AMUR GAS PROCESSING PLANT

NON-TECHNICAL SUMMARY

Prepared by:
Ramboll CIS

Date:
May 2019

Contract No:	RU1100150
Issue:	3
Author(s)	Ivan Senchenya, Svetlana Chernova, Olga Tertitskaya
(signature):	
Project Manager/ Director (signature):	Ivan Senchenya
May 2019 2018	

Version Control Record

Issue	Description of Status	Date	Reviewer Initials	Author(s) Initials
A	First Internal Draft	15/04/2018	IS	SC,OT,IS
B	First Draft (to Client)	01.05.2018	IS	OT, IS
1	Final issued to Client	28.05.2018	IS	IS
2	Updated Final Issue	30.10.2018	IS	IS
3	Final Issue	15.05.2019	IS	IS

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABBREVIATIONS

ADT Advanced Development Territories

AGPP Amur Gas Processing Plant

AIIB Asian Infrastructure Investment Bank

AMR Access Motor Road

AoI Area of Influence

API Air Pollution Index

APR Asian Pacific Region

AR RDB Red Data Book of Amur Region

AS Archeological Sites

BCS Booster Compressor Station

BOD Biological Oxygen Demand

CHP Combined Heat Plant

CIA Cumulative Impact Assessment

CIS Commonwealth Independent States

CJSC Closed Joined Stock Company

CL Cable Line

CMP Construction Management Plan

CNPC China National Petroleum Corporation

EBRD European Bank for Reconstruction and Development

EC European Community

ECA Export Credit Agency

EGP Eastern Gas Program

EHS Environmental, Health and Safety

EIA Environmental Impact Assessment

EPC Engineering Procurement and Construction

ESAP Environmental and Social Action Plan

ESIA Environmental and Social Impact Assessment

ESMP Environmental and Social Management Plan

EU European Union

FCCW Federal Classificatory Catalogue of Wastes

FGTU Fuel Gas Treatment Unit

FGUP Federal State Unitary Enterprise

GAU CSN Amur Region Governmental Agency "Amur Region Center for Cultural Heritage Protection"

GCU Gas Compressor Units

GHG Greenhouse Gases

GPP Gas Processing Plant

GPPB Gazprom pererabotka Blagoveshchensk

HEGP HP Hazardous Exogenous Geological Processes and Hydrologic Phenomena

HSE MS Health, Safety and Environment Management System

IFC International Finance Corporation

IFI International Financial Institutions

ISO International Organization for Standardization

IUCN International Union for Conservation of Nature

IUTS Integrated Unit Transformer Substation

IW Industrial Waste

JBIC Japan Bank for International Cooperation

JSC Joint Stock Company

LHG Liquefied Hydrocarbon Gas

LLC Limited Liability Company

LNG Liquefied Natural Gas

LPG Liquefied Petroleum Gas

MPC Maximum Permissible Concentration

MPE Maximum Permissible Emissions

NGL Natural Gas Liquid

NGO Non-Governmental Organization

NTS Non-Technical Summary

OAC Office and Amenity Complex

OEC Operational Environmental Control

OECD Organization for Economic Cooperation and Development

OHS Occupational Health and Safety

OHSAS Occupational Health & Safety Advisory Services

OJSC Open Joint Stock Company

PDS Permissible Discharge Standard

PJSC Public Joint Stock Company

PM Particulate Matter

PPE Personal Protection Equipment

PS Performance Standard

PS Pollutant Substance

PSAoI Project Social Area of Influence

RATU Restricted Administrative Territorial Unit

RF Russian Federation

SAoI Social Area of Influence

SCIWC Specific Combinatorial Index of Water Contamination

SDIW Solid Domestic and Industrial Waste

SEP Stakeholder Engagement Plan

SN Sanitary Norms

SNIP Construction Rules and Regulations

SP Set of Rules

SPL Sound Pressure Level

SPZ Sanitary Protection Zone

SRLI Safe Reference Levels of Impact

SSM SvyazStroyMontazh

TBI Temporary Buildings and Installations

TDU Thermal Decontamination Units

TF Temporary Facilities

TPP Thermal Power Plant

VC Vapour Cloud

VCE Vapour Cloud Explosion

VEC Valued Environmental and Social Components

WEP Work Execution Plan

WHO World Health Organization

WI Water Intake

WIS Water Intake Structure

WLFH Wide light fraction of hydrocarbons

WTF Water Treatment Facility

WWTF Wastewater Treatment Facility

WWTP Wastewater Treatment Plant

1. INTRODUCTION

1.1 Introduction to the Project

Amur Gas Processing Plant (AGPP) will be constructed in the Far Eastern Federal District of Russia, in the Svobodnensky District of the Amur region (Figure 1.1). It will be the largest gas processing plant in Russia and the second largest in the world by processing capacity. The design capacity of the plant will be 42 billion cubic meters of gas per year. The commissioning of the 1st start-up complex is scheduled for 2021.

