouse gas emissions.

2.3.4 POWER PLANT

The main power supply for the Project during the operational phase will be a 380MW power plant located within the LNG plant site. The power plant comprises a total of eight gas turbines. Waste heat recovery units will be installed on four of the turbines in order to increase energy efficiency. Emergency power will be provided by back-up diesel generators.

The main source of fuel gas will be BOG from the LNG storage tanks, which will be supplemented by treated gas from the inlet facilities.

Power will be distributed to the various Project facility areas via overhead transmission lines. The total length of transmission lines will be 330km.

2.3.5 SEAPORT FACILITIES

The seaport facilities will comprise:

- A Materials Offloading Facility (MOF) to receive heavy equipment and other construction materials
- The main seaport facilities for the export of LNG and gas condensate, which includes the following elements:
  - A 49km long navigation channel in the northern part of the Gulf of Ob (construction by dredging)

- berth waters (turning/ manoeuvring area) and approach channel (constructed by dredging)
- two ice-barriers of 3,500m total length
- navigation aids
- two berths with loading platforms for LNG and gas condensate offloading
- 1,300m long pipeline trestle for LNG and condensate offloading (connecting onshore storage tanks to offloading berths)
- ice formation control system (IFCS) for reduction of ice thickness within berth waters
- administration and auxiliary facilities.

The seaport will be located adjacent to the LNG site (see Figure 2.2 above), and the seaport facilities are shown on Figures 2.4 and 2.5 below.

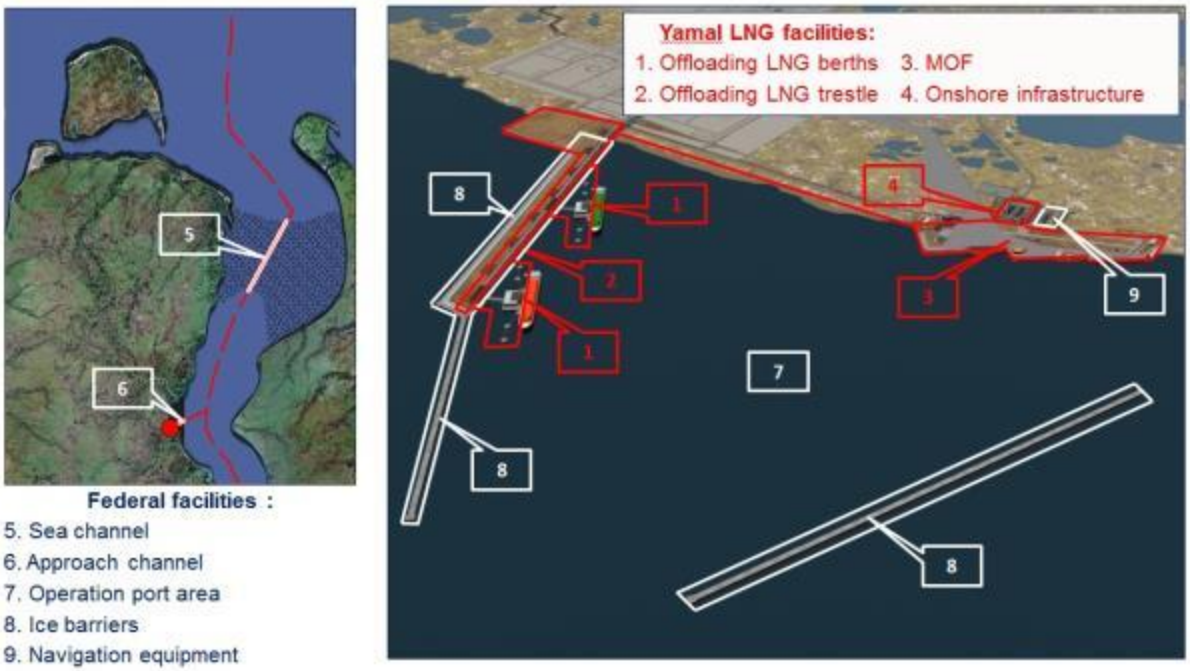


Figure 2.4 Seaport facilities and responsibilities

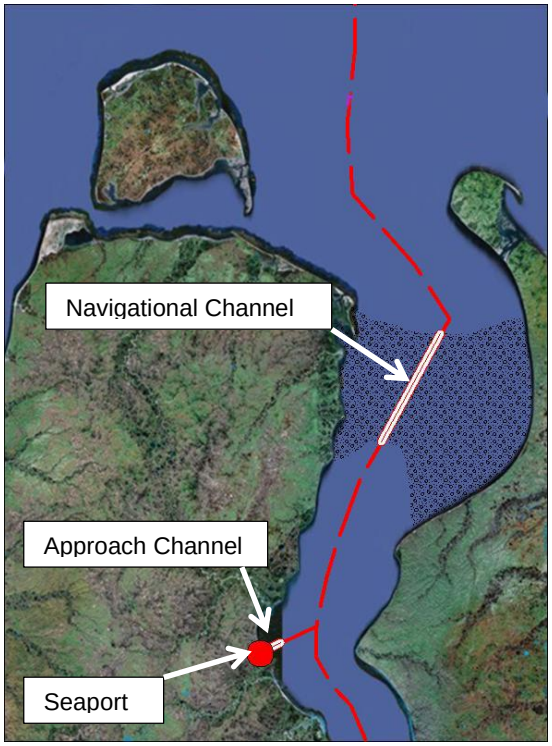


Figure 2.5 Approach and Navigation channels

The number of vessels receiving LNG and condensate cargoes will increase with the phased commissioning of the LNG trains, reaching 215 loading operations/voyages following the commissioning of the third train in late 2018.

Some of the facilities, including dredging facilities, ice-barriers and navigation equipment, will be assigned as federal property under the supervision of the Federal Agency of Sea and River Transport (Rosmorport). The split in responsibility between Yamal LNG and the federal authorities for the seaport is also shown in Figure 2.4.

2.3.6 WORKER ACCOMMODATION

During the construction period the Project will require a large skilled workforce that is estimated to peak between 2015-2016 at approximately 14,000 personnel working in rotation, i.e. 7,000 construction workers present on site at any one time. The workers' accommodation (approximately 5,200 personnel per rotation) will be located mainly at Sabetta, located 6km south of the main LNG site (see Figure 2.2). In addition, smaller temporary satellite contractor accommodation camps (housing approximately 1,800 personnel per rotation) will be located within the license area during the construction period to minimize travel distances between workers and their relevant work sites.

Due to the remote location of the Project, all utilities and services required to support worker accommodation will be purpose built, including: boilers for heating, water supply and wastewater treatment, solid waste management, power supplies (gas powered), medical facilities, firefighting system, fire tenders and personnel, canteen and link roads with the main site and

accommodation/welfare facilities. The accommodation areas will evolve in line with the phased construction.

Further accommodation will be constructed in close proximity to the LNG plant for operations personnel (see Figure 2.2). The operations phase field camp will be designed to accommodate 1,050 workers during each shift. Operations phase workers will work in rotation i.e. two shifts each of approximately 1,050 workers.

Buildings will be constructed with piled foundations with ventilated crawl space below and thus elevated above ground level for permafrost protection, i.e. to prevent the thawing of permafrost. Piled foundations may also have vertical thermal stabilizers, where necessary, to further ensure soils are preserved in a frozen state.

2.3.7 AIRPORT

The airport location is shown in Figure 2.2. The airport will include the following elements:

- 2,704m long runway length
- Helicopter pad
- A taxiway which connects the runway with an apron area
- An apron of sufficient size to accommodate three IL-76-TD/ Boeing 737 type aircraft with extra space for helicopters
- An aircraft de-icing area
- A cargo storage area
- A fire station.

A plan of the airport is proved in Figure 2.6 below.

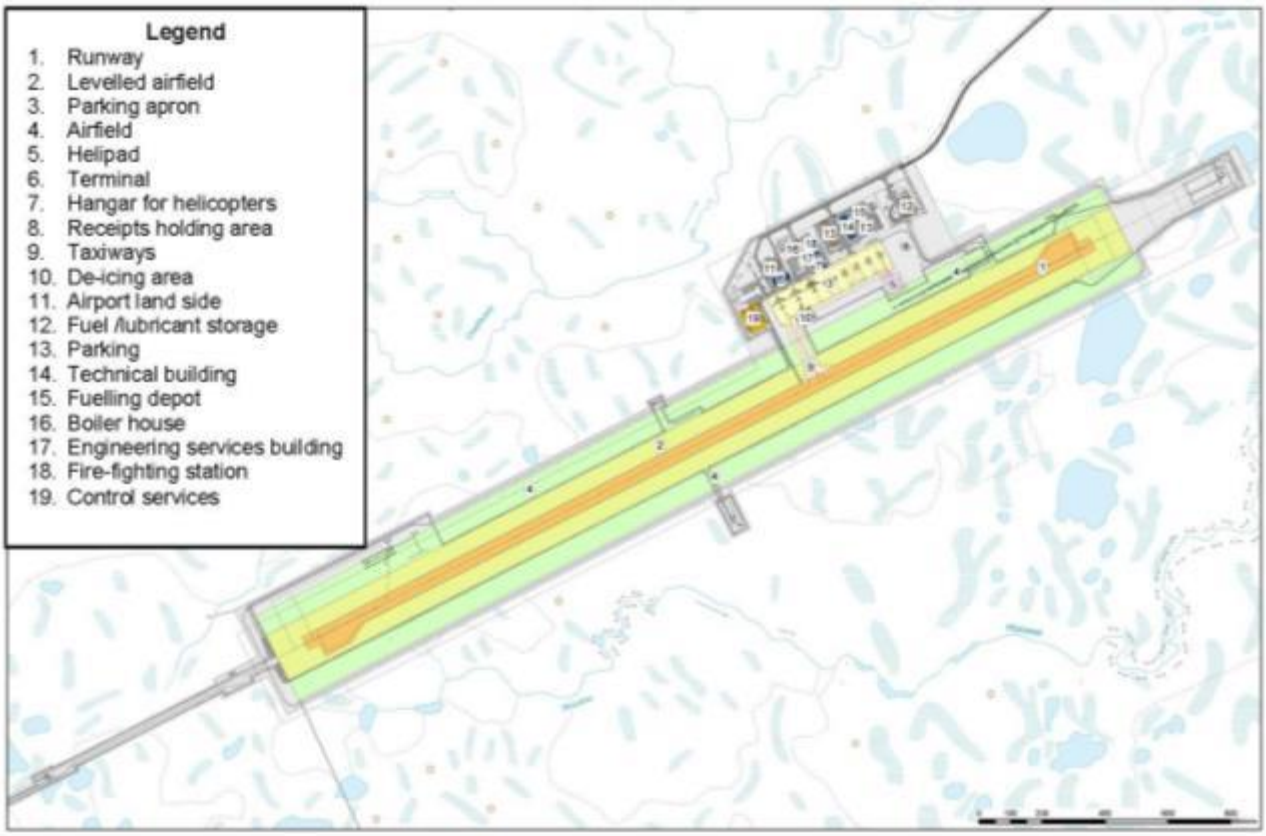


Figure 2.6 Airport Plan Layout

Discharge from the de-icing area will be diverted through conduits equipped with block valves and directed to the collection reservoirs for de-icing liquid. Collected waste de-icing fluid will be sent the wastewater treatment facility at Sabetta (see below).

The first fixed-wing aircraft flights at the airport are planned to commence in late 2014. In the interim, personnel are required to travel to the site by helicopter.

2.3.8 WASTE MANAGEMENT

The Project will have its own fenced waste management facility, known as the Solid Industrial and Domestic Waste (SIDW) facility. The SIDW facility includes a dedicated landfill complete with separate cells for disposal of solid domestic and category IV industrial waste, to be located west of the LNG complex (see Figure 2.2). A plan of the SIDW facility site is shown in Figure 2.7 below.

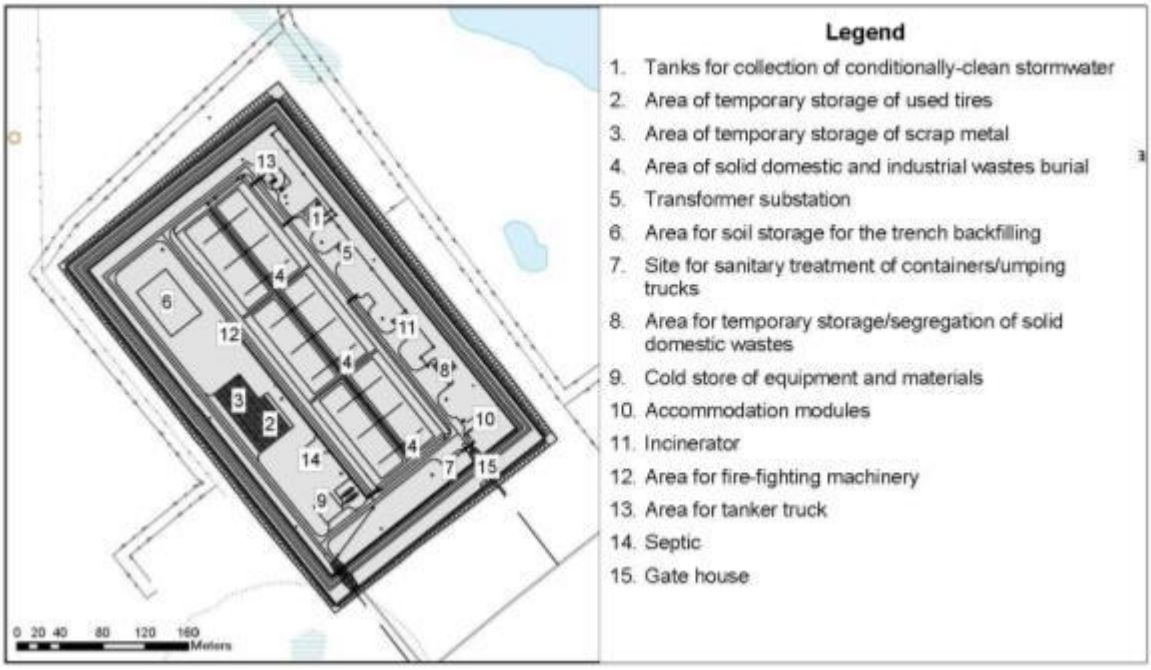


Figure 2.7 SIDW Facility Plan Layout

The landfill will be constructed and managed in line with good international industry practice in a manner that prevents contamination of the surrounding soils and water resources. The waste management facility will also include three incinerator units that are designed to meet international emission standards.

The landfill will be commissioned in 2015. In the interim wastes will be transferred to licensed landfill sites located in Salekhard or temporarily stored until the SIDW facilities have been constructed and are ready to receive Project wastes.

2.3.9 WATER ABSTRACTION AND TREATMENT

During the initial stage of construction water will be abstracted from an existing source in the Sabetta settlement (Glubokoye Lake). After this initial period, abstraction from the Glubokoye will cease and water will then be abstracted from an artificial pond near Sabetta. Water will be transported from Sabetta to construction sites by road tankers.

In the future, to coincide with operations phase water demands (for domestic water, production and fire-fighting water), the construction of a unit for surface water intake from the Gulf of Ob is envisaged. This would comprise:

- water treatment and desalination facilities, including a 2,500m³/day capacity water treatment plant;
- water supply pump station;
- an 8,000m³/hour capacity fire water pump station with fire water reserve tanks;
- separate water supply systems for domestic and drinking water, for plant and fire water, and an independent firewater supply system.

The water intake portals will be equipped with fish protection devices to prevent entrainment of fish and shellfish. A water treatment system, inclusive of filtration, coagulation processes and a

desalination unit is also planned. Power for the desalination unit will be provided by the main power plant. Brine from the desalination unit will be comingled with treated sewage/domestic water prior to discharge to the Gulf of Ob.

2.3.10 WASTEWATER TREATMENT PLANT

During the construction phase, effluents are collected by a domestic household sewage system at the Sabetta settlement and directed to a biological treatment unit with subsequent discharge of the treated water to local marsh land. The treatment capacity will be expanded as construction proceeds. For Project facilities outside of Sabetta, domestic household effluents will be collected in sealed containers and transferred to the sewage treatment plant.

During the operations phase, sanitary, process and potentially contaminated wastewaters will be collected at the Project facilities via drainage systems prior to treatment at dedicated wastewater treatment facilities. A number of wastewater treatment facilities are to be developed for the operations phase at the following locations:

- The Sabetta accommodation site
- Near to the LNG site
- MOF
- Airport
- Upper fuel store

All waste waters will be treated to meet applicable discharge standards. During the operational phase treated waste waters will be either injected into deep water disposal wells or to the Gulf of Ob.

2.3.11 OTHER UTILITIES INFRASTRUCTURE

Other infrastructure will include:

- **Roads.** Intra-field roads will be constructed within the licence area to provide access to Project facilities. Roads will be designed with a width of 4-6 meters. Roads within the main facilities will typically be constructed with concrete slabs, while interconnecting roads and roads for the well pads will be made of earth and gravel mixtures. Ice roads will be used during winter outside of the main facilities. These will follow the course of the earth/gravel roads.
- **Transmission lines.** Electrical power will be distributed to the Project facilities in the Licence Area via a network of elevated transmission cables.
- **Transport, Fire Station, Fuel Storage depot and Medical facilities**. Depots for fuel storage, transport services, a fire station and a clinic will be constructed near to the LNG accommodation camp.

2.4 SCOPE OF ACTIVITIES AND FACILITIES COVERED BY THE ESIA

Not all of the Project facilities described above will be directly funded, constructed and/or operated by Yamal LNG. In addition, there are a number of other support facilities and activities that will be provided by third parties.

Within the context of the ESIA, the Project and related facilities/activities are categorised as either:

- Components of the 'Funded Project' (i.e. components that will be constructed and/or operated by Yamal LNG as part of the Project). These components are addressed within the ESIA.
- 'Associated Facilities', which are defined as those activities and facilities that are not part of the Project but which would not be conducted, built or expanded if the Project was not carried out, and without which the Project would not be viable. Associated Facilities are addressed within the ESIA, although in doing so, it is recognised that Yamal LNG will not have direct control over such activities/facilities.

The facilities and activities covered by the ESIA as Components of the Funded Project and Associated Facilities are summarized in Tables 2.1 and 2.2 respectively.

Table 2.1 Components of the Funded Project

Element	Components
Gas field development facilities	• Well pads, wells and associated facilities • Gas gathering pipeline network
LNG facilities	• Pre-processing treatment facilities • LNG facilities
Power plant	• 380MW gas-fired power plant
Supporting infrastructure	• Intra-field roads and bridges • Electrical transmission lines • Water abstraction and treatment facilities • Fuel storage areas • Waste management facilities • Worker accommodation facilities
Airport	• See section 2.3.7

Seaport	• Seaport facilities constructed and operated by Yamal LNG comprise:
	  ○ Offloading LNG berth
	  ○ Offloading LNG trestle
	  ○ Onshore port infrastructure

Table 2.2 Associated Facilities

Element	Components

Seaport and navigation channels	• Seaport facilities constructed by the Federal authorities and operated by Rosmorport comprise:
	  ○ Navigation channel (including dredging)
	  ○ Approach channel (including dredging)
	  ○ Operational seaport area (including dredging)
	  ○ Ice barriers
	  ○ Vessel traffic control systems and navigation aids
	  ○ Buildings for marine service divisions

Table 2.2 Associated Facilities	
Element	**Components**
Project shipping	• Shipping (LNG carriers and condensate tanker movements) are considered as Associated Facilities (and therefore considered in this ESIA) only between the seaport and the point at which the shipping route intersects with the Northern Sea Route.

There are also activities that will not be addressed by the ESIA, typically because they fall outside of the Project's Area of Influence (see Section 2.5 below) and YLNG's control. Out of scope activities of particular note are summarized in table 2.3 below

Table 2.3 Out of Scope Activities and Facilities	
Element	**Commentary**
Vessel construction	• All vessels will be built at existing yards and are therefore considered out-of scope
Project shipping	• LNG carriers, condensate tanker and ice-breaker movements outside of the Gulf of Ob (defined as the intersect with the Northern Sea Route) are considered out-of-scope • Transshipment facilities • Cargo receiving ports
Aircraft	• Aircraft movements outside of the landing and take-off cycle
Waste facilities	• Remote waste reception / recycling facilities (as these already exist and are not considered as Associated Facilities)

2.5 AREA OF INFLUENCE

The Area of Influence (AoI) will include areas both directly and indirectly affected by both the funded Project and Associated Facilities within and beyond the Project License Area.

The AoI for the direct impacts considered within the ESIA is as follows and is also shown in Figure 2.8.

- The Project License Area
- The waters of the Gulf of Ob from a point 10km south of Sabetta seaport northward to its mouth.
- The shipping route from the mouth of the Gulf of Ob to the intersect with the Northern Sea Route (depending on the ice conditions, the route can be varied within a strip approximately 50km wide).
- Seyakha village.

It should be noted that:

- Different impact types will affect different portions of the AoI
- The AoI has been conservatively determined and therefore:
    - Not all portions of the assumed AoI will be subject to significant impacts
    - The majority of the AoI (and indeed the Licence Area and the Mining Allotment Area) will remain available to its current users.

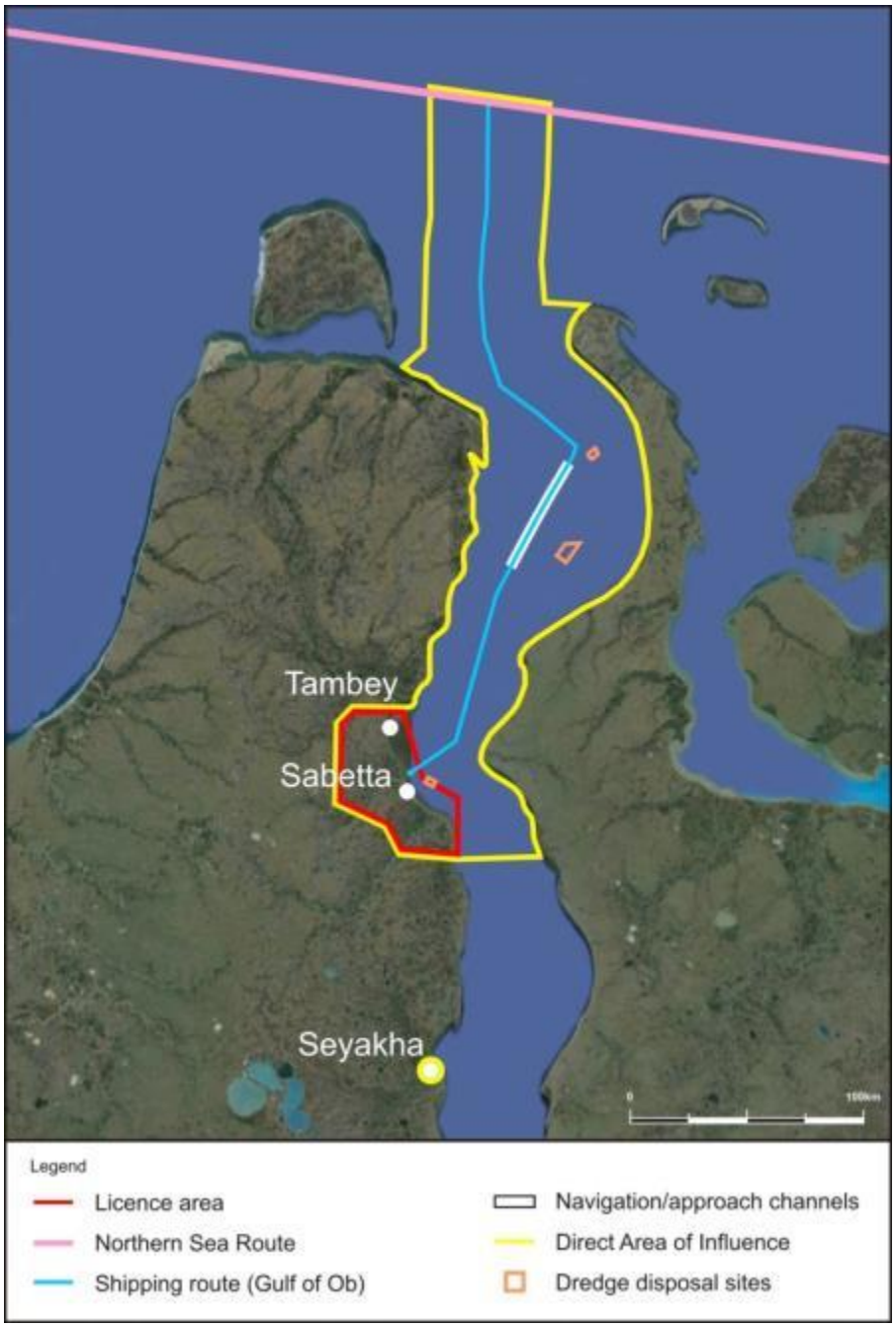


Figure 2.8 Direct Area of Influence

In addition to direct impacts, the Project will also have indirect impacts beyond the direct AoI, including:

- Neighbouring areas (and their existing users) subject to increased reindeer grazing pressure in the event that any reindeer are displaced from the direct AoI (Licence Area).
- Potential impacts (including positive effects) on region-wide social support structures (including health and education facilities).
- Socio-economic benefits to nearby communities and settlements within the Yamalsky District (including beneficiaries of Yamal LNG-funded social development programmes), affecting, among others, Yar-Sale and Salekhard (see Figure 2.9 for the location of these settlements).

Figure 2.9: Location of regional communities

2.6 ENVIRONMENTAL AND SOCIAL PROECTION IN DESIGN

2.6.1 ENVIRONMENTAL RISK ANALYSIS IN DESIGN

Yamal LNG implemented a risk management system as part of its design process in accordance with good international practices and standards. Yamal LNG's internal risk management procedures require:

- Managerial decisions based on HSE risk assessment;
- Documentation of the HSE risk management process;
- Preparation and implementation of risk mitigation plans.

The risk management process that has been implemented at Yamal LNG includes the following elements:

- identify risk-contributing factors;
- assess the risk (likelihood and consequence);
- develop risk response/mitigation;
- risk reporting.

The risk assessment process during the design phase includes consideration of environmental risks. Environmental risk of particular note that have been addressed during the Project design included risks related to:

1. Potential impacts on specially protected conservation areas
2. Potential changes to hydrodynamic and salinity conditions in the Ob Bay due to dredging within a sand bar in the bay
3. Potential impacts from the dredge spoil disposal on the aquatic biological resources
4. Thawing of permafrost
5. Waste management

Each of these aspects is discussed in turn below.

2.6.1.1 SPECIALLY PROTECTED CONSERVATION AREAS

Specially Protected Areas (SPA) that are the closest to the design area of operations are:

- Gydan State Nature Reserve (119 km away from the South Tambey Field);
- Yamal State Nature Reserve (139 km away from the South Tambey Field).

The locations of the proposed Project facilities (see Figure 2.10 below) were selected so as to minimize the adverse impact on SPAs.

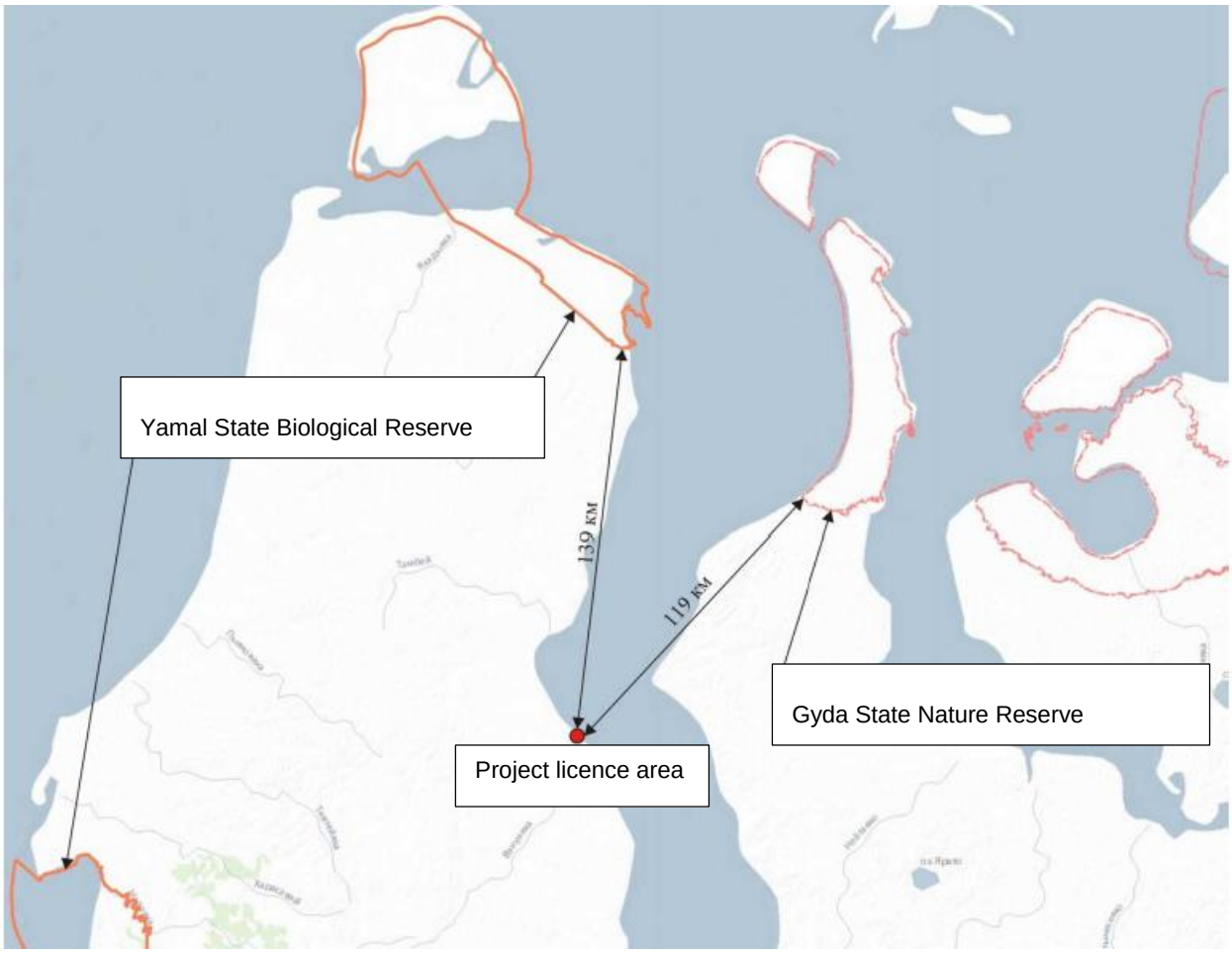


Figure 2.10: Protected areas in relation to the Project Licence Area

2.6.1.2 POTENTIAL CHANGE OF HYDRODYNAMIC CONDITIONS AND INCREASE OF SALINITY IN THE OB BAY

During the development of the design documents for construction of the seaport, including the navigation channel in Ob Bay, special attention was given to the baseline assessment of the water bodies, including the Ob Bay. This included evaluation of environmental risks related to:

- the potential for dredging of the navigation channel through a natural sandbar to increase salinity in the Ob Bay (due to potentially increased water exchange with the more saline Kara sea to the north)
- the effects of raised sediments and sedimentation resultant from dredging operations, including disposal of dredge spoil, into the aquatic biological resources (see also Section 2.6.1.3).

In order to gain a comprehensive understanding of these potential consequences for the Project, as well as to assess all possible environmental risks and develop an action plan to mitigate negative impacts, the decision was made to expand the assessment scope beyond the boundaries of the Environmental Impact Assessment, and to simulate the hydrodynamic changes, including temperature, salinity, dissolved oxygen in pre-Project and Project conditions.

To this end, the Yamal LNG contracted several recognized institutions with experience in simulation and assessment of hydrodynamic and hydrochemical processes. To ensure the reliability of the results, the simulation was run by both Russian and Western companies, comprising:

- Institute of Russian Academy of Sciences "Dorodnitsyn Computing Centre of RAS";
- State Scientific Centre of the Russian Federation "Arctic and Antarctic Research Institute and Hydrometeorological Center of Russia";
- MORTRANSNIIPROJECT LLC;
- PORTECO LLC (Belgium);
- Eco-Express-Service LLC;
- Petro-Chem Technologies LLC.

The simulation results indicated that construction of the navigation channel will not have any significant impact on the hydrodynamic conditions and other parameters in the Ob Bay.

2.6.1.3 IMPACT FROM THE DREDGE SPOIL DISPOSAL ON THE AQUATIC BIOLOGICAL RESOURCES.

Special seabed sites located in natural depressions have been selected during the site surveys in order to reduce the impact of the dredge soil dumping on the aquatic biological resources. All dredging operations are conducted by ROSMORPORT Federal State Unitary Enterprise, using the funds of the Federal Budget. According to the Federal Law dated July 31, 1998, No. 155-FZ - *On the Internal Sea Waters, Territorial Sea and the Contiguous Zone of the Russian Federation*, USK MOST JSC (the contractor of ROSMORPORT) obtained a permit from the ROSPRIRODNADZOR (No. 15M dated 21.07.2014) to dispose dredge spoil in the underwater dumping areas.

2.6.1.4 PERMAFROST THAWING RISKS.

The Project is implemented in challenging environmental conditions, characterised by permafrost. Appropriate project/ design solutions have been developed to minimize possible risks and to protect natural permafrost during the entire operations period, including:

- Pre-construction filling activities;
- Use of pile foundations for structures;
- Construction of ventilated cellars;
- Installation of soil thermostabilizers.

Utilizing the best construction experience in the Far North areas, the adopted design and technical solutions are fully in line with the provisions of the regulatory documents of the Russian Federation.

Furthermore, specialised geotechnical monitoring has been established by the Company in order to control foundation soil temperature (through thermo-wells), and to conduct inspections. The most critical facilities will be equipped with monitoring systems that are based on the geophysical methods of electrical tomography and include strain gauge transducers and fibre optic systems, enabling control over deformations in the structures and foundations.

Hazardous geological process will be monitored by the remote sensing (data acquisition) methods.

Thus, these actions mitigate the main permafrost risk factors that may arise during the operations of the structures erected/ constructed on the permafrost, including:

- uneven permanent deformations of the foundations;
- oil spills/ gas leakages in the oil- or gas pipelines and condensate lines;
- failures of the utilities;
- collapse of the buildings and structures;
- wide spread of the hazardous geological processes and phenomena;
- surface falls into karst caves (sinkholes).

2.6.1.5 WASTE MANAGEMENT

In order to control waste management risks in the remote location of the Project Licence Area, the decision was made to develop the Project's own dedicated waste management facility within the Licence Area as described in Section 2.3.8 above. The plan is to complete the construction of this waste facility so that it comes into operation in Q1 2015 (it is included in the design package developed for the Project: "*Construction of Integrated Facility for Production, Treatment, Liquefaction, LNG and Gas Condensate Offloading for the South Tambey Gas Condensate Field*").

2.6.2 OTHER MITIGATION IN DESIGN

Yamal LNG has designed the Project in accordance with Good International Industry Practice (GIIP) using modern technologies. By taking this approach environmental and socio-economic impacts will be minimised. Some key elements of mitigation in design are summarised below.

Design element	**Environmental/social benefit/mitigation**
Well pads	
Application of horizontal directional drilling	Reduction of footprint through drilling of multiple wells from a relatively small number of well pads
Gathering pipelines	
Above ground installation of pipelines on supports	Avoid warming impacts on permafrost from warm gas
Power plant	
DLN technology	Minimise NO_X emissions
Waste heat recovery	Improved energy efficiency resulting in lower emissions and fuel use
LNG facility design	
Air cooled LNG process	Minimise water usage and avoids discharge of cooling water

Design element	Environmental/social benefit/mitigation
Gas turbines with DLN technology	Minimise NO_X emissions
Recovery of BOG and use as fuel gas	Improved resource usage and reduced emissions
Floating roof design for condensate storage tanks	Reduced VOC/GHG emissions
Minimisation of flaring	Reduced atmospheric and noise emissions
Vapour recovery on condensate loading	Reduced VOC/GHG emissions
Full containment of storage tanks	Prevention of contamination in event of ruptures/spillages
Accommodation	
Dedicated closed, dry (alcohol-free) accommodation camps	Minimises potential impacts to social communities
Fly-in/fly-out workforce	Minimises impact outside of licence area
Waste facilities	
Provision of dedicated waste management facilities	Reduces waste transport impacts and minimises pressures on existing third party waste facilities
General construction techniques	
Structures built on piled foundations	Protection of permafrost against warming affects
Piling undertaken using auger piling techniques	Reduced noise impacts

3 REGULATORY STATUS

3.1 GENERAL

An extensive body of studies and reports has been prepared for Project design and to meet Russian Federation regulatory requirements. These include a number of 'OVOS' (environmental assessment) documents, covering different Project facilities, that have been prepared as a part of the Russian permitting process and submitted to the Ministry of Natural Resources and Ecology for approval.

The OVOS provide information on existing baseline data, impact assessments and mitigation measures. As such the OVOS materials provide valuable input to the development of the ESIA. OVOS materials have been submitted to and approved by the Russian authorities for "Expertisa" review (this is a formal expert review under the Russian planning approval process) for the following proposed project facilities/activities (see also Chapter 2 for a description of the facilities):

- The complex for the production, processing, liquefaction, and export of liquefied natural gas and gas condensate (i.e. the LNG Plant and associated infrastructure facilities).
- The worker camp facilities necessary for the development of the South Tambey Gas Condensate Field (including worker accommodation).
- The early works seaport facilities near the Sabetta camp, including construction of the shipping approach channel in the Obskaya estuary (i.e. for materials offloading during the construction period).
- The main seaport facilities
- The drilling of gas production wells.
- The airport 'Sabetta'.