Figure 1.1: AGPP Location

The basis for implementation of this Project has been determined in the following essential documents:

- Governmental Program for construction of a united system in Eastern Siberia and Far East of Russia for natural gas production, transportation and supply including potential export to the markets in China and other countries of the Asian Pacific region approved by the Russian Federation (RF) inistry of Energy Order No.340 of 03.09.2007[1].

AGPP will serve as an important link in the technologic system designed to supply natural gas to China via "Power of Siberia" gas pipeline (the Eastern route). On May 21, 2014 the Purchase and Sale Agreement for Russian gas supply by the Eastern route was signed between Gazprom and China National Petroleum Corporation (CNPC). The 30-year contract provides for Russian gas supplies of 38 billion cubic meters per year to China. On October 13, 2014 RF Government and the Government of the People's

[1] http://docs.cntd.ru/document/902059423

Republic of China signed an agreement on cooperation in natural gas supply from the Russian Federation to China by the Eastern route.

The AGPP will operate based on a tolling agreement (conversion of the toller's fuel - multi-component natural gas) with Gazprom export, the company that will perform all marketing operations with its products. In addition to natural gas, the commercial gas products produced by the plant will include ethane, propane, butane, the pentane-hexane fraction and helium. It is anticipated that the purified methane will be exported to China and annual 2 million-ton production of ethane will be supplied to the Sibur Group's planned Amur Gas Chemical Complex (GCC).

The Amur GPP will also include the world's largest helium production facility with a capacity of up to 60 million cubic meters per year. Being one of the global leaders when it comes to helium reserves contained in natural gas deposits, Russia could become the world's largest helium supplier with commissioning of the AGPP.

The organizational structure for the AGPP construction project is shown in Figure 1.2 below.

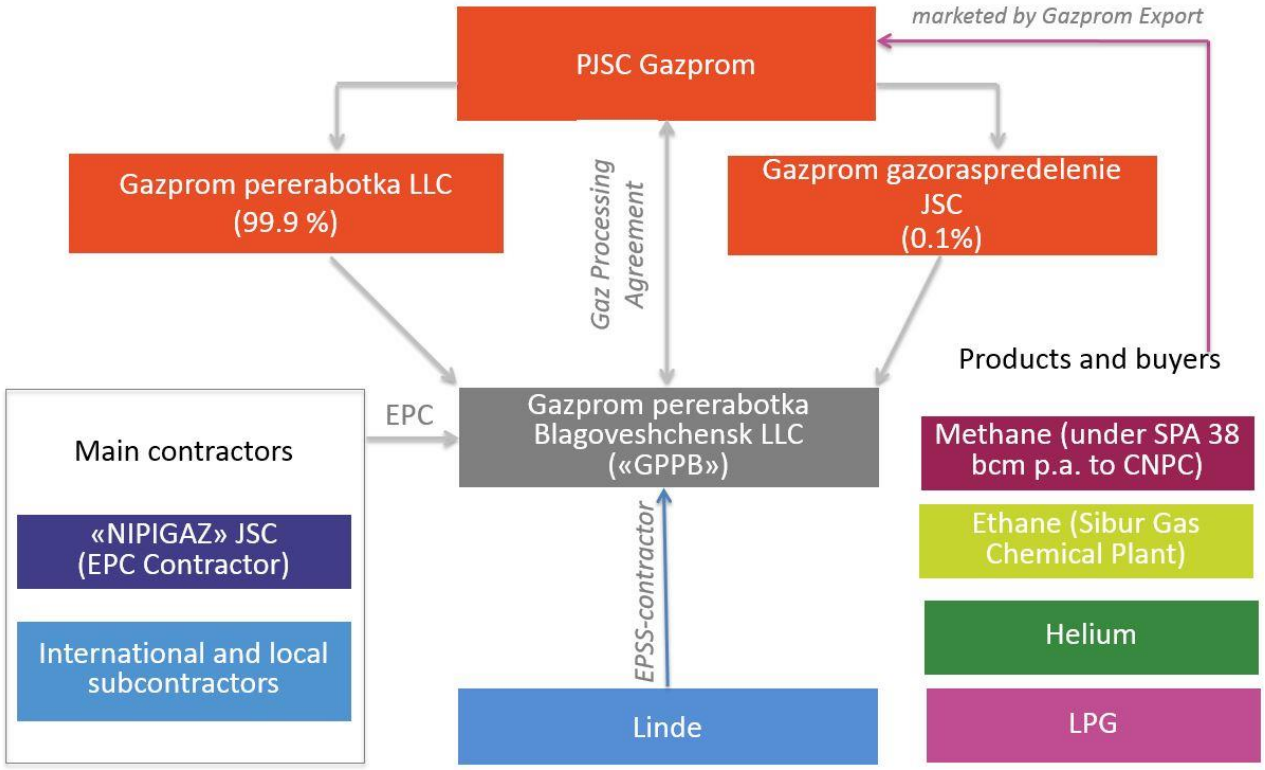

Figure 1.1: AGPP Project organizational structure

Gazprom pererabotka and Gazprom gazoraspredelenie by the decision of PJSC Gazprom established Gazprom pererabotka Blagoveshchensk (GPPB or the Company), which is a specialized company for implementation of the Amur GPP Project. GPPB and NIPIGAZ (NIPIGAZ is an entity within the Sibur group of companies)) entered in an agreement to design, coordinate delivery of equipment and materials for and manage construction of AGPP. NIPIGAZ will act as the general contractor responsible for Project implementation.

Linde AG (Germany) will supply core process equipment for AGPP for cryogenic gas separation and extraction of helium and valuable components for petrochemical industry. Peton, a technical and engineering holding company, has been engaged to adopt Linde's technologies under the import replacement program.

As part of the Project, Peton is planning to open a state of art training center in order to provide advanced training for process management and helium production plant staff.

1.2 Environmental and Social Requirements Applicable to the Project

The Company is seeking to procure long-term project financing for the Project and the development and operations stages. Funding is expected to be raised from Export Credit Agencies ("ECAs"), commercial banks ("Banks"), capital markets (including bond underwriters and bond investors), and other prospective lending institutions (collectively, the "Lenders" or "AGPP Lenders").

The Project is being developed in compliance with environmental and social requirements of the following laws and regulations:

- Russian law, codes and standards;
- All applicable international laws and conventions to which the RF is a signatory and which have been ratified into law in the RF; and
- Applicable international Lender requirements, including:
  - The Equator Principles (2013);
  - The Organization for Economic Cooperation and Development (OECD) Common Approaches (2012);
  - The World Bank/IFC Environmental, Health and Safety (EHS) Guidelines (April 2007) including the General EHS guidelines and applicable Industry Sector Guidelines;
  - The International Financial Corporation (IFC) Performance Standards (January 2012);
  - The European Bank for Reconstruction and Development (EBRD) Performance Requirements;
  - The Asian Infrastructure Investment Bank (AIIB) Environmental and Social standards;
  - Japan Bank for International Cooperation (JBIC) Guidelines for Confirmation of Environmental and Social Considerations (2012).

This document is a Non-Technical Summary (NTS) of the Project Environmental and Social Impact Assessment (ESIA) performed in compliance with the requirements of international Lenders' standards.

2. PROJECT OVERVIEW

2.1 General Information

The Project site is in the southwest of the Amur region, 10 to 15 km from the administrative center of Svobodny on the right bank of the River Zeya (the Amur's left tributary), and 146 km from Blagoveshchensk. The geographical coordinates of the center of the AGPP are 51° 32' 12" N and 128° 10' 56" E (WGS84).

The distances from the AGPP Project site to other nearby settlements are as follows:

- Yukhta settlement 2.3 km;
- Garden/Vegetable allotments of the Yukhta settlement 1.7 km;
- Tchernigovka village 7.14 km;
- Dmitrievka village 2.9 km.

The following economic conditions have been considered during site selection for the future gas processing plant and associated facilities[2]:

- Vicinity to the raw gas source, i.e. the "Power of Siberia" gas pipeline (2.3 km from Project site);
- Vicinity of the planned Sibur's deep hydrocarbon conversion plant which will use AGPP products as raw materials for operations;
- A convenient location at the crossing of transnational and transregional transport corridors);
- The availability of power supply infrastructure, i.e. electric power transmission lines and the planned Yerkovetskaya thermal power plant;
- Vicinity to the administrative district center (13 km to the town of Svobodny) as a potential source of workforce resources and a center of social, industrial, educational and medical infrastructure[3].