A more detail description of the statutory environmental review process is presented in Section 3.2.

3.2 STATUTORY ENVIRONMENTAL REVIEW OF THE PROJECT

3.2.1 BACKGROUND TO THE DEVELOPMENT OF DESIGN DOCUMENTATION

All design documentation for the Yamal LNG Project has been prepared in full compliance with the Russian laws. Engineering surveys for Yamal LNG's capital facilities were performed by specialized companies engaged by Yamal LNG in accordance with the Rules for the Engineering Surveys for Construction. General Provisions of SP 47.13330.2012 apply to the architectural design, construction, redesign, operations, demolition of buildings and structures, as well as landscape planning and grading activities.

The surveys were undertaken by the following companies:

- OOO Uralstroyproekt (Certificate authorizing engineering survey activities affecting the safety of capital facilities, dated 03.09.1009, No. 01-I-No. 0260);
- OOO FREKOM (Certificate authorizing specific activity or activities affecting the safety of capital facilities, dated 18.10.2011, No. 01-I-No. 0799-2);
- OAO LENMORNIIPROEKT (Certificate authorizing specific activity or activities affecting the safety of capital facilities, dated 18.10.2011, No. 01-I-No. 0128-3);

- PAO UZHNIIGIPROGAZ (Certificate authorizing specific activity or activities affecting the safety of capital facilities, dated 29.05.2012, No. II-027-368).

The engineering surveys included specific environmental surveys to assess the current status of the Project's forecast environmental footprint. The environmental surveys were based on:

- The review of high resolution satellite images (environmental interpretation);
- Field reconnaissance;
- Hydrogeological studies;
- Hydrological studies;
- Geocryological studies;
- Soil studies;
- Geo-environmental testing and pollution assessment of air, soil, dirt, surface and underground water;
- Lab chemical analysis;
- Radiological data analysis and assessment;
- Physical effect analysis and assessment;
- Biological (flora, geobotanics, fauna) studies;
- Socio-economic studies;
- Archaeological studies.

The above list fully meets the requirements defined in the Rules for the Engineering and Environmental Surveys for Construction (SP 11-102-97).

The engineering survey results served as the environmental basis of design solutions so as to ensure preservation of favourable life conditions for the local population, ensure safe operations of buildings, structures and sites, and preclude adverse environmental impacts.

All design documentation for the facilities under construction has been developed to fully comply with the scope and requirements of Russian Government Resolution 87, dated 16.02.2008, "*On the structure of sections of design documentation and requirements to their content*."

3.2.2 STATUTORY ENVIRONMENTAL REVIEWS

According to Federal Law N 174-FZ, dated 23 November 1995, *On the Environmental Expert Review*, the design documentation that is subject to State Environmental Expert Review (SEER) was submitted to the Federal Service for the Supervision of Nature Resources (Rosprirodnadzor) for the State Environmental Expert Review (SER). Table 3.1 below provides a list of the Yamal LNG design documentation that was reviewed and approved by the SEER and SER boards.

Table 3.1 Yamal LNG Design Documentation Subject to

No.	Design Engineering Documentation	Positive Conclusion of the SEER Board	Positive conclusion of the SER Board (GlavGosExpertiza).
1	South Tambey Gas Condensate Field: Life Support infrastructure	Rosprirodnadzor Agency, the Urals Federal District. Order No. 90 dated 01.02.2012. The conclusion of the State Environmental Expert Review	№ 216-12/ОГЭ-2218/02 dated 07.06.2012

Table 3.1 Yamal LNG Design Documentation Subject to			
No.	**Design Engineering Documentation**	**Positive Conclusion of the SEER Board**	**Positive conclusion of the SER Board (GlavGosExpertiza).**
		Board shall be valid for 5 years.	
2	Construction of the sea port facilities near Sabetta, the Yamal Peninsula, Including the Construction of the Navigable Approach Canal in the Ob Bay (Early Phase Port Facilities).	Federal Service for Environmental Management Supervision (Rosprirodnadzor). Order No. 122 dated 28.03.2012. The conclusion of the State Environmental Expert Review Board shall be valid for 2 years[5]	№ 475-12/ГГЭ-8066/04 dated 01.06.2012
3	Construction of the sea port facilities near Sabetta Village, the Yamal Peninsula, including the Construction of a Navigable Approach Channel in the Ob Bay (Early Phase Port Facilities, Main Phase Port Facilities).	Federal Service for Environmental Management Supervision (Rosprirodnadzor). Order No. 529 dated 23.08.2013. The conclusion of the State Environmental Expert Review Board shall be valid for 5 years.	№852-13/ГГЭ-8066/04 dated 25.09.13
4	Construction of the sea port facilities near Sabetta Village, the Yamal Peninsula, including the construction of a navigable Approach Channel in the Ob Bay (correction)	Federal Service for Environmental Management Supervision (Rosprirodnadzor). Order No. 95 dated 17.02.2014. The conclusion of the State Environmental Expert Review Board shall be valid for 5 years.	№581-14/ГГЭ-8066/04 dated 30.04.14
5	Construction of complex for production, treatment, liquefaction and shipment of natural gas and natural gas liquids from the South Tambey Gas and Condensate Field	Federal Service for Environmental Management Supervision (Rosprirodnadzor). Order No. 718 dated 28.12.2012. The conclusion of the State Environmental Expert Review Board shall be valid for 5 years.	№179-13/ГГЭ-8113/02 dated 15.03.2013
6	Group drilling project for wells located in the IX interval up to 4350 m deep (TP20-TP26 formations) at the South Tambey Gas Condensate Field	Federal Service for Environmental Management Supervision (Rosprirodnadzor). Order No. 115 dated 12.03.2013. The conclusion of the State Environmental Expert Review Board shall be valid for 3 years.	№287-13/ГГЭ-8503/02 dated 09.04.13
7	Group drilling project for wells located in the IX interval up to 3550 m deep (TP20+TP26 formations) at the South Tambey Gas Condensate Field	Federal Service for Environmental Management Supervision (Rosprirodnadzor). Order No. 114 dated 12.03.2013. The conclusion of the State Environmental Expert Review Board shall be valid for 3 years.	№257-13/ГГЭ-8476/02 dated 03.04.13
8	Construction of the airport in Sabetta, Yamalo-Nenets Autonomous Okrug	Not required	№1167-12/ГГЭ-8169/04 dated 14.12.2012

[5] The Design Engineering Documentation developed for the Early Phase Port Facilities in 2012 has been corrected and re-submitted together with the design documents related to the Main Sea Port Facilities to the State Environmental Expert Review (positive conclusion №ВС-08-05-32/12147 dated 23.08.2013)

According to the *Provision on the Environmental Impact Assessment of the Activities Planned in the Russian Federation*, as approved by Order 372 of the State Committee for Environmental Protection, dated 16.05.2000, the Expert Reviews were preceded by public hearings in the Yamal Area of the YNAO district as listed below (see also Chapter 5):

1. Public Hearing Minutes to support the Declaration of Intent for the Yamal LNG Project, w/o number, dated 27.05.2010, Yar-Sale,
2. Public Hearing Minutes on the EIA materials for the construction of the seaport facilities in Sabetta, including a navigable approach channel in the Ob Bay, w/o number, dated 06.12.2011, Seyakha,
3. Public Hearing Minutes on the EIA materials for the operations camp facilities for the development of the South Tambey Gas Condensate Field, w/o number, dated 19.12.2011, Seyakha,
4. Public Hearing Minutes on the EIA materials for development well drilling (3,550m and 4,350m deep) at the South Tambey Gas Condensate Field, w/o number, dated 20.03.2012, Seyakha,
5. Public Hearing Minutes on the EIA materials for the construction of the Facility for production, processing, gas liquefaction, and export of liquefied natural gas and gas condensate from the South Tambey Gas Condensate Field, w/o number, dated 13.08.2012, Seyakha,
6. Public Hearing Minutes on the design documentation review for the construction of the seaport in Sabetta in the Yamal Peninsula, including a navigable approach channel in the Ob Bay (MOF and main port facilities), including EIA materials, w/o number, dated 11.12.2012, Seyakha; w/o number, dated 13.12.2012, Tazovsky,
7. Public Hearing Minutes on the design documentation update for the construction of the Seaport in Sabetta in the Yamal Peninsula, including a navigable approach channel in the Ob Bay (MOF and main port facilities), including EIA materials, w/o number, dated 19.11.2013, Seyakha; w/o number, dated 21.11.2013, Tazovsky.

The public hearing minutes were submitted to the SEER and SER boards as part of the design documentation.

In line with Russian Government Resolution N 384, dated 30.04.2013, *On the approval by the Federal Fishery Agency of the construction and re-design of capital facilities, implementation of new technologies or other activities affecting aquatic bio-resources and their habitats*, all documentation was approved by the Federal Fishery Agency.

For all the Project facilities listed in Table 3.1, the design documentation that contains the Environmental Impact Assessment and the Action List for Environmental Protection, as well as the engineering survey results were recognized by Rosprirodnadzor and the State Expert Review as complying with the environmental and other requirements; the environmental impact is recognized as allowable. Permits for construction were issued based on the approvals of the expert review boards.

3.3 SANITARY PROTECTION ZONES

Under Russian Federation regulatory requirements for the protection of human health, Sanitary Protection Zones (SPZ) are required around certain industrial facilities. The size of the SPZ is set such that the relevant standards for the protection of human health against impacts associated with air emissions, noise, vibration etc. are met at its boundary. Human land use restrictions are applied within the SPZ. The SPZs have been formally approved by the Russia Federation for the relevant Project facilities, including the LNG plant/Power plant, seaport, airport and waste management facility. All Russian Federation standards are predicted to be met at the boundary of each SPZ and no permanent human residential areas (e.g. worker accommodation facilities) lie within the SPZ.

4 PROJECT ALTERNATIVES

4.1 THE 'NO PROJECT' ALTERNATIVE

The 'no project' alternative considers the outcomes should the Project not go ahead. In this case, not developing the Project would mean that the large reserves of the the South Tambey Gas Condensate Field (see Chapter 4, Project Description for full details) would remain unexploited. This would result in:

- The loss of a resource development project of both national economic importance and international energy resource importance.
- Failure to capitalise on previous well development in the field that has resulted in up to 80% of the reserves having already been explored and being ready for commercial production. This may lead to increased pressure to capitalise on other, less well developed, fields either in the Yamal region or elsewhere in the Russian Federation.
- Failure to meet the requirements of the Resolution of the Russian Federation's Government # 1713-R "On the Comprehensive Plan of Development of LNG Production in the Yamal Peninsula" dated October 11, 2010.
- The loss of regional development and inward investment opportunities associated with the Project in the Yamal region.

In addition, as part of the development Project, disused facilities on the site and contamination associated with previous oil and gas exploration and production activities (by previous operators) in the field will be removed and reinstated respectively by Yamal LNG. Without this Project it is uncertain whether such remediation works would be undertaken.

The 'no project' option would avoid the potential adverse environmental and social impacts identified in Chapters 9 and 10 of this ESIA report. However, the economic, social and environmental benefits of the Project associated with the aspects identified above, coupled with the international demand for gas, are compelling.

4.2 ASSESSMENT OF DEVELOPMENT OPTIONS

Following a decision to proceed with the Project, the identification of preliminary high-level development options for the Project included consideration of:

1. Methods for the export of gas reserves, and in particular either:

   a. Gas pipeline transport of natural gas to end users
   b. Export as LNG via carriers.
2. For LNG export, the following sub-options were considered:
   a. Geographic location of LNG facilities either in:
      i. the Yamal peninsula
      ii. remote locations nearer to ice-free conditions.
   b. Development of LNG facilities as either:
      i. Offshore facilities
      ii. Near-shore coastal facilities on barges
      iii. Onshore facilities.
   c. LNG Export by either:
      i. Loading jetty
      ii. Offshore single point mooring.

The assessment of the different options took into consideration the following criteria: cost, schedule, technology-risks, environmental impacts and socio-economic impacts. Following a detailed option analysis, the development of a modular build onshore LNG facilty located with the gas field and with export by jetty-based facilities was identified as the preferred development option. Primary factors for the selection of this option (relative to other development options) included:

- Relatively small physical footprint
- Reduced extent of linear structures (i.e. pipelines)
- Greater access to international markets (as compared to non-LNG options)
- Use of proven technology
- Lack of available capacity and remote distance to existing export gas pipeline network is disadvantageous for non-LNG options
- Presence of some existing infrastructure at the proposed development site
- No requirements for resettlement

5 STAKEHOLDER ENGAGEMENT

5.1 INTRODUCTION

Engagement with stakeholders is of key importance in ensuring that potential adverse impacts are identified and managed, and that benefits to the community stemming from the Project are enhanced. Initiating the engagement process at an early stage of the Project, together with the adoption of appropriate communication mechanisms, helps to ensure:

- the timely public access to all relevant information; and
- that stakeholders are provided with an opportunity to input into the Project design, the identification and assessment of impacts and measures for impact mitigation and enhancement (in the case of beneficial effects).

In order to manage its consultation activities, Yamal LNG has developed a Stakeholder Engagement Plan (SEP) document. The SEP is publicly available and remains a live document that will be updated regularly in order to incorporate stakeholders' opinions throughout the Project duration.

The first step of the consultation process is the identification of relevant stakeholders. To ensure effective and tailored engagement, the Project stakeholders have been categorised into the following groups:

1. Affected Parties – persons, groups and other entities within the Project Area of Influence that are potentially affected by the Project;
2. Other Interested Parties – individuals/groups/entities that may not experience direct impacts from the Project but who consider their interests as being affected by the Project and/or who could influence the Project; and
3. Disadvantaged or Vulnerable Parties – persons who may be disproportionately impacted or further disadvantaged by the Project relative to other groups (and for whom special engagement efforts may be required).

A comprehensive list of stakeholders at the local, regional, Federal and international levels has been identified in the SEP.

5.2 CONSULTATION ACTIVITIES UNDERTAKEN TO DATE

To date, the Project has undertaken the following broad types of consultation (summaries of these consultations, and the issues raised, are provided in the SEP):

1. **Public hearings**. Consultation in the form of statutory public hearings for project development activities is a primary method of engagement with the communities in the Project area of Influence. To date over ten separate public hearings have been held in relation to the project between 2010 and 2013.
2. **Regional Engagement.** Yamal LNG has undertaken a series of meetings with regional (Okrug) level representatives of government authorities, reindeer herder communes and indigenous peoples organisations.
3. **Local Engagement.** A series of meetings have been held between 2012 and 2013 within the Project Area of influence, including meetings with representatives of the local nomadic population, indigenous communities, reindeer breeding enterprises and local district authorities. The meetings included in-depth interviews with local communities undertaken by ethno-cultural specialists.

5.3 SUPPORT PROGRAMMES AND COMPENSATION

Yamal LNG has established the following support programmes and compensation arrangements (further details are provided in the SEP):

1. **Support for Yamalsky District Indigenous Population.** The Company has launched the “Engagement and Support Programme for Indigenous Population of the Yamalsky District” in cooperation with the Municipal Administration of Yamalsky District and the Yamalsky District Public Association of Indigenous Small-Numbered of the North “Yamal” in 2012. The purpose of the Programme is to enable the Company to provide active contribution in supporting the local indigenous communities and in preservation of their history, culture, traditions and the way of life. The Programme is also aimed to improve living conditions and the quality of life of the local population through creating opportunities for development and the implementation of targeted social programmes. In 2014 the Program served as a basis for development of the Indigenous People Development Plan for Yamal district of YNAO for

period of time 2014-2018. The Plan contain activities aimed on prevention or mitigation of project impact to the indigenous population, development of economic potential of economic entities of indigenous people as well as settling out problems associated with life support and upgrading of facilities of nomadic families.

2. **Compensation Agreements.** The Company has established a compensation framework based on the agreements with the Yamal-Nenets Autonomous Okrug (YNAO)Regional Administration and the Yamalsky District Municipal Administration.
3. **Foundation for the Development of Yamal Rural Territories.** Company funding contributes to the activities of the non-governmental Foundation for Development of Yamal Rural Territories aimed at modernisation of the Seyakha rural settlement and the implementation of the programme for development of Seyakha settlement for 2011-2015.

5.4 ON-GOING AND FUTURE STAKEHOLDER ENGAGEMENT

The Company will continue to actively engage with its stakeholders throughout the Project lifecycle. The Company will also initiate public consultations in relation to any future environmental and social impact assessment studies in case of expansion, modernisation and variations to the proposed Project activities, as required.

The Project will use the following key consultation methods:

- Public consultations and focus group discussions
- Household visits
- Focus groups discussions and round table workshops
- Site tours to Project assets

The Project disclosure process will include the dissemination of the following reports:

- Environmental and Social Scoping Report (Scoping Report);
- ESIA Package:
  - ESIA Report;
  - Stakeholder Engagement Plan (SEP), and
  - ESIA Non-Technical Summary (NTS).

5.5 FREE, PRIOR AND INFORMED CONSENT

As part of the Company's commitment to international lenders standards, and in particular IFC Performance Standard 7, the Project is required to obtain "Free, Prior and Informed Consent" (FPIC) of the Indigenous Peoples' communities that are likely to be subject to various Project impacts. There is no universally accepted definition of FPIC. However, it assumes good faith negotiation between the Company and the affected indigenous communities and a mutually accepted process of negotiations and agreements that should be documented.

In order to fulfil the requirements for consultations to be 'free, prior and informed', as well as to ensure the FPIC of affected Indigenous Peoples, a range of engagement methods have been applied by the Company as described in the SEP.

By the third quarter of 2014, Yamal LNG completed the first round of activities related to the preparation of the Indigenous Peoples Development Plan (IPDP) and the formal obtaining of FPIC

of Yamal District Indigenous Peoples. Starting from October 2013 the following actions related to IPDP elaboration and the obtaining of FPIC have been undertaken:

- Research on traditional land use and ethno-cultural environment of indigenous peoples in the Yamal LNG Project area of influence;
- Historical and cultural research of the land allotted to the Yamal LNG Project;
- The Advisory Board consisting of the representatives of Yamal LNG, regional and Municipal authorities, NGOs and indigenous organizations has been established;
- Three rounds of consultation with indigenous peoples of Yamal District were implemented between March and May 2014

Decisions were made to approve the IPDP and commence signing of the FPIC Declaration during the second meeting of the Advisory Board. By July 7th 2014, all Declarations of FPIC to the Yamal LNG Project and IPDP realization were signed by the authorized representatives.

5.6 PUBLIC GRIEVANCE MECHANISM

The Company has developed and implemented a Grievance Procedure to effectively address affected communities' concern and complaints in a timely manner. The Company uses the following methods to address incoming complaints:

- An online facility for placing any stakeholder feedback on the Yamal LNG corporate website: www.yamalspg.ru.
- A dedicated telephone number enabling contact with designated Company staff.
- Information leaflets on the Public Grievance Procedure with an accompanying grievance form.
- Suggestion boxes installed in the Project's public reception office in Seyakha and Mys Kamenniy villages.
- E-mail: vopros@yamalspg.ru.
- Public liaison offices in Salekhard, Yar-Sale and Sabetta.
- Filling in Public Enquiry Form and sending in by postal mail.

Further details about the Company public grievance mechanism is provided in the SEP.

6 ESIA METHODOLOGY

6.1 DEFINITION OF TERMS

Some of the more important terms used in the ESIA are provided below.

- A project ***phase*** is a series of related activities, which together form a distinct stage in the life of the Project. Four phases are considered in the ESIA as follows (although for simplicity these may be combined in some sections of the ESIA where appropriate):
  - Construction
  - Commissioning
  - Operation
  - Decommissioning
- Environmental and social ***receptors*** are those elements of the environment and/or human society that may be affected by the Project.
- Environmental and social ***impacts*** are changes on environmental and/or social receptors that occur as a consequence of the Project. Impacts to individual receptors may be either ***adverse*** (having a detrimental/negative effect on a receptor) or ***beneficial*** (having an advantageous/positive effect on a receptor). Different types of environmental and social impacts are defined in terms of:
  - ***Duration.*** The 'duration' of impacts includes consideration of the period over which the source of impact occurs and also, for reversible impacts, the period over which recovery may occur (see also 'reversibility' below). The duration is classified as either ***Short***, ***Medium*** or ***Long*** term.
  - ***Extent.*** The 'extent' of impacts is dependent on the nature of the impact and the receptor of the impact, and are classified as either ***Local***, ***Regional***, ***National***, or ***International***.
  - ***Irreversible*** impacts are defined as those impacts that cause a permanent change in the affected receptor.
  - ***Reversible*** impacts are those impacts that can be reversed back to pre-existing conditions as a result of mitigation/reinstatement measures and/or natural recovery. The periods over which impacts may reverse/recover is a key link to the duration over which an impact is felt (see 'duration' above).
  - ***Residual impacts.*** These are the impacts on receptors that remain after mitigation measures have been put in place (see 'mitigation measures' below).
  - ***Cumulative impacts.*** Those impacts that result from the incremental impact of the Project when added to other existing, planned, and/or reasonably predictable future projects and developments that are not be directly associated with the Project.
- **Mitigation measures** are actions designed to reduce adverse impacts to acceptable levels. Mitigation measures may form part of the Project design, or may be additional actions that are put in place to reduce impacts that have been identified in the ESIA.

6.2 OVERVIEW OF THE ESIA PROCESS

The impact assessment process is carried using a number of steps. In summary, these are:

- Setting the scope of the ESIA ('Scoping') to identify aspects of the Project that are likely to give rise to key issues. This usually includes consultation with stakeholders to ensure that the concerns of all potentially affected parties are addressed in the ESIA.
- Collecting baseline data on the aspects identified during scoping, to provide the basis for the evaluation of potential or actual impacts. These data also serves as a baseline against which to compare/monitor subsequent changes due to the Project.
- Identify the impacts from the Project and assess their significance.
- Identify mitigation measures that could remove impacts or reduce their significance.
- Re-assess the impacts from the Project in the scenario that mitigation measures are in place.

Further details are given in Sections 6.3, 6.4 and 7 below.

6.3 SCOPING AND CONSULTATION

Scoping is the process of determining what should be covered in the ESIA and associated documentation. The scoping process aims to identify the types of environmental and social impacts that would be relevant to the Project, and to determine those aspects that are of potentially greatest significance. The process includes consultation with potentially affected communities, to identify their concerns and to ensure that they are appropriately addressed. Scoping also considers whether there are any issues that are not relevant to the Project, and hence do not need to be assessed in the ESIA. A full description of the scoping assessment undertaken for the Yamal LNG Project is provided in the Yamal LNG Scoping Report, a copy of which is provided in Appendix 1 to the ESIA. The Scoping Report has been made publicly available as part of the consultation process and to help direct the development of the ESIA (see Chapter 5 for further details).

6.4 SIGNIFICANCE CRITERIA OVERVIEW

This ESIA adopts an approach to impact categorization and significance that is commonly used in the preparation of large project ESIAs. This makes use of quantitative criteria where available, and where not available uses qualitative criteria and expert judgment.

6.4.1 KNOWN/CERTAIN IMPACTS

Where impacts are certain to occur and the extent of such impacts can be reasonably predicted (for example in relation to routine and/or planned events with reasonably predictable consequences), the significance is defined by the assessed severity of that impact. Table 6.1 below details generic severity criteria for negative impacts. Where appropriate, these qualitative generic criteria have been supplemented by more detailed and quantitative criteria that are presented on a topic-by-topic basis in the main ESIA.

Table 6.1 Severity Criteria	
None/Negligible	No discernible impact – Effects are non-existent or the impact of a particular activity is deemed to be 'negligible' or 'imperceptible' and is essentially indistinguishable from natural background variations.
Low	Slight effects, well within Project Standards[6]. **Duration:** short term **Extent:** localised to immediate area **Reversibility:** reversible **Sensitivity of the receptor**: low sensitivity/value.
Moderate	Noticeable effect but still within Project Standards. **Duration:** short-term (moderate receptor sensitivity/value), medium term (low receptor sensitivity/value) **Extent:** local (moderate receptor sensitivity/value) or regional (low receptor sensitivity/value) **Reversibility:** reversible **Sensitivity of the receptor:** see duration and extent above.
High	Considerable effect and/or repeated breach of regulatory/project limits. **Duration:** medium to long term (moderate to low value receptors), short-term (high value receptors, protected habitats/species) **Extent:** local (high receptor sensitivity/value, protected habitats/species) or regional (moderate receptor sensitivity/value) **Reversibility:** reversible (moderate/high value receptors), or irreversible (low value receptors or localised moderate/high value receptors/habitats) **Sensitivity of the receptor**: see duration, extent and reversibility above.
Major	Major effect, continuous breach of Project Standards. **Duration:** Long term **Extent:** regional, national or international effect **Reversibility:** Limited reversibility/irreversible **Sensitivity of the receptor:** highly valued/sensitive receptors.

6.4.2 UNCERTAIN IMPACTS AND RISKS

Where an impact is not certain to occur (e.g. due to the inherent unpredictable nature of the potential impacts from routine/planned activities, or else where impacts are associated with unplanned/emergency events), the significance of the impact ***risk*** is a function of the ***likelihood*** that it occurs and the ***severity*** of the impact should it occur. Table 6.2 below provides a description of the likelihood categories applied in this ESIA. These are set and do not vary according to impact type.

[6] The Project Standards are as defined in the Project Standards Document.

Table 6.2	Likelihood Criteria
Probable	Events that are known to occur within the specific industry and likely to occur on multiple occasions during the design lifetime of the Project. Probability of occurrence – more than 50%.
Possible	Known to occur periodically within specific industry and reasonably foreseeable to occur once during the design lifetime of the Project. Probability of an occurrence – less than 50%.
Unlikely	Known to occur rarely in specific industry or periodically within wider industry. Realistically feasible but unlikely to occur during the design lifetime of Project. Probability of occurrence – less than 10%.
Improbable	Rarely heard of within wider industry and extremely unlikely to occur during the design lifetime of the Project. Probability of occurrence – less than 1%.

The significance of the overall impact risk is then determined using the following risk matrix.

Likelihood of impact	**Severity of Impact**				
	Negligible	**Low**	**Moderate**	**High**	**Major**
Probable	Negligible	Low	Moderate	High	Major
Possible	Negligible	Negligible	Low	Moderate	High
Unlikely	Negligible	Negligible	Negligible	Low	Moderate
Improbable	Negligible	Negligible	Negligible	Negligible	Low

7 ENVIRONMENTAL IMPACT ASSESSMENT

7.1 INTRODUCTION

The following sections summarize the key environmental impacts that have been identified and assessed in the ESIA process. Each of the following environmental aspects is assessed in turn:

- Air emissions
- Geology, geomorphology and soils
- Surface water
- Groundwater
- Waste management
- Noise and vibration
- Terrestrial flora and fauna
- Marine flora and fauna

For each of these aspects, the summaries focus on the more important or interesting results of the ESIA and comprise:

- An overview of the relevant baseline characteristics
- Identification of key receptors and assessment of potential impacts
- Identification of the design controls and mitigation measures
- A summary of the residual impacts and conclusions

7.2 AIR EMISSIONS

7.2.1 BASELINE CONDITIONS

Due to the largely non-industrialized nature of the Project location, the existing air quality baseline is good. Some existing air quality monitoring data is available and is used in the air quality assessment. However, this data was collected in the vicinity of historical exploration activities that have now ceased. The assessment of Project air quality impacts considers whether criteria for air quality are met at given locators. These criteria are based on the cumulative concentrations including pre-existing background concentrations of given substances in air. Therefore, the use of baseline data collected in the vicinity of historic exploration activities within the air quality assessment for the ESIA is considered to be highly conservative.

7.2.2 IMPACTS AND RECEPTOR

Emissions to air will occur during both construction and operation phases, principally as a result of the combustion of fuels and other hydrocarbons by construction equipment, power plant and process equipment etc. The emissions to air are most significant during the operational phase, with the primary emission sources being the power plant and the liquefaction gas turbines.

Air emissions may impact human health (through deterioration of air quality), vegetation (through deterioration of air quality and also through deposition of nitrogen) and climate change (through emission of CO_2 and other greenhouse gases). The only permanent human population that may

be affected by air quality impacts are the work force, and hence the human receptor locations considered in the air quality assessment are the worker accommodation facilities.

The primary potential vegetation impacts are associated with nitrogen deposition on lichen. Lichen are of particular importance in the region as a source of food for reindeer, and lichen pastures in the Yamal district are known to be particularly sensitive due to over-grazing by reindeer.

7.2.3 MITIGATION

A series of good practice measures, both in terms of equipment selection/design, and procedural controls, will be implemented to minimize impacts. During construction, these include measures to reduce emissions from construction equipment and vehicles, such as vehicle speed limits and switching off machinery when not in use. During the operational phase, key design features to minimize air emissions include:

- Energy efficiency / loss control measures:
  - Waste heat recovery units will be installed at the power plant to utilize waste heat from the power generators
  - Capture and use of methane gas ('Boil off Gas' or BOG) for LNG handling and storage as a fuel gas for the power plant and LNG process turbines
  - Process design to avoid continuous flaring
  - Vapour recovery on condensate handling and storage (to avoid fugitive of emissions of methane, a greenhouse gas)
- Control of air quality pollutants:
  - Use of Dry Low NOx (DLN) technology on gas turbines to reduce the emissions of oxides of nitrogen (a primary air quality pollutant and also the source of nitrogen deposition)
  - Field gas has a naturally very low sulphur content, thus reducing emissions of sulphur dioxide (an air quality pollutant)

The overall scale of potential impacts on human health is also reduced by the location of the Project facilities in a remote area with no permanent communities in near proximity to the main project facilities.

7.2.4 RESIDUAL IMPACTS AND CONCLUSIONS

Air quality impacts have been assessed in the ESIA using predictive air quality dispersion modelling. The assessment considered both construction and operation phases (including normal operations and a range of upset/abnormal operating conditions). The modelling results show that:

- Russian Federation air quality standards are met at the boundary of the SPZ for all facilities
- The Project air quality standards are comfortably meet at the identified nearest human receptor locations (the project accommodation facilities)
- Predicted nitrogen deposition rates are below identified critical loads for tundra environments at all locations.

Overall, residual air quality impacts are assessed as **Low** and nitrogen deposition impacts as **Negligible**.

Greenhouse gas emissions are also estimated, with total CO_2-equivalent emissions from operation of the main LNG and power plant estimated at 2,440kt/year.

7.3 GEOLOGY, GEOMORHOLOGY AND SOILS

7.3.1 BASELINE CONDITIONS

The Project Licence Area is located at the southern boundary of the arctic tundra. The Licence Area is a flat, lowland plain, with an elevation of between zero and 25 m above sea level. The topography of the plain is made up of land that forms a series of 'steps', each with a different elevation. The plain is also cut by numerous river valleys, with the biggest rivers in the area being the Sabettayakha and the Venuymuyeyakha (see Section 7.4 for further details).

The Project Licence Area lies in a continuous permafrost zone where thawing occurs only seasonally and to relatively shallow depths. The continuous permafrost sheet is broken only under river beds, lakes, and in the coastal zone of the Gulf of Ob.

The South Tambey gas condensate field was discovered in the mid-1970s. Since that time, extensive prospecting surveys and exploratory drilling operations have been performed by other past operators to estimate recoverable reserves. This historical activity has resulted in a legacy of disturbed and contaminated land (including a legacy of residual industrial wastes), and contaminated surface waters within the Licence Area. The extent of these legacy issues has been studied by Yamal LNG and the areas affected by historical activities are shown on Figure 7.4.1.

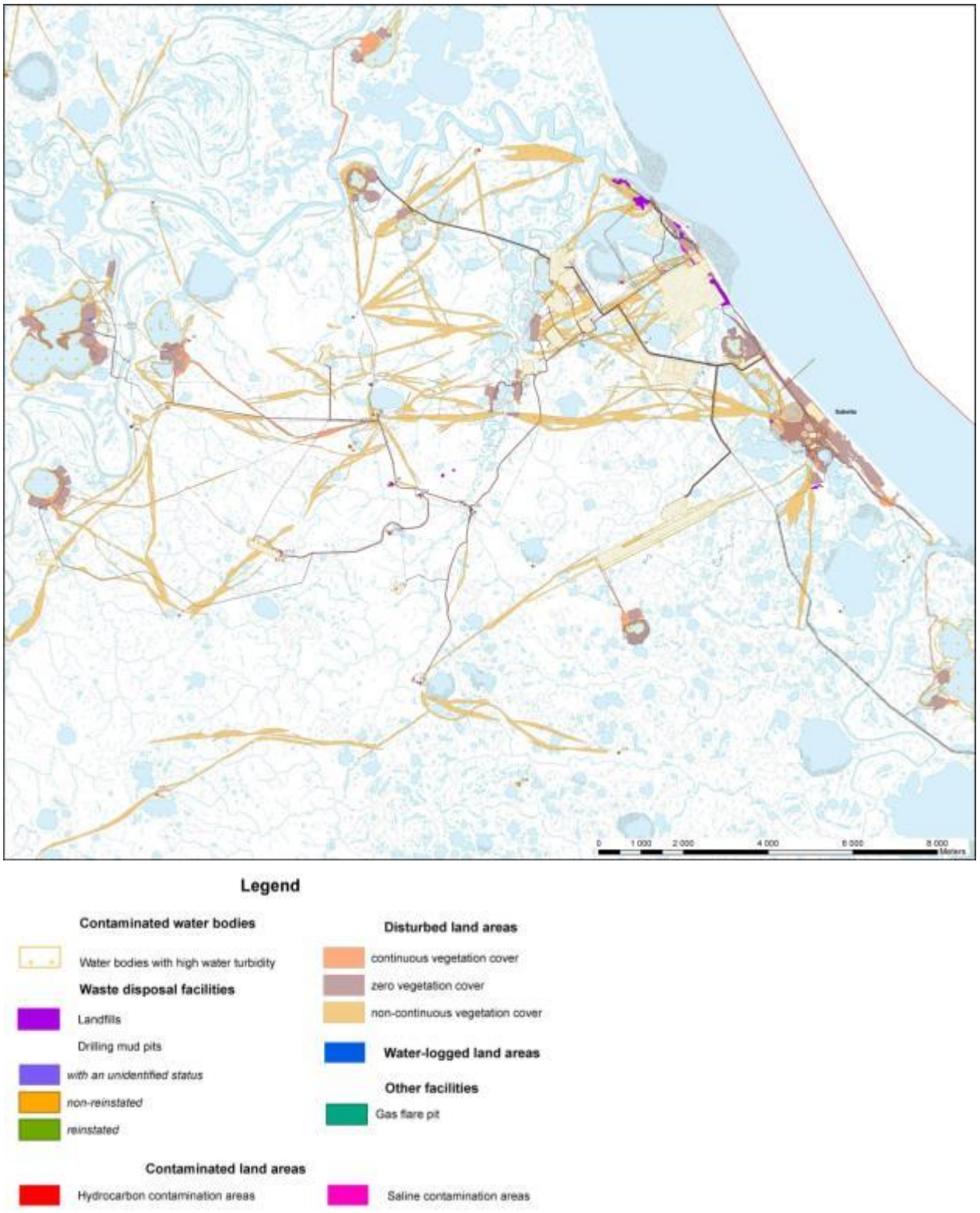


Figure 7.4.1 Location of Historically Contaminated and Disturbed Areas around the Central Project Facilities

7.3.2 IMPACTS AND RECEPTORS

The general types of potential impacts on the geological environment from the Project development are summarized in Table 7.4.1

Table 7.4.1: Summary of potential impacts on the geological environment

Class and subclass		Impact description	Impact type	Potential sources of impact
Physical impact	Mechanical impact	Compaction	Static	Buildings, structures, power transmission lines
			Rolling Tamping	Vehicles
		Removal of rock	Drilling Digging Excavation	Bore wells Open pits Dredging works in the Gulf of Ob resulting in sea bed deepening
		Surface accumulation	Dumping Banking	Construction Temporary disposal of soil in above and below ground dumps
		Land relief formation (levelling)	Levelling Reclamation	Construction Land reclamation
		Land surface erosion	Formation of hollows	Open pits
	Thermal	Changing of Permafrost	Melting / loss of permafrost	Linear and areal facilities
Chemical impact		Pollution	Phenols, heavy metals, hydrocarbons, salinization	Transport Landfill for solid domestic and industrial waste Underground wastewater disposal facility
Physiochemical impact		Colmatation (clogging of pore space)	Physical Physiochemical	Underground wastewater disposal facility

Table 7.4.1: Summary of potential impacts on the geological environment			
Class and subclass	**Impact description**	**Impact type**	**Potential sources of impact**
Biological impact	Pollution	Bacteriological, microbiological	Landfill for solid domestic and industrial waste Underground wastewater disposal facility

The geological receptor of primary importance is identified as permafrost.

7.3.3 MITIGATION

A range of mitigation controls will be adopted by the Project in order to control and reduce mechanical, thermal, chemical, physiochemical and biological impacts. Such mitigation measures include:

- Minimisation of the Project footprint, and hence the area of land/soils potentially subjected to direct impact (examples of measure to reduce the physical Project footprint include drilling of multiple wells from a small number of well pads, avoidance of long distance linear infrastructure, prohibition of vehicle movements outside of dedicated roads, etc.).
- Implementation of spill prevention measures to prevent chemical contamination of soils (examples include re-fuelling and maintenance of mobile equipment in dedicated sealed areas, provision of secondary containment for bulk storage of fuels and other hazardous liquids, etc.).
- Appropriate treatment of all waste waters prior to discharge to the environment (see Section 7.4 below)
- Appropriate management of wastes, including the design of the SIDW landfill with a low permeability liner (see Section 7.6 below), to prevent bacterial/microbiological contamination of the environment.
- Development and implementation of a post construction reinstatement plan (for temporary construction areas)
- Commitment to the reinstatement of legacy waste and contamination areas.
- Measures to prevent thermal impacts on permafrost, including:
  - Conservation of permafrost by adopting snow clearance measures in winter
  - An insulating sand layer to be installed at the base of each road
  - Construction of above-ground facilities on piles
  - Ventilation of underfloor spaces
  - Seasonally operated refrigerating plants (thermal stabilisers)
  - Thermal shields (includes combination of filled soil and insulation material).