The AGPP site is located at the crossing of the following transnational and transregional transport corridors:

- The nearest airports are located at Blagoveshchensk and Svobodny.
- There are four river ports (Blagoveshchensky, Svobodnensky, Poyarkovsky, and Zeisky), which allow for the transportation of goods to/from China.
- The Trans-Siberian Railway is 2 to 5 km west of the Project site.
- The Federal motorway R-297 ("Amur") is about 7 to 8 km northeast of the Project site. The distance from the AGPP site to the federal route is approximately 23 km by road.

A satellite image of the Project site area is presented in Figure 2.1.

[2] Amur Gas Processing Plant. Project design documentation. Environmental Impact Assessment. Volume code: 4700-0095-OBOC. Ufa: Research Design Institute of Oil and Gas (RDI OG PETON), 2015.

[3] A residential settlement with a church complex will be located within the boundaries of the town of Svobodny

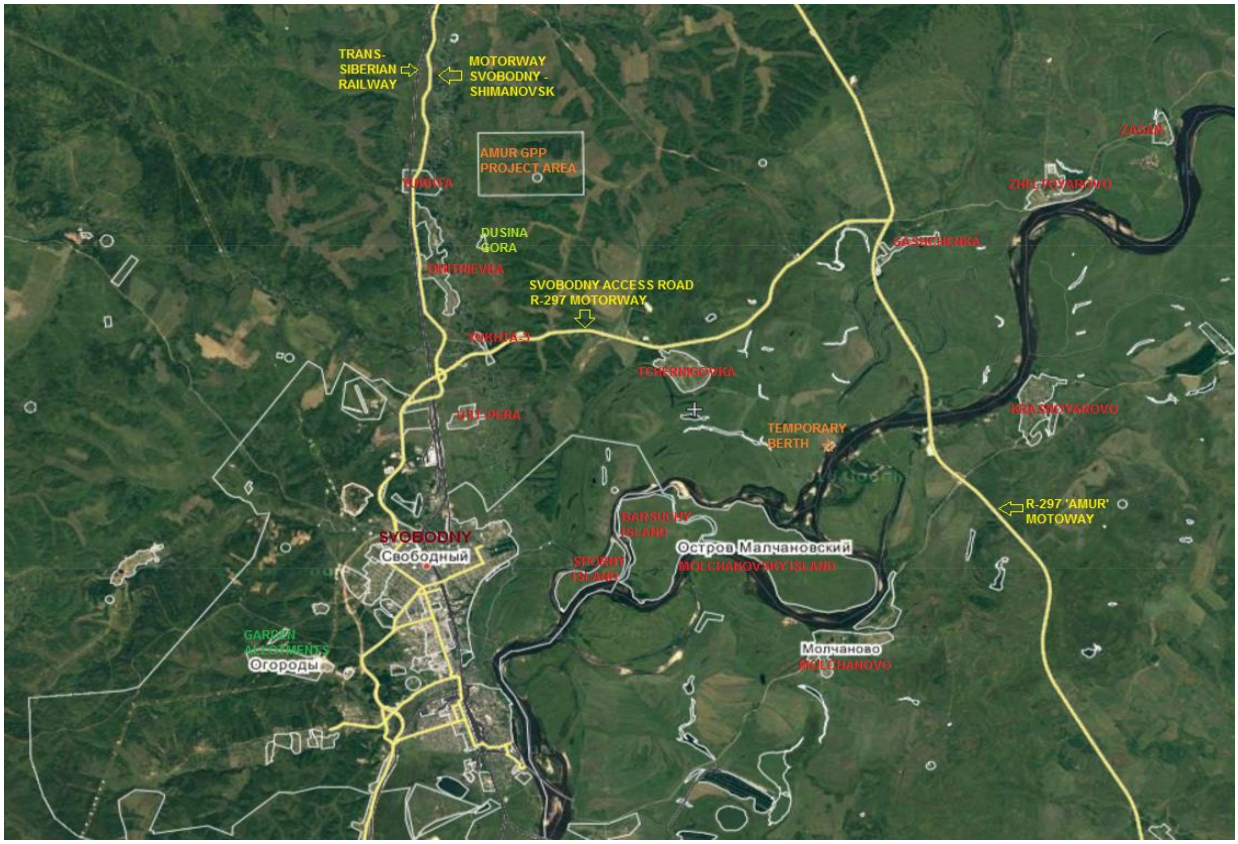

Figure 2.1: Satellite map of the Project location

The Project will include sites designated for main activities (gas processing and helium complex) and auxiliary activities (water intake and wastewater treatment facilities, railroad facilities). A residential area (microdistrict) in the town of Svobodny is planned to accommodate Project personnel and their families. The siting of the residential area has considered the location of the "Power of Siberia" pipeline system, existing railway lines and roads, as well as the topographic, geological, and hydrological features of the area. The following is a summary of the planned and existing facilities or features surrounding in the Amur GPP:

- The town of Svobodny is located 13 km to the north;
- The underground water intake facility site is located 870 m to the west;
- A solid domestic and industrial waste landfill lies 8.1 km to the southeast;
- Zavodskaya-1 railway station is located 600 m to the southeast;
- Zavodskaya-2 railway station is in close proximity to the "Ust-Pera" railway public station.

In addition, a temporary jetty was constructed on the right bank of the Zeya River for the transfer of oversized cargoes during plant construction (6 km from Tchernigivka village near the point where the River Gashchenka falls into the Zeya River).

Seismic intensity at the Amur GPP site has been estimated as seven points with an average occurrence period of T = 5,000 years (according to SP 14.13330.2014). The seismic hazard parameters for all buildings and structures located within the AGPP main production site, including the storage facilities and railway infrastructure facilities, have been rated as eight points. All other facilities located outside of the main Amur GPP site are rated as seven seismic hazard points.

2.2 Project Implementation Timeframe

Commissioning of the AGPP is scheduled for 2021. The Project will include implementation of the following stages/facilities and works (see Section 2.3 for details):

- Stage 1. Early works facilities (preparatory works);

- Stage 2. Railway infrastructure;
- Stage 3. Project infrastructure and auxiliary facilities;
- Stage 4. Gas Processing Plant;
- Stage 5. Residential district (microdistrict) in Svobodny outside the Project area (it is not funded as part of the Project);
-
- Stage 6. Solid Domestic and Industrial Waste Landfill.

These stages are not sequential and in some case the stages overlap or run concurrently, in accordance with the Project implementation schedule.

The start of AGPP construction was officially announced in October 2015. The design work was completed in May 2016. The Project was submitted to Glavgosexpertiza and the experts' positive conclusion was obtained on July 15 2016, which covered the auxiliary production facilities, Gas Processing Plant, and solid domestic and industrial wastes landfill. A positive conclusion was also obtained from Amurgosexpertiza (Regional Board of State Expert Review) for railway infrastructure facilities and automobile roads.

Preparatory works (Stage 1) have already been completed. Railway infrastructure (Stage 2) and auxiliary facilities (Stage 3) construction commenced in May to July 2016. Construction of a section of railway line connecting "Zavodskaya-2" and "Zavodskaya" stations (including railway bridge and overpass across the motorway) is completed by the end of 2017.

Works on Stage 4 (GPP) were commenced by GPPB in 2017. First it is planned to construct C_2H_6 and natural gas liquids (NGL) (propane, butane, pentane and hexane mixture) extraction and N_2 rejection unit; a helium production unit,[4] two units of gas drying and purification, gas fractioning unit, and NGL purification. They are scheduled to be commissioned in 2021. Four more gas processing units (one gas processing line per year) will be built by 2025.

The design documentation for construction of residential district (microdistrict) for Project personnel in Svobodny and Solid Domestic and Industrial Waste Landfill (Stages 5 (as discussed above) and 6) has been prepared.

2.3 Key Project Facilities

The AGPP complex encompasses several sites for main (AGPP) and auxiliary facilities (e.g. water intake, sewage treatment, railway transport, Solid Domestic and Industrial Waste (SDIW) landfill), as well as infrastructure facilities. A temporary rotational camp will be built on the Temporary Buildings and Installations (TBI) site to provide accommodation for construction workers, and a residential housing project will be constructed in Svobodny to accommodate AGPP support staff.

The key facilities, activities and processes planned for those sites appear below in the order of their proposed construction.

2.3.1 Stage 1: Early works facilities

This stage involves site clearance and landscaping, installation of engineering protection structures, construction of temporary facilities and structures, providing site accommodation for the construction contractors and other Project staff, providing water, heat, power supply, and wastewater treatment equipment for temporary facilities, building of a fence, including a checkpoint at the site entrance, and construction of temporary administrative and service building in close proximity to the main AGPP construction site. As for October 2018, early works completed.