7.3.4 RESIDUAL IMPACTS AND CONCLUSIONS

With the adoption of the project mitigation measures, residual impacts are assessed to be **Negligible** (for impacts on deep strata) to **Low** (for all other geological impacts).

7.4 SURFACE WATERS

7.4.1 BASELINE CONDITIONS

The hydrographic network belongs to the Kara Sea catchment and surface watercourses mainly comprise small and mid-size rivers, with the largest rivers within the License Area being the Sabettayakha and the Venuymuyeyakha. There are also many lakes, most of which are located in river floodplains, in estuaries and near-estuarine areas. Lakes occupy up to 38% of the area of the river basins in the Yamal Peninsula.

The main rivers and lakes in close proximity to the Project facilities are shown in Figure 7.4.1.

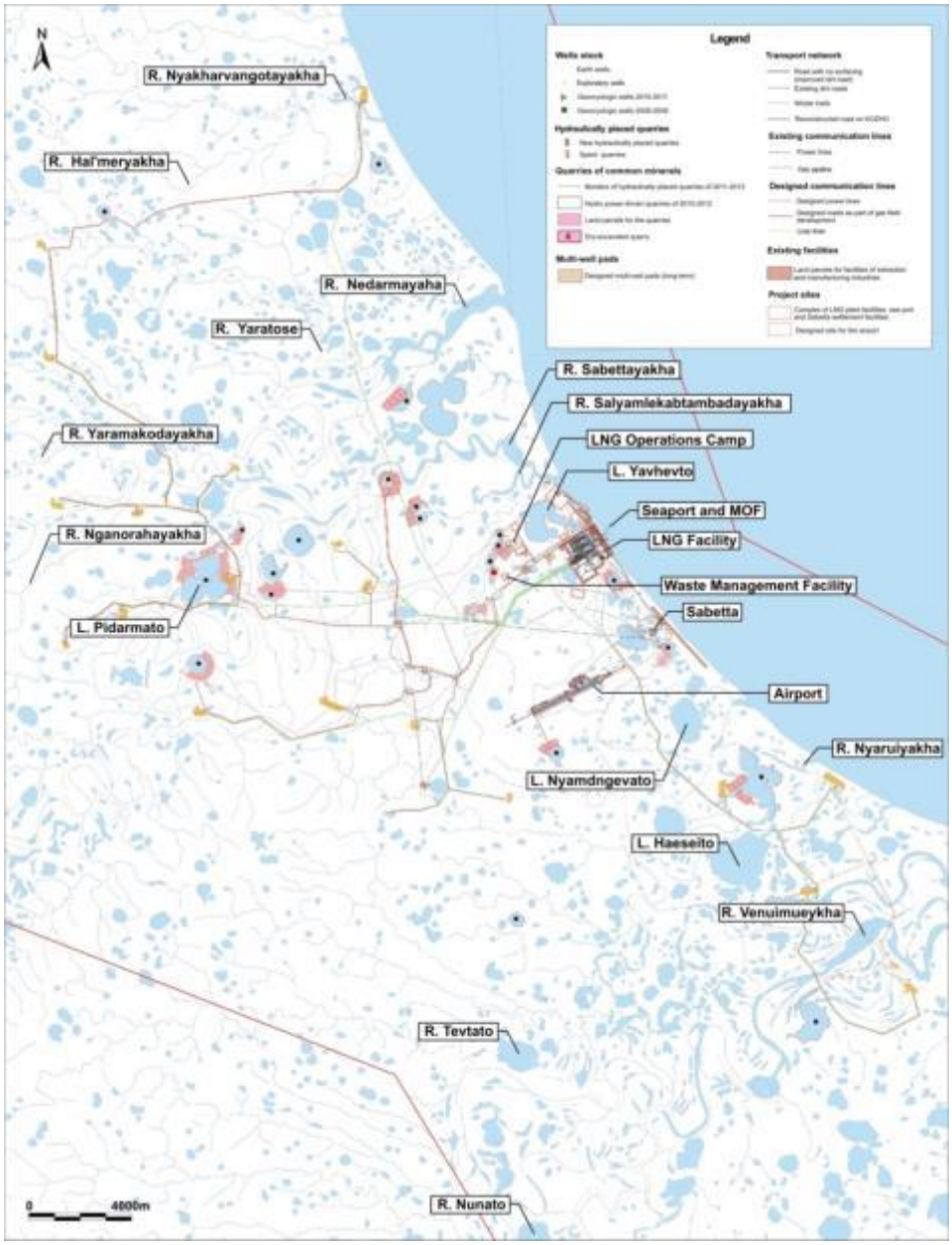


Figure 7.4.1 Main rivers and lakes within the Project Licence Area

While water quality in the rivers and lakes of the Yamal peninsula is generally good, some historical contamination has been identified in certain surface waters within the Licence Area.

The Gulf of Ob is approximately 760km long (from the Ob estuary in the south to the Kara Sea outlet in the north), with a width of 35 to 80km and a depth of 10 to12m, deepening to 20-22m in the northern section. The Gulf is ice-free between July and October. Of particular note is that salinity levels vary significantly in the Gulf of Ob, with a strong seasonal influence due to fluctuations in annual river discharge.

7.4.2 IMPACTS AND RECEPTORS

Potential impacts to surface water can be categorised into the following types:

- **Water abstraction**. Surface waters are used as water supplies to meet the needs of the Project in terms of potable water as well as water for sanitary, construction, firewater and process requirements. During the construction phase, water will be initially be abstracted from an existing water supply from the Glubokoye Lake near Sabetta. A new water supply would then be developed from an artificial lake, also near Sabetta (after which abstraction from Glubokoye will cease). For the operational phase, it is planned to install a water abstraction facility from the Gulf of Ob, including a desalination system. Water abstraction from lakes has the potential to impact freshwater ecology by reducing water levels if abstraction rates exceed recharge rates. In addition, small aquatic fauna may be sucked into the abstraction inlet.
- **Wastewater Discharges**. Wastewaters will be generated during both construction and operation from a variety of sources, including: surface runoff of rain/melt waters from potentially contaminated Project areas (e.g. fuel storage areas, deicing pads at the airport etc.); discharges from sanitary and process wastewater treatment units, brine residues from the desalination unit, hydrotest waters (i.e. waters used for pressure testing of equipment prior to being commissioned); and ballast water discharges from vessels. Such discharges can impact water quality, which in turn may affect aquatic flora and fauna. Ballast waters may also contain marine species from the origin seaport and, if released into the seaport at Sabetta, may result in colonisation of the Gulf of Ob by these 'alien' species.
- **Accidental contamination**. Accidental spills of harmful substances, including oils and fuels, may occur during both construction and operation, which may lead to contamination of surface waters. Construction activities involving earthworks in the vicinity of surface waters also have the potential to result in sediment flows into surface water, resulting in raised turbidity levels. Accidental contamination of surface waters can impact water quality, which in turn may affect aquatic flora and fauna.
- **Hydrological impacts.** Construction works in and around surface waters, such as where pipelines or roads cross rivers, have the potential to alter the flows in rivers, potentially leading to scouring and/or deposition effects, and so altering the physical nature of the river.
- **Dredging Impacts.** Dredging activities are required as part of the construction of the seaport and associated approach and navigation channels (see Figure 2.5). Dredging impacts include: physical disturbance of the seabed both at the area being dredged and the areas where the removed spoil is deposited (three dredge disposal sites will be used and are shown on Figure 2.8); raised turbidity levels in the sea waters during the dredging and dredge disposal activities (impacting water quality and hence fish and other marine fauna), followed

by smothering of the seabed as the raised sediment settle (impacting marine flora and fauna on the seabed). Because of the potential significance of the impacts, detailed modelling has been undertaken to assess the extent of the turbidity plumes and sedimentation effects during dredging. The results of the modelling show that sediment plumes may extend over distances of up to 9km from the dredging sites. Sedimentation impacts are generally predicted to extend over smaller distances, although may still extend over several hundred meters from the dredge/disposal site.

Dredging of the navigation channel will result in the removal of part of a natural sand bar that runs across the northern portion of the Gulf of Ob (see Figure 2.5). The sand bar plays an important role in the hydrological flow regime in the Gulf of Ob and, in particular, influences the salinity gradient in the Gulf as it provides a natural boundary between the saline waters of the Kara Sea to the north and the less saline waters of the southern Gulf of Ob. It was therefore important to assess whether dredging in the sand bar could have an impact on salinity levels in the south portion of the Gulf of Ob. To investigate this potential impact, detailed modelling studies have been performed to assess the extent to which dredging of the navigation channel through the sand bar may influence salinity levels in the Gulf of Ob to the south of the sand bar. These modelling studies predicted only very small (non-significant) changes in salinity.

7.4.3 MITIGATION

A range of mitigation controls will be adopted by the Project in order to control and reduce impacts to surface waters. Some of the more important control measures for each of the impact types described above are summarized below:

- **Water abstraction**. Key mitigation controls include:
  - Maintaining water abstraction levels from the Glubokoye lake to within existing licensed abstraction levels and to then cease abstraction altogether, thereby leading to a long term reduction in impacts on this natural lake.
  - Using artificial (and hence less environmentally sensitive) lakes for new water abstraction sources during the construction phase.
  - Using the Gulf of Ob for water abstraction during the operational phase (thereby avoiding the potential to affect water levels in freshwater lakes).
  - Installation of fish protection filtering devices on the abstraction inlets (to prevent ingestion of fish).
- **Wastewater Discharges**. Key mitigation controls include:
  - All waste sanitary and process waters, together with all runoff water from potentially contaminated process areas, will be routed to wastewater treatment plants. All discharges from the wastewater treatment plants will meet applicable regulatory and Project standards relevant to the receiving environment.
  - Salinity impacts from the discharge of brine from the desalination plant to the Gulf of Ob will be avoided by mixing the brine with low salinity treated wastewater prior to discharge.
  - Control of ship wastes in line with MARPOL and exchange of ballast waters in deep waters (the Kara Sea) to prevent introduction of alien coastal species to the Gulf of Ob.

- **Accidental contamination**. In order to prevent accidental contamination, a range of good practice pollution prevention and erosion control measures will be implemented. These include:
  - Re-fuelling and maintenance of mobile equipment in dedicated sealed areas.
  - Provision of impermeable secondary containment for bulk storage of fuels and other hazardous liquids.
  - Runoff rain/meltwater from potentially contaminated process areas to be collected and treated prior to discharge (see wastewater discharges above).
  - Development of detailed Oil Spill Response Plans covering both onshore and offshore activities.
  - Use of double-hulled tankers.
  - Use of appropriate erosion control measures (e.g. silt fencing) during all earthworks in the vicinity of surface waters.
  - Road crossings of rivers will utilise bridges or culverts, and vehicle access through rivers will be prohibited.
  - Installation of drainage control on bridges
- **Hydrological impacts.** Measures to prevent hydrological impacts to rivers include the use of single span bridges for all but the largest rivers.
- **Dredging Impacts.** Dredging activities will be undertaken by third parties not under the direct control of Yamal LNG. However, it is anticipated that good practice mitigation controls will be implemented and will include:
  - The use of appropriate dredging equipment/technology to minimize the amount of sediment released to the water column, including trailing suction hopper dredgers (TSHDs) wherever possible.
  - Unloading of dredge materials from vessels at the disposal sites will only take place once the vessel has come to a complete stop, to avoid unnecessary spreading of sediment.
  - Ensuring that the dredge bucket is no more than 75% full to prevent spillage of soil back to water.
  - Performing chemical and analytical monitoring of water quality at the Gulf of Ob before, during and after dredging activities.

7.4.4 RESIDUAL IMPACTS AND CONCLUSIONS

With the adoption of the proposed mitigation controls all residual impacts on surface waters are assessed as **Low**. The only exception to this is dredging in the Gulf of Ob for the seaport and associated approach and navigation channels. Because of the spatial and temporal scale of the sediment plume and sedimentation effects, the residual impacts on the Gulf of Ob are assessed as **Moderate**.

7.5 GROUNDWATER

The primary potential impacts to groundwater are related to potential contamination from accidental releases of harmful substances and wastewater discharges. The potential significance of such impacts is reduced by the fact that there are no potable groundwater wells within the Area of Influence. Measures to control contamination impacts to groundwater are identical to those

described above for the project soils and surface waters. Deeper groundwater may also be potentially affected by loss of fluids during drilling activities and the disposal of some wastewaters via deep boreholes. Potential impacts to deeper groundwater would be controlled through the application of standard drilling practices (e.g. installation of well casings and monitoring of drilling fluids) and the selection of geological strata for wastewater injection (i.e. selecting strata that are isolated from the rest of the hydrological system). The residual impacts to groundwater are assessed as **Low**.

7.6 WASTE MANAGEMENT

7.6.1 BACKGROUND

The Project will produce a range of waste streams throughout its lifetime. A primary factor in the development of the Project's waste management strategy is the absence of existing suitable waste management facilities on the Yamal peninsula. With this in mind, the overall philosophy for waste management adopted by the Project is as follows:

- Removal of recyclable materials to suitable external companies
- The development of the following on-site waste facilities for the treatment and disposal of remaining wastes:
  - A solid industrial and domestic waste (SIDW) landfill
  - Five waste incinerators (3 located adjacent to the SIDW, and 2 located at the LNG waste water treatment plant for the thermal treatment of dried sludges)

The development of dedicated on-site waste facilities has a number of benefits, including avoidance of unnecessary long distance transport of waste and minimising impacts on the capacity of municipal waste facilities in the wider YNAO.

7.6.2 LEGACY WASTE

In order to identify legacy waste that had accumulated during previous historical activities within the Licence Area prior to the launch of the Yamal LNG Project (hereafter "accumulated legacy waste"), an inventory of the anthropogenic impact was performed in the Licence Area in 2012 under the contract between Yamal LNG and Federal State Unitary R&D Institution AEROGEOLOGIA. This study was performed by interpretation of high-resolution space images and comparison with field survey data.

In total 64 unauthorised dump sites were identified (59 accumulated legacy waste sites, occupying 41 ha). A total of 25,000 tonnes of accumulated legacy waste has been identified (including scrap metal and solid domestic waste).

Yamal LNG JSC executed a contract with TYUMENFTORRESURS LLC in 2012 to remove accumulated legacy waste to final disposal sites outside of the battery limits of the South-Tambey Licence Area. The removal of these wastes started at the end of 2012. All accumulated legacy waste is scheduled to be fully removed in 2015.

7.6.3 IMPACTS AND RECEPTORS

The management of wastes, including the operation of the on-site SIDW and waste incinerators, poses a number of potential impacts to human health and the environment, including:

- Impacts on human health from hazardous waste
- Impacts on surface water from liquid waste
- Impacts on groundwater from liquid waste and leachate from the landfill
- Impacts on air quality from the operation of waste incinerators (these impacts have been assessed through dispersion modelling, which demonstrated that all applicable air quality standards will be met)
- Impacts on ecology from:
  - Contamination of terrestrial, freshwater and marine environments from liquid and solid waste
  - Attraction of vermin to waste storage areas

7.6.4 MITIGATION

These potential impacts will be managed through:

- The development and implementation of detailed waste management plans for the construction and operational phases that define the procedures and monitoring controls necessary to ensure that all wastes are handled in line with good practice. These will encompass a range of good practice measures, including but not limited to:
  - Adoption of the waste hierarchy to 'reduce-reuse-recycle'
  - Storage and segregation of wastes in suitable containers at source, with regular collection for removal to the central waste management facility
  - Training of personnel
  - Vermin control (e.g. removal/control of food wastes, bait boxes, etc.)
- The appropriate design of the waste management facilities, including the SIDW landfill and incinerators.

Key elements of the design of the SIDW landfill include:

- Location of the SIDW landfill to minimise environmental impacts (e.g. in an area of relatively low permeability soils and outside of surface water protection zones)
- Installation of groundwater monitoring wells around the SIDW
- Provision of a low permeability liner and leachate collection systems.

The incinerators will be designed to meet international standards for air emissions, including the destruction of harmful substances such as dioxins.

7.6.5 RESIDUAL IMPACTS AND CONCLUSIONS

Residual impacts associated with waste management are assessed as **Low**.

7.7 NOISE AND VIBRATION

7.7.1 BASELINE CONDITIONS

Due to the remote and largely unpopulated nature of the Project Licence Area, anthropogenic (human-related) background noise levels are minimal. As such, background noise levels are dominated by natural phenomena such as wind and sea induced noise.

Underwater noise can impact fish and, more particularly, marine mammals. Marine mammals are generally not present in significant numbers in the Gulf of Ob. However, some seal species (e.g. ringed seals) have been infrequently observed as far south in the Gulf of Ob as Sabetta seaport. Whales (including beluga whales) have been identified as potentially present in the more northerly portions of the Gulf of Ob, although are considered unlikely to be present as far south as Sabetta seaport.

7.7.2 IMPACTS AND RECEPTORS

Airborne noise will be generated during the construction and operation phases, which can lead to noise disturbance of humans and animals, especially birds.

The only permanent human population that may be affected by noise is the work force, and hence the human receptor locations considered in the noise assessment are the worker accommodation facilities. Noise modelling has been undertaken around the main Project facilities/construction areas and has shown that noise disturbance levels are limited to the near vicinity of the main Project facilities/ construction areas and that noise standards are met at the nearest human receptor sites. For the operational phase, the modelling has also demonstrated that noise standards are met comfortably at the perimeters of all the facility SPZ; the SPZ around the main Project facilities are shown in Figure 7.7.1 below together with the 45dB (the night time noise limit standard for residential areas) contour.

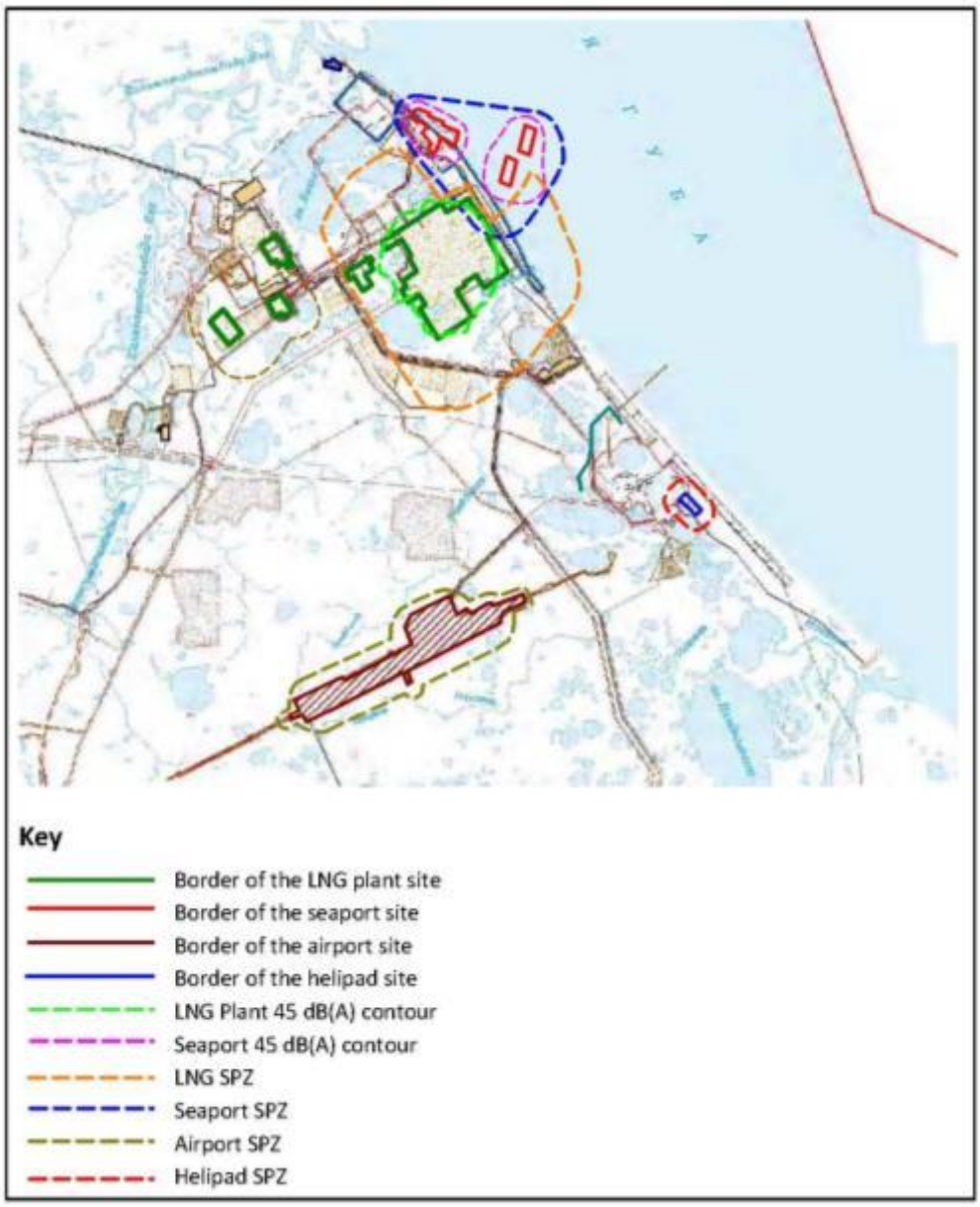


Figure 7.7.1 Summary SPZ and 45dB(A) contours around main facilities

Overall, noise impacts from the construction and operation of the land-based Project facilities on both humans and animals are limited to within close proximity of the Project facilities/construction areas themselves. As such noise impacts on animals from these facilities are not considered significant.

However, one source of airborne impact that may result in more significant impact, especially on birds during the breeding season, is noise disturbance from aircraft operating out of the Sabetta airport. Helicopter movements, especially those used to access remote parts of the Licence Area, may be the source of particular noise nuisance due to their low flight altitudes and relatively slow speed (leading to longer duration periods of disturbance). Fixed wing aircraft are likely to be less important in terms of noise disturbance as they will operate within more limited take-off and landing flight paths, will be few in number (around 4 flights per day), and the duration of each noise event will be short.

In addition to airborne noise, the Project will also result in the generation of underwater noise. The primary sources of underwater noise will be: piling during the construction of the jetty; dredging; and vessel movements and most especially ice-breaking by vessels. Underwater noise impacts on marine animals can include both physical harm (in the case of extremely high noise levels, for example where marine animals are present very close to the noise source) and behavioural change/disturbance.

Noise disturbance zones have been assessed as being around 1km for dredging activities and 4km for piling (reducing to less than 1km if vibropiling rather than impact hammer techniques are used). Risks of physical harm are limited to the immediate vicinity of the construction activities.

Noise impacts associated with ice-breaking are most pronounced for beluga whales. This is because beluga swim relatively large distances under the ice edge (up to around 100km under the ice), and it is thought that beluga are especially sensitive to noise disturbance when swimming under ice. Based on review of available research, it is cautiously assessed that ice breaking may lead to disturbance of beluga whale at distances of up to 50km. However, it is noted that such impacts only occur when the ice edge is within 150km of the shipping route, which only occurs during two relatively short periods per year. In addition, beluga whales are extremely unlikely to be found in the Gulf of Ob during ice conditions, and the Kara Sea in general is not a primary habitat for beluga whales.

No significant vibration impacts are anticipated (except as related to the generation of underwater noise as described above).

7.7.3 MITIGATION

Noise levels from the land-based Project facilities/construction areas will be controlled through a range of good practice measures, including selection of low noise equipment, installation of soundproof structures where necessary, and performance of regular equipment maintenance.

Noise impacts from aircraft will be mitigated through:

- Use of fixed wing aircraft (rather than helicopters) to transport personnel to the Project License Area once the airport becomes operational
- Daytime operation only of aircraft (fixed wing aircraft and helicopters)
- Flight route design to avoid overflight of residential/accommodation camps
- Helicopter flight route design to avoid overflight along the coastal strips (to avoid impacts on seabirds and marine mammals
- Adherence to minimum altitude heights for helicopters except where safety requirements over-ride.

Underwater noise impacts will be controlled through the adoption of the following measures during piling activities:

- Use of vibro-piling for jetty construction
- Use of soft-start procedures (to ensure marine fauna are displaced from the immediate vicinity thus avoiding the risks of physical harm)
- Use of marine mammal observers to ensure that marine mammals are not present within close proximity before piling commences.

7.7.4 RESIDUAL IMPACTS AND CONCLUSIONS

All residual noise impacts on humans are assessed as **Low** to **Negligible**. Residual noise impacts on terrestrial animals are assessed as **Low**, with the exception of helicopter noise disturbance to birds, which is assessed as **moderate**.

Residual noise impacts on marine fauna from dredging and piling are assessed as **Low**. Residual noise impacts on beluga whales from ice-breaking are assessed as **Moderate**.

7.8 TERRESTRIAL FLORA AND FAUNA

7.8.1 BASELINE CONDITIONS

General

Terrestrial species and habitats identified in the project License Area are typical of the wider arctic tundra environment in which it is located. There are no designated sites or otherwise protected areas within the Area of Influence.

Habitat Types

There are a range of habitat types within the License Area, including five sub-categories of tundra vegetation habitat types, bogs, floodplain habitats, sandy habitats and water bodies (lakes and rivers). Small land parcels of Forb-graminoid, horsetail graminoid meadow communities have been identified on valley slopes within the Licence Area (see Figure 7.8.1), and which have been assessed as being 'Critical Habitat' under the criteria defined within international lender standards adopted by the Project (i.e. IFC Performance Standard 6). These habitat parcels are too small to be measured by remote sensing, and further botanical field studies in the License Area were commissioned for 2014 to better understand their potential presence.

Figure 8.8.1 Forb-graminoid, horsetail graminoid meadow communities on valley slopes

The tundra habitats include pasture areas for reindeer, although evidence of over-grazing of such pastures has been identified (see also Chapter 8). Over-grazing by reindeer is also through to have a negative impact on habitats for ground nesting birds.

Rare plants

No plant species have been identified that are listed in national (Russian Federation) or international (IUCN) red data lists of threatened species. A single species listed in the regional (YNAO) Red Data Book has been recorded in the License area, namely northern Jacob's ladder (status 3 – a rare species).

Fish

The rivers and lakes within the Project license Area as well as the brackish coastal waters of the Gulf of Ob may have up to 27 fish species, of 14 families. During surveys in 2013, 14 freshwater/ anadromous[7]/semi-anadromous fish were recorded within the Project License Area, along with two marine species. None of these species are listed on the regional (YNAO), national (Russian Federation) or international (IUCN) Red Lists. Neither Siberian sturgeon nor sterlet, which are IUCN RL Endangered and Vulnerable species respectively, are thought to be present in the Gulf of Ob waters, were recorded during surveys undertaken in 2013. Neither species is considered likely to regularly occur within the Project License Area.

See also Chapter 8 for consideration of fisheries.

Birds

The avifauna in the Arctic tundra subzone in the north-eastern parts of the Yamal peninsula includes about 80 bird species, of which 52 are likely to breed (46 confirmed and six probable), five species are transient migratory and around 25 species are vagrant. The proximity of the coast, together with the large area of wetlands means that aquatic and semi-aquatic bird species are common in the Yamal peninsula.

The majority of the breeding bird species present in the Project Licence Area are long-distance migrants. Precise understanding of breeding bird habitats, and estimation of the size of the bird populations within them, is currently difficult to determine due to data deficiency. Key among the uncertainties in this regard is the uncertainties in bird densities identified during 2013 field surveys due to the atypical conditions encountered, although breeding bird density estimates within the Project Licence Area have been produced by earlier studies. In order to further investigate the nature of the potential breeding bird habitats, additional field surveys will be undertaken in 2014.

Of the birds having been previously recorded breeding within the Project License Area, a number have been assessed as threatened by either the IUCN (IUCN Red List (RL)), the Russian Federation (RF Red Data Book (RDB)) and/or the YNOA (YNAO RDB).

- **Black-throated diver** *(Gavia arctica)* assessed as category 2 (by the RDB RF). Not included in RDB YNAO and assessed as Least Concern by IUCN RL.

[7] Anadromous fish species are ones that migrate from the sea into fresh water to spawn.

- **Brent goose** (*Branta bernicla*) assessed as category 3 by the RDB RF. Not included in RDB YNAO and assessed as Least Concern by IUCN RL.
- **Steller's eider** (*Polysticta stelleri*). Not included in RDB RF or RDB YNAO. Assessed as Vulnerable (VU) by IUCN RL.
- **Long-tailed duck** (*Clangula hyemalis*). Assessed as Vulnerable (VU) by IUCN RL. Not included in RDB RF or RDB YNAO.
- **Peregrine** (*Falco peregrinus*). Included in the RDB RF (category 2) and RDB YNAO (category 3) and assessed as Least Concern by IUCN RL.
- **Snowy owl** (*Bubo scandiaca*). Listed within RDB YNAO (category 2). Not included in RDB RF and assessed as Least Concern by IUCN RL.

7.8.2 IMPACTS AND RECEPTORS

The development of the physical Project facilities will inevitably lead to loss of habitats. Each of the different natural habitats in the License Area will lose between 1 to 2.5% of their area due to the physical footprint of Project facilities. The effect is limited to some extent by the re-use of lands that have been subject to previous historical disturbance (see Section 7.3 above). This loss of habitat could potentially impact plant species, including Forb-graminoid and horsetail graminoid meadow communities, although generally the risk of this is reduced as the Project facilities are generally located away from river valley slopes.

Bird species may be affected by both loss of habitat (as described above) and through noise impacts, with noise disturbance by helicopter movements identified as the impact of highest likely significance.

Fish species may be affected by the same mechanisms as for impacts to surface waters described in Section 7.4 above.

7.8.3 MITIGATION

The primary mitigation controls for the loss of terrestrial habitat include:

- Minimization of the project footprint and maximization of the use of historically disturbed lands (to minimise loss of undisturbed natural habitats)
- A Biodiversity Action Plan (BAP) and off-setting strategy will be produced to compensate for habitat loss.
- For the protection of Forb-graminoid and horsetail-graminoid meadow community habitats, the following mitigation will be implemented:
  - A pre-construction survey will be completed to produce a detailed map showing areas of Forb-graminoid and horsetail-graminoid meadow communities.
  - Roads, pipelines and transmission lines will be micro-sited to avoid losses of Forb-graminoid and horsetail-graminoid meadow communities.
  - A detailed assessment will be completed to assess precise levels of loss of Forb-graminoid and horsetail-graminoid meadow communities caused as a result of construction activities
- For the protection of rare plants:
  - Pre-construction surveys will identify any rare plants in the footprint of the development.
  - Any rare plants will be translocated to unaffected areas prior to construction.

  - Populations of rare plants within the Project License Area will be monitored.
- For the protection of birds:
  - An off-setting strategy will be produced as part of the BAP to compensate for bird habitat loss. Measures may include working with local people to reduce the effects of overgrazing.
  - Bird populations will be monitored over the lifetime of the Project. The results of the monitoring will feed into the BAP to inform actions taken.
  - Implementation of the mitigation controls to minimize aircraft disturbance of birds as described in Section 7.7 above.
- Reinstatement of:
  - Temporary construction areas immediately after construction
  - Legacy waste and contamination areas within the Project License Area
  - The Project facilities at the end of the lifetime of the Project

For the protection of fish habitats, see the mitigation measures identified in Section 7.4 above.

7.8.4 RESIDUAL IMPACTS AND CONCLUSIONS

With the implementation of the mitigation controls identified above, the residual impacts on terrestrial fauna are reduced from **Moderate** (without mitigation) to **Low/Negligible** (with mitigation, including the development of the BAP). The only exception to this is noise disturbance to birds from helicopters, which is assessed as a **Moderate** impact as described in Section 7.7 above.

7.9 MARINE FLORA AND FAUNA

7.9.1 BASELINE CONDITIONS

Benthic (Sea Bottom) Species

Benthic studies have been undertaken in the Gulf of Ob, with particular emphasis on the northern part of the Gulf where dredging will be undertaken,. Overall, the studies indicate:

- The northern part of the Gulf of Ob, which has greater salinity levels, is characterised by low biomass and abundance rates and poor species composition.
- Surveys in the near-shore area of the Gulf of Ob found low levels of zoobenthos development, which indicates that these areas of the Gulf of Ob lack food sources for fish populations.
- No protected benthic species have been identified in the surveys.

The flora and fauna in the northern part of the Gulf of Ob are regularly subjected to natural impacts of ice gouging and are able to recover after such impacts. However, the recovery processes at higher latitudes is slower and, due to this reason, the biodiversity in the project dredging areas in the north is lower than in the middle and southern parts of the Gulf of Ob.

Fish

Fish species in the Gulf of Ob include a number of marine and anadromous fish species (see also Section 7.8 above). None of the species identified in the Project Licence Area during surveys undertaken in 2013 are listed on the regional (YNAO), national (Russian Federation) or international (IUCN) Red Lists (RL). Neither Siberian sturgeon or sterlet, which are IUCN RL Endangered and Vulnerable species respectively, were recorded during surveys undertaken in 2013, although they are thought to be present in the Gulf of Ob waters.

See also Chapter 8 for consideration of fisheries.

Whales

No whales were recorded during the marine mammal survey that was carried out in 2013 for the ESIA. However, the following three species of whales are thought to have the potential to occur in the Gulf of Ob, although year-round use is excluded by fast sea ice. :

- Beluga whale (*Delphinapterus leucas*). There is limited information about population abundance of beluga whales in the Russian sector of the Arctic (including the Kara, Laptev and East Siberian Seas). They are the most abundant whale species in the Kara Sea, which provides an important summer feeding area for the species. The Kara Sea beluga whale population is thought to over-winter in the Barents Sea. The beluga whale is classified on the IUCN RL as Near Threatened, but is not included in the RDB RF and is included in the RDB YNAO as insufficiently studied and uncertain in status.
- Fin whale (*Balaenoptera physalus*). Available research indicates that the main range of the fin whale does not extend into the Kara sea, although anecdotal reports of fin whale sightings occur from the northern end of Yamal peninsula. The fin whale is classified by the IUCN RL as Endangered and category 2 in the RDB RF.
- Bowhead whale (*Balaena mysticetus*). The bowhead whale population in the Svalbard-Barents Sea area has not been estimated due to low numbers, although up to 17 bowhead whales were sighted on summer surveys between 2006 and 2008 in North-East Greenland and the Fram Strait, indicating that whales do persist in this area. There is a small population in the Sea of Okhotsk that likely number less than 400 animals, but no recent surveys have been conducted. The bowhead whale is assessed of being of Least Concern by the IUCN RL.

Based on the survey evidence and available information it is considered unlikely that whales occur regularly within the Gulf of Ob as far south as the Project Licence Area. However, the presence of whales in the more northern reaches of the Gulf of Ob and up to the Northern Sea Route cannot be ruled out.

Seals

Bearded seal (*Erignathus barbatus*) and ringed seal (*Phoca hispida*) are the two most common species of seal found along the coastline of the Gulf of Ob and Kara Sea. Harp seal (*Phoca groenlandica*) is also present. However, the main area for these species in the region is on the northern border of the Yamal Peninsula. Ringed seal were regularly recorded at sea and on the coast of the Gulf of Ob during 2013. They also enter the mouths of a number of rivers on the coast, particularly at high tide.

Polar Bear

In the Russian Arctic, polar bears spend most of the year out to sea, although they also occur on-land depending on the abundance of food or the presence of unusual ice conditions. The detailed distribution of polar bears within the Kara Sea is not known, although sightings from vessels using the northern sea route show that they occur along the northern shore of the Yamal Peninsula. Isolated reports of polar bears have been recorded in the territory of the Project License Area, but, overall, the Project License Area is not considered to form part of the Polar bears' primary habitat.

7.9.2 IMPACTS AND RECEPTORS

Dredging represents the primary potential impact on the marine environment. Impacts that can result from dredging include:

- Benthic species:
  - Physical disturbance/removal in the areas being dredged
  - Smothering effects, both in the spoil disposal areas and in wider areas around dredging due to settling of raised sediments in the wider area
- Fish (non-benthic):
  - Loss of prey associated with loss of zoobenthos (as described above)
  - Physical impacts (e.g. on gill function) and disturbance (avoidance) effects of sediment plumes

The spatial extent of the sediment plumes and sedimentation are as described in Section 7.4 above. In terms of the assessment of significance of such impacts, while baseline studies indicate that the benthic resources are of a low value, the likely slow rates of recovery also need to be taken into account.

Marine mammals may also be impacted by underwater noise generated during dredging and construction of the seaport jetty, and these impacts are assessed in Section 7.7 above. Another potential impact on marine mammals is that associated with the physical disturbance of ice habitat during ice-breaking activities by vessels. Potential impacts from ice breaking can include destruction of seal breathing holes, haul-out areas, seal lairs and polar bear dens. However, the area affected by direct disturbance from ice breakers is limited largely by the width of the icebreaking ships and, in the context of the entire Kara Sea, would not be a significant proportion of the total available ice habitat.

Liquid discharges to the marine environment may also affect water quality and aquatic fauna. Potential marine discharges include treated waste water from the shore-based Project facilities and ship discharges, including ballast waters. The potential impacts associated with these discharges are described in Section 7.4.

7.9.3 MITIGATION

Mitigation controls for impacts associated with ice breaking include the use of dedicated shipping routes (to minimize the total area disturbed).

Mitigation controls for underwater noise impacts are as described in Section 7.7.

The primary mitigation controls for the protection of the marine environment from dredging and discharges to the marine environment are as described in Section 7.4. In addition, and specifically

in relation to impacts on fish and fish spawning areas from dredging activities, Yamal LNG will support the creation of facilities for reproduction of valuable fish species. Yamal LNG will also use best endeavours to ensure that Rosmorport (who will be performing and managing the dredging activities) provides continuous monitoring and complies with regulatory compensatory measures to ensure that damage to aquatic biological resources is compensated in a timely manner. In terms of mitigating the risk of introducing invasive species via ballast waters, ballast waters will be exchanged in deep waters (i.e. the Kara Sea) to prevent introduction of alien coastal species to the Gulf of Ob.

7.9.4 RESIDUAL IMPACTS AND CONCLUSIONS

With the adoption of the mitigation measures identified above, the residual impacts on the marine environment are assessed as:

- **Moderate** for impacts associated with dredging (see also Section 7.4)
- **Moderate** for underwater noise impacts (see also Section 7.7)
- **Low** for impacts associated with ice disturbance from icebreaking
- **Low** for impacts associated with discharge of treated wastewater from shore (see also Section 7.4)
- **Low** for impacts associated with discharge of ballast water (see also Section 7.4).

8 SOCIAL ASSESSMENT

8.1 BACKGROUND

8.1.1 POPULATION OVERVIEW

The Project Licence Area is situated in the Yamalsky district of the Yamal-Nenets Autonomous Okrug (YNAO). YNAO is characterised by a very low population density averaging 0.7 people/km^2. Administratively, the regional centre of YNAO is the city of Salekhard (see Figure 8.1.1). The Yamalsky District is one of seven municipal districts that comprise the YNAO. The population of the Yamalsky District is approximately 17,000, over 11,000 of whom belong to the Indigenous Peoples of the North (IPN), and of which over 50% lead a nomadic way of life.

Yar-Sale (population approximately 6,500) is the administrative centre of Yamalsky District and is located in the south of the district, some 460km to the south of the Yamal LNG Project Licence Area (see Figure 8.1.1). The permanent settlements nearest to the Project Licence Area are:

- Seyakha village (population 2,605)
- Tambey village (population 34)

Figure 8.1.1: Map of YNAO and Yamalsky District

8.1.2 HUMAN RECEPTORS IN THE PROJECT AREA OF INFLUENCE

The human receptors that may be directly impacted by the Project (i.e. within the direct Project Area of Influence) are summarized below:

- Within the Project Licence Area:
  - Sabetta worker accommodation camp for shift-based personnel, located approximately 6km to the south of the main LNG site (the camp is a Project facility and will be used both during the construction and operational phases);
  - The Project's accommodation facility (camp) for the LNG operations personnel, to be situated to the west of the main LNG site, about 1,200m from the boundary of the LNG site;
  - A number of temporary mobile camps set up by some of the construction contractors accommodating up to 1,800 workers in total; and
  - Tambey village/factoria, located 30km to the north of the main LNG site.

- Outside the Project licence area:
  - Seyakha village, some 90km to the south of the licence area boundary and 120km from the main LNG site. The potential human receptors are mainly nomadic reindeer herders that use the licence area periodically as part of their traditional migrations and who are formally registered in Seyakha for their domicile.

The inter-settlement territories within the Licence Area are also considered to be part of the Project direct Area of Influence due to their use by the indigenous nomadic population as part of their migratory reindeer herding, and also use of lands for informal fishing and gathering of wild foods (see the description of indigenous peoples below).

In addition to direct impacts, the Project will also have indirect impacts beyond the direct area of influence (AoI), including:

- Neighbouring areas (and their existing users) subject to increased reindeer grazing pressure in the event that any reindeer are displaced from the direct AoI (Licence Area)
- Potential impacts (including positive effects) on region-wide social support structures (including health and education facilities).
- Socio-economic benefits to nearby communities and settlements within the Yamalsky District (including beneficiaries of Yamal LNG-funded social development programmes), affecting, among others, Yar-Sale and Salekhard.

8.1.3 INDIGENOUS PEOPLES

The most significant local population within the Project's direct AoI is the indigenous population who lead a traditional nomadic lifestyle herding reindeer. The Project Licence Area and the territory in its vicinity are used by members of the Ilebts Commune and some private reindeer owners (see Figure 8.1.2).

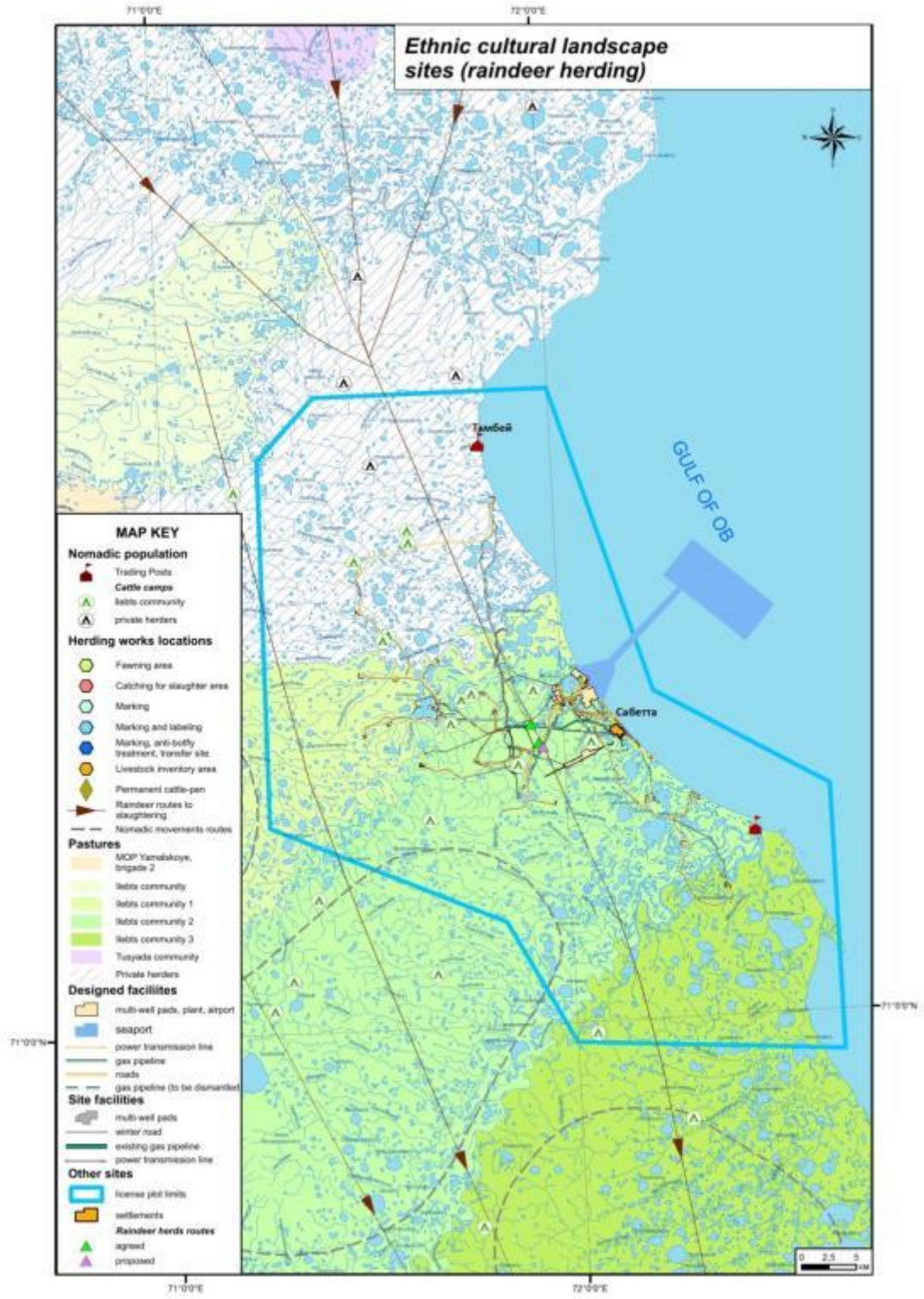


Figure 8.1.2: Land use within the Project license area and in its direct vicinity

Recent data indicates that 56 families (i.e. approximately 280 people) migrate within the Licence Area. Families form into groups and they migrate in a broad circular manner around the pasture areas (see indicative dotted lines in Figure 8.1.2).

In addition to the use of the Licence Area by the Ilebts Communes, other reindeer herder groups that use the pasture lands in the more northerly areas on the Yamal district will also traverse through, or near to, the Licence Area during annual southward migration to the slaughter facilities at Seyakha. These annual migratory routes are shown in Figure 8.1.3.

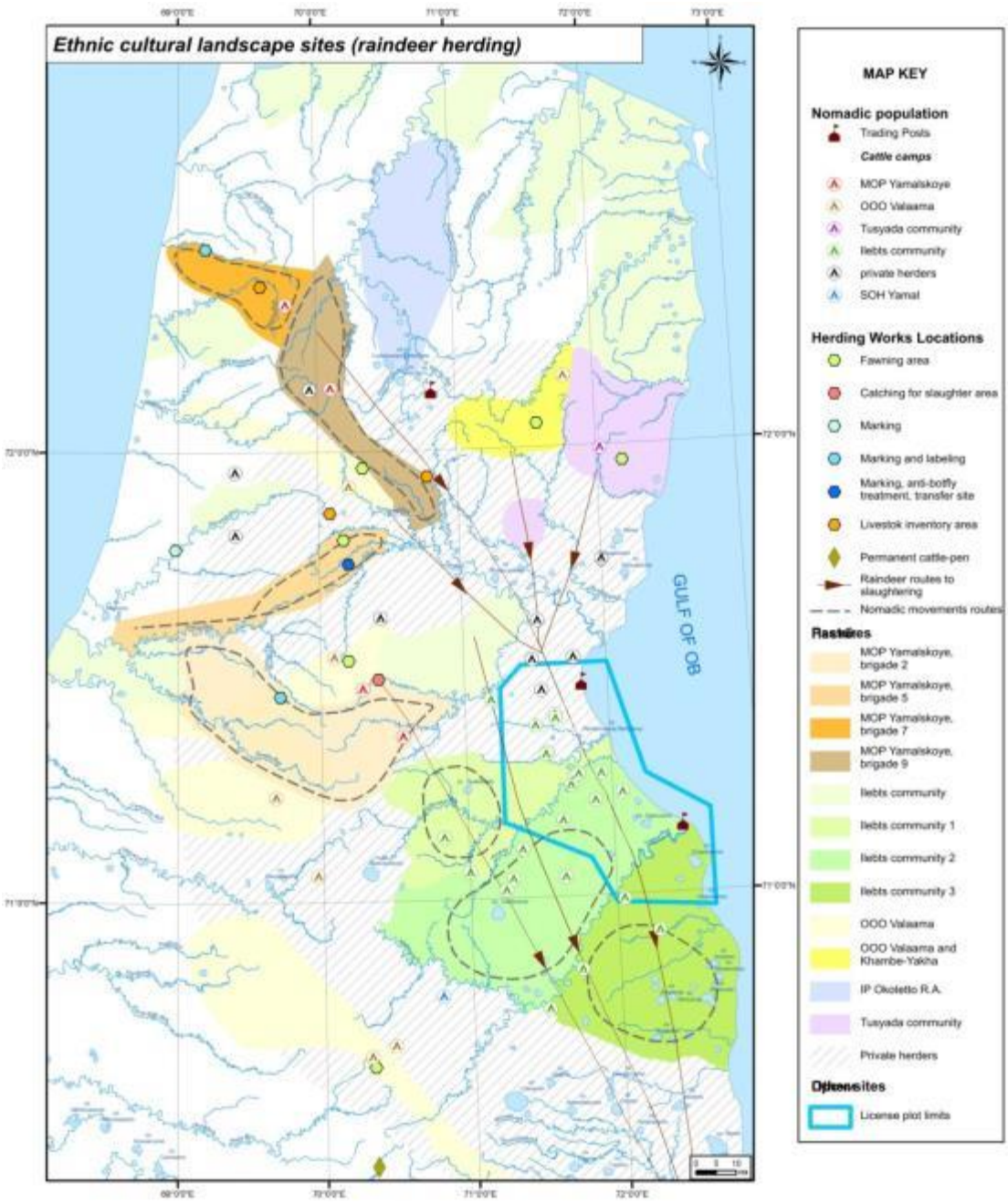


Figure 8.1.3: Nomadic reindeer herders and their migration routes in and close to the Licence Area

Sacred sites of the indigenous people are also associated with the annual migration routes, and, according to state records, include a number of sites within or adjacent to the Project Licence area, and these are shown on Figure 8.1.4 below.

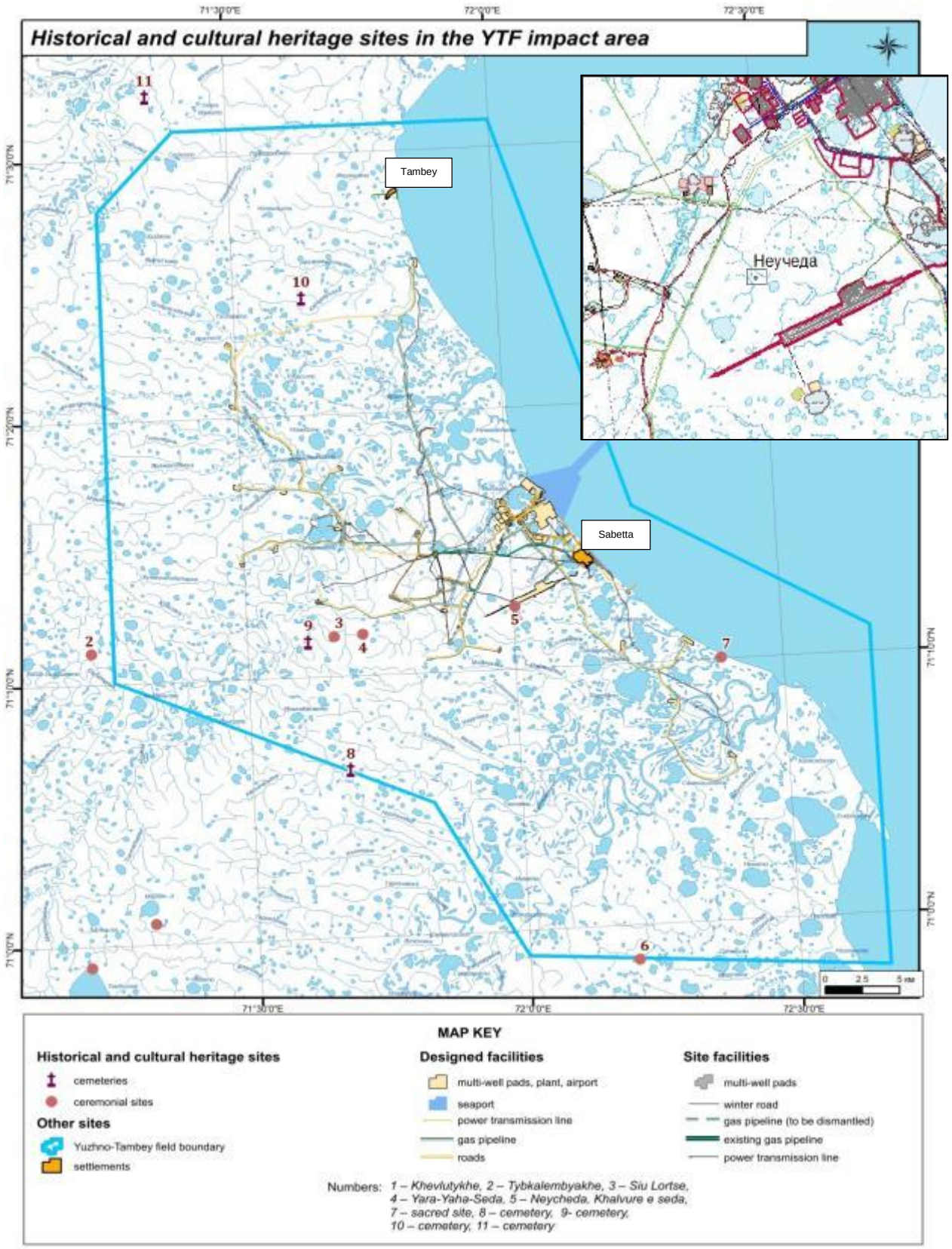


Figure 8.1.4 Location of sacred sites within the Project Licence Area and in the zone affected by the Project

To augment available state records, Yamal LNG commissioned site-specific surveys of the Licence Area in 2013. In the process of the archaeological survey, 49 sites were investigated, one object of cultural heritage was identified and 65 stratigraphic cross-sections plotted. The identified object of cultural heritage was an ancient settlement (known as “Salyangylnato 1”) located within the planned corridor for linear Project facilities (pipeline and transmission lines etc.) to well pad K-25 (see Figure 2.2). In light of this, Yamal LNG implemented appropriate mitigation to bypass the Salyanglnato 1 site (see Section 8.7 for further details).

8.1.4 FISHING, HUNTING AND GATHERING

Commercial and offshore fishing is prohibited in the Yamalsky district. However, indigenous peoples continue to fish without formally designated fishing grounds or special fishing permits. Reliable baseline information on these informal fishing practices is difficult to ascertain. According to the results of ethnological field studies conducted during the period from May through August 2013, traditional non-commercial fishing is focused on the estuaries of the rivers Sabettayakha and Vanuymueyakha. Reportedly, local people (exact numbers are unknown but roughly assessed as a few tens of individuals) come to these areas for autumn fishing. The research revealed that this type of fishing is not a subsistence activity (whereas reindeer herding is), but performed by locals mainly for diversification of their diet.

The reindeer herders also undertake seasonal hunting and gathering of wild foods during their reindeer migrations.

8.2 OVERVIEW OF SOCIAL IMPACT ASSESSMENT

Social impacts are assessed in terms of the following aspects:

- Community health, safety and security
- Population influx
- Land use
- Economy and employment
- Cultural heritage.

Each of these aspects is discussed in turn in the sections below.

8.3 COMMUNITY HEALTH, SAFETY AND SECURITY

8.3.1 IMPACTS AND RECEPTORS

The low population levels in the Project Licence Area, and the absence of permanent settlements in the near vicinity of the Project facilities, means that local community interactions with the Project’s facilities and personnel would be limited. Nonetheless, nomadic reindeer herders, in particular, will occasionally interact with the Project, and these interactions have the potential to result in a range of health, safety and security impacts including:

- Risks associated with interaction with Project personnel (some of which are heightened by the fact that the majority of the Project personnel will come from outside of the local region), including:

  - The spread of communicable disease (including the risk of diseases unusual in the Yamal region and to which the local population may have low immunity)
  - Stress effects from conflict situations or due to a lack of cultural sensitivity from Project workers (including security personnel)
  - Risk of increased access to drugs and alcohol
- Noise disturbance from construction and operational activities and equipment (these are described in Section 7.7 above and are not discussed further in this section)
- Air quality impacts due to emissions from Project equipment, especially during operations (these are described in Section 7.2 above and are not discussed further in this section)
- Health and safety risks associated with potential access to the Project's construction/industrial facilities
- Risks associated with Project road traffic
- Risks associated with Project emergency situations

8.3.2 MITIGATION

The mitigation of risks associated with interactions between the local population and the Project will be managed through a suite of project controls. The primary control mechanisms for such risks are the use of closed accommodation camps for the workforce (thus restricting the potential for uncontrolled interaction with the local community) and the use of perimeter fencing around Project facilities (to prevent access by the public to potentially dangerous construction and industrial sites). In addition to these primary controls, additional mitigation measure will include:

- Development of worker codes of conduct and cultural awareness training as part of worker induction programmes (including for security personnel)
- Screening of security personnel
- Health screening and provision of on-site health programmes for workers
- Prohibition of drugs and alcohol at all Project facilities, including the worker accommodation camps
- Implementation of a public grievance mechanism
- Measures to control road traffic risks including:
  - Driver training
  - Enforcement of speed limits
  - Establishment of crossing locations for reindeer herder at the Project's linear facility corridors (see also Section 8.5 below for further details)
- Development of Project emergency response plans.

8.3.3 RESIDUAL IMPACTS

With the adoption of the above mitigation measures, and also taking into account the low frequency of likely interactions of the local community with the Project, all residual impacts on community health, safety and security are assessed as **Low**.

8.4 POPULATION INFLUX

8.4.1 IMPACTS AND RECEPTORS

In addition to the community health, safety and security risks discussed above, the influx of a large Project workforce may result in increased pressure on district and regional infrastructure. However, the likelihood and scale of these impacts is limited by both the remote nature of the Project location and also by the basic Project design concept, including the development of dedicated Project facilities such as:

- Electric power generation
- Water supply and treatment facilities
- Worker accommodation
- Airport (for transport of workers to/from the Licence Area)
- Intra-field Project road network within the Licence Area
- On-site medical facilities.

8.4.2 MITIGATION

The primary mitigation controls are the basic Project design concepts described above.

8.4.3 RESIDUAL IMPACTS

The Project design concept means that impacts on the existing district and regional infrastructure are **low** to **Negligible**. Indeed, in the event of emergency situations the Project's medical facilities could be made available to the local community, leading to beneficial effects.

8.5 LAND USE

8.5.1 IMPACTS AND RECEPTORS

The main existing land use in the Project's direct Area of Influence is reindeer herding as described in Section 8.1. Potential Project impacts are physical loss of land and reduced access to lands. The impacts of physical loss of lands due to the physical presence of Project facilities is limited by the location of the main facilities (e.g. the LNG, seaport and Sabetta accommodation camps) in the coastal zones that are largely unsuitable for reindeer herding. However, the construction of linear facilities, including the airport runway, the network of above-ground gas gathering pipelines and intra-field roads, does have the potential to limit access to reindeer pasture lands (and also freshwater fishing areas and cultural heritage sites).

8.5.2 MITIGATION

The primary mitigation control to avoid loss of access to lands is the installation of crossing points (for people, skidoos and reindeer) at strategic locations along the linear Project facilities (and especially pipelines). The location of the crossing points is being agreed with representatives of the indigenous communities. The precise number and location of the crossing points will be

confirmed through this consultation process, but the preliminary layout of the proposed crossings is indicated on Figure 8.5.1 below.

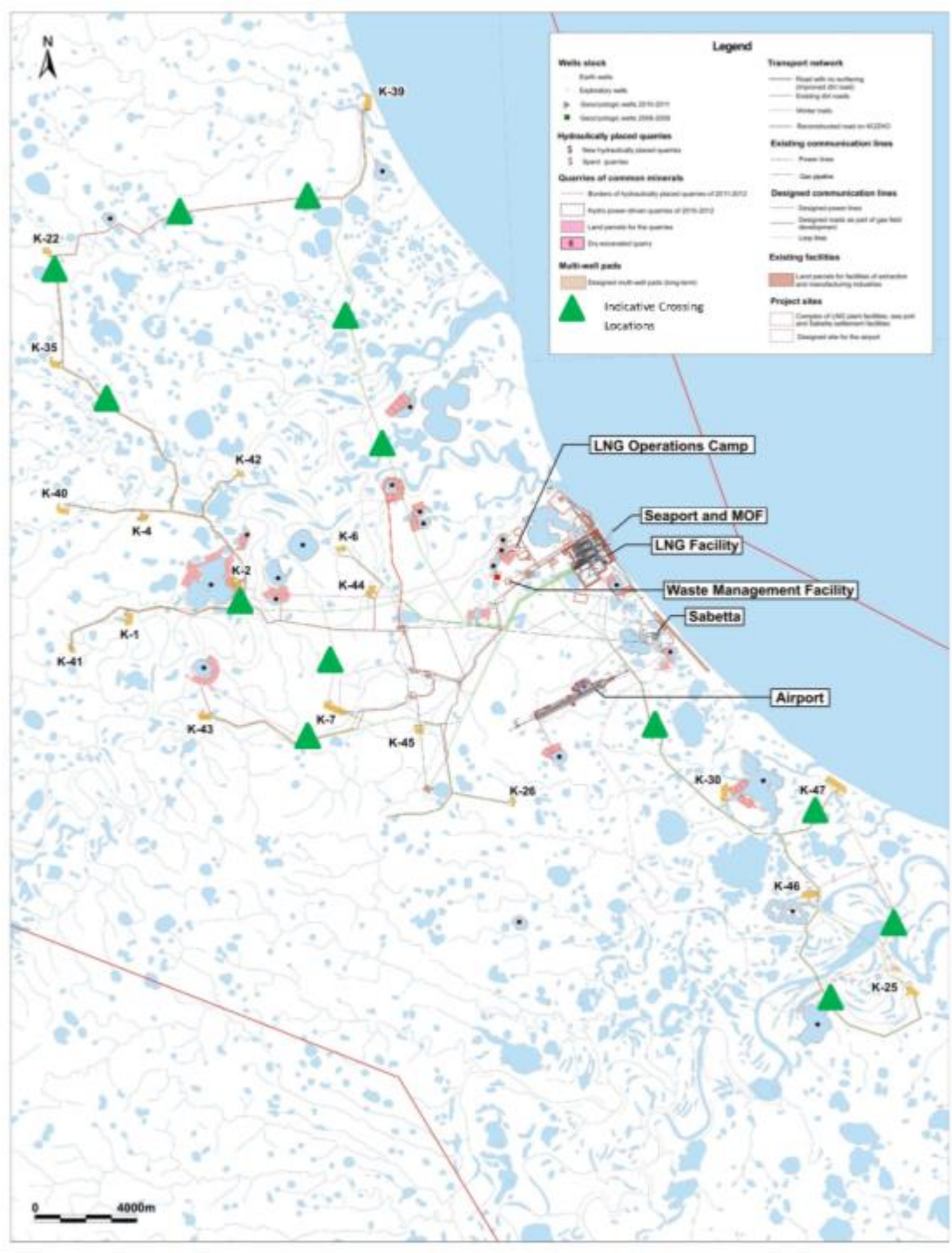


Figure 8.5.1 Location of the crossing points over the Project linear infrastructure

Development of the specific design of the crossings is currently underway and final designs will be made in agreement with representatives of the indigenous reindeer herders.

8.5.3 RESIDUAL IMPACTS

With the installation of crossing points, residual impacts on land use access are assessed as **Low**.

8.6 ECONOMY AND EMPLOYMENT

The Project has the potential to lead to benefits to the local economy through direct employment opportunities and also indirect benefits to the local supply chain economy. The numbers of reindeer and reindeer herders on the Yamal peninsula have been increasing over recent years, and there is now some evidence that at least some reindeer pasture lands in the district are reaching carry-capacity. This makes potential Project-related employment opportunities for the local indigenous populations of particular value. In order to maximize such benefits to indigenous people, Yamal LNG has committed to the following employment policies:

- Preferential recruitment of employees from the local population (including indigenous population) by use of a 'local candidates' database' before interviewing any non-local candidate;
- Liaison with YNAO and the Yamalsky District educational institutions to provide relevant training for the local population;
- Development and use of incentive mechanisms to encourage contractors to recruit semi-skilled workers and workers with few or no qualifications from the local area;
- Primary employment of indigenous people for work positions that do not conflict with their traditional lifestyle (e.g., control of reindeer crossings', environmental and cultural heritage monitoring, working as guides during execution of further field research in the area, etc.).

Overall, the employment and economic impacts on the local communities are assessed as being **beneficial**.

8.7 CULTURAL HERITAGE

8.7.1 IMPACTS AND RECEPTORS

Sites of cultural heritage of the local indigenous peoples are described in Section 8.1.3. Potential Project impacts on these sites may result from:

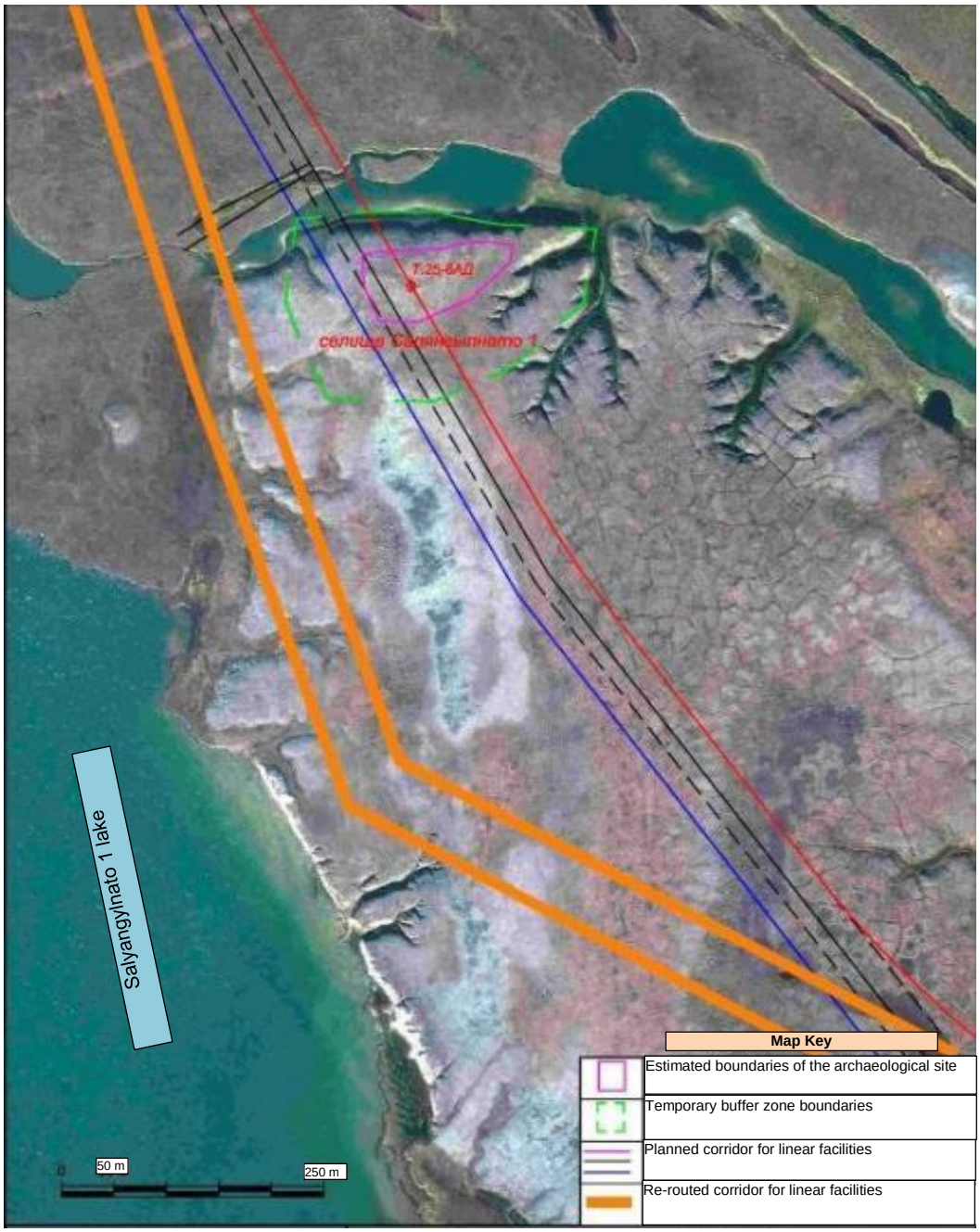
- Loss of access by the indigenous people to the sites
- Physical damage to the sites during Project construction.

8.7.2 MITIGATION

The mitigation controls for the protection of cultural heritage include:

- Performance of fields surveys and consultation with indigenous people to identify the location of cultural heritage sites (to enable these sites to be protected)
- Location/alignment of project facilities to avoid direct disturbance/damage to cultural heritage sites. This has included the re-routing of a pipeline corridor to avoid the Salyangylnato 1 site that was identified through field surveys (see Section 8.5 above for further details and also Figure 8.7.1 below)

- Installation of crossing points for reindeer herders at strategic locations along linear Project facilities to avoid loss of access to cultural heritage sites (see also Section 8.5)
- The development of a chance finds procedure that, in the event that previously unidentified cultural heritage sites/artefacts are discovered during construction activities, controls are implemented to ensure that these sites/artefacts are appropriately protected.



- **Figure 8.7.1: Location of the identified object of cultural heritage "Ancient Settlement Salyangylnato 1" in relation to the planned corridor route**

8.7.3 RESIDUAL IMPACTS

With the development and implementation of the above mitigation controls, residual impacts on cultural heritage are assessed as **Low** to **Negligible**.

9 TRANSBOUNDARY IMPACTS

The Project Area of Influence is not expected to extend beyond international boundaries on the basis of:

- The scope of the Project is located entirely within the Russian Federation (for example, the transport of LNG/condensate in existing shipping lanes, including the Northern Sea Route, is excluded from the scope of the ESIA because it is not considered within the Project Area of Influence).
- The extremely low levels of sulphur in the feed gas means that regional acidification effects of SO_2 generated by the operation of the LNG Complex and associated power generation plant will not be significant, and hence will not result in significant transboundary impacts.
- The effects of nitrogen deposition from the Project's combustion of natural gas are assessed in the ESIA, but given the location of the Project significant impacts are not anticipated to extend beyond national boundaries.

Significant transboundary impacts are therefore not anticipated. The one exception to this relates to emission of greenhouse gases (GHG) through the lifecycle of the Project and these impacts are addressed in the ESIA (see Chapter 6).

Project waste will generally be managed locally at the onsite waste facility. Select wastes will also be sent to third party licenced facilities for recycling, including scrap metals, spent catalysts etc. These will generally be facilities in the Russian Federation (only facilities with all relevant licences will be used), although during the operational phase small quantities of some wastes may also be sent to suitability licenced specialist international companies for recycling. In the event international companies are used for this recycling, the transport of such wastes will be undertaken in accordance will all applicable international laws and conventions (including the Basel Convention), and therefore no significant impacts are anticipated.

10 DECOMMISSIONING AND ABANDONMEMT

It is anticipated that the majority of the Project facilities will be in place for the full lifecycle of the Project (the Project Licence currently extends until 2045). Given that decommissioning of these main Project facilities will not be undertaken until many years into the future, precise details for the decommissioning process cannot be defined at the present time due to inherent uncertainties concerning (for example):

- Evolution of the relevant legislative environment at the time of decommissioning;
- The status of Project developments over the currently envisaged project lifetime;
- The development of future abandonment and decommissioning technologies and practices that may be available at the time of decommissioning.

The actual abandonment and decommissioning procedures will be designed and implemented through the development of an Abandonment and Decommissioning Plan, which will reflect good international industry practice (GIIP) and Russian regulations in place at that time. In broad terms, decommissioning and abandonment of the Project Licence Area will comprise the following activities:

- Operating processes will be systematically shutdown in a safe manner;
- Liquid and solid contents/wastes will be removed for treatment and disposal. For pipelines, tanks and process vessels this will entail flushing and cleaning to remove oils and grease;
- The fate of the emptied and cleaned structures, facilities and equipment will then be decided by a feasibility study to determine the best environmental, social and economic solution in line with GIIP;
- It is anticipated that all decommissioned aboveground structures will be removed and this will be facilitated by the modular design of the primary structures and process unit, which can be readily removed for offsite dismantling and disposal;
- Abandoned wells will be capped using GIIP;
- Following removal of structures, facilities and equipment, surveys will be undertaken to identify any areas of Project-related contamination and a reinstatement plan will be developed in line with GIIP;
- Certain Project facilities, including the main seaport and the airport are not operated by Yamal LNG and may be retained after the decommissioning of the Project if future use for these facilities is identified by their operators.

Given the above uncertainties, the significance of the environmental and social impacts associated with decommissioning and abandonment cannot be determined at this stage of the Project. Nonetheless, the adoption of the GIIP in place at that time will ensure that such impacts are minimised to within acceptable levels.

11 ENVIRONMENTAL AND SOCIAL MANAGEMENT

Yamal LNG will establish management programmes that describe mitigation, monitoring and performance improvement measures and actions that address the potential environmental and social risks and impacts identified through the ESIA process. These programmes will include procedures, practices and plans to ensure that all environmental and social aspects of the Project are managed and monitored in a comprehensive and systematic way. The programmes will apply across the Project, including both Yamal LNG and the contractors over which it has control.

In particular, Yamal LNG will produce an Environmental and Social Management Plan (ESMP). The ESMP will comprise a suite of individual environmental and social management plans (MPs) that define the Project's environmental and social requirements and describe how these requirements are to be managed throughout the Project's development. In particular, the MPs will describe:

- The organisational approach to environmental and social management, including definition of roles and responsibilities.
- The environmental and social standards to be applied.
- The specific management, mitigation and monitoring measures to be implemented. These will include the mitigation and monitoring measures identified under each topic area in the ESIA and which have been used to determine the residual environmental and social impacts in this ESIA.

Recognizing the dynamic nature of the Project, the MPs will be responsive to changes in circumstances, unforeseen events, and the results of monitoring and review. At this stage the ESMP and associated Construction Management Plans (CMPs) have been developed that address the construction phase of the Project. The structure for the construction phase ESMP is described in the ESMP (Construction) Framework Document, which forms part of the overall package for this ESIA, together with the individual CMPs. The operational phase ESMP will be developed at a later date prior to commencement of operations.

These plans will sit within the Project's overarching management systems, including Yamal LNG's Health, Safety & Environmental Management System (HSE MS) that is being developed to the international ISO14001 and OHSAS 18001 standards.