[4] http://www.gasworld.com/russia-helium-surge-continues-as-linde-contracted-by-gazprom/2009834.article

2.3.2 *Stage 2: Railway Infrastructural Facilities*

Building of railway infrastructural facilities is area of responsibility of OJSC RZD. To meet AGPP needs, permanent facilities will be built to enable transportation of 2.4 million tons of cargo per year. This infrastructure will include a bridge across the Bolshaya Pera River, a highway overpass, nearly 45 km of non-public railway tracks, and two railway stations, "Zavodskaya" and "Zavodskaya-2", near the AGPP production facilities and "Ust-Pera" Station.

The "Ust-Pera" station upgrade activities include:

- extending of receiving and departure tracks to the minimum usable length of 1,050 m;
- tail track with the usable length of 300 m;
- crossover tracks between two main tracks ensuring exits from both "Ust-Pera" station bottlenecks;
- construction of spur tracks for attaching/detaching individual train cars to/from assembled trains and delivering rolling stock to "Zavodskaya-2" station.

The "Zavodskaya" station is located southeast of, and in close proximity to, the AGPP site, which will minimizing rolling stock traffic and the length of shunting tracks. The railway line between "Zavodskaya" and "Zavodskaya-2" is to be 17.4 km long. It was bulit according to the Project schedule.

A railway bridge was constructed across the Bolshaya Pera River, as will an overpass across the motorway leading to the town of Svobodny. The 252 m long railway bridge will consist of seven bridge spans, each 33.6 m long. The spans shall be placed on bridge abutments and pre-fabricated intermediate bridge pillars on reinforced concrete piles. The 85 m long overpass will consist of three spans on abutments and intermediate pillars on drilled piles.

2.3.3 *Stage 3: Auxiliary Facilities*

This stage includes construction of Project infrastructure for delivery and storage of over 2.6 million tons of cargo per year. It includes construction of access roads and bridges, vehicle parking lots and repair workshops, storage for diesel fuel and lubricants, a fuelling station, water treatment and sewage treatment facilities, a temporary rotational camp, transformer substations, an automated modular boiler plant (with a fuel line between the pumping station and the boiler plant), a communications block-container with a mast, a waste container enclosure, a fire depot and a parking lot for buses. In addition, a temporary jetty was constructed on the right bank of the Zeya River for unloading and temporary storage of oversized cargoes and heavy equipment for AGPP construction.

Power to the TBI facilities is supplied from the 10 kW network of AO "DRSK" with the backup from "NG Energo D1000/0.4 KN20" (three diesel generators, each with the rated capacity of 1,000 kW) and generated voltage of 10 kV.

объектов ВЗиС обеспечено от сетей 10 Кв АО «ДРСК» с резервированием от АГЦ «НГ Энерго Д1000/0,4КН20» (три дизельных агрегата единичной мощностью 1000 кВт), генераторным напряжением 10 кВ.

Temporary jetty at the Zeya River. The jetty will handle 32,000 tonnes of cargo, which will be delivered during the navigation periods (nearly 4 months a year) in 2017 to 2022. The jetty will not be in operation outside of these periods. The Project provides for shore strengthening activities and, crane installation sites with the area of 8,400 m^2, driveways, warehouses and slab-paved parking lots, office building, checkpoint. Main facilities were built in November 2017, all construction works were completed in May 2018. A temporary jetty was commissioned in July 22 (2018).

Construction of access motor roads (stage 3) includes the following activities:

- AMR #1 to the AGPP site (6.988 km);
- AMR #2 to the AGPP site (2.146 km);
- AMR #3 to the TBI site (0.558 km);
- AMR#4 to the railway station "Zavodskaya" (1.692 km);

- Upgrade of a 6.5 km section (of the road connecting the Amur Highway and Svobodny);
- AMR#6 to the jetty on the River Zeya (5.947 km);
- AMR #8 to the WIS site (1.261 km);
- AMR #9 to the SDIW landfill (1.925 km).

2.3.4 Stage 4: Gas Processing Plant

2.3.4.1 Key Facilities and Processes

Natural gas will be supplied to the AGPP via two lines of the "Power of Siberia" gas pipeline, both of which will be design to Gazprom standard STO 089-2010. AGPP key process components are presented in Table 2.1.

Table 2.1: AGPP Key Process Components

No.	Process units	Number of process trains
1	Natural gas metering unit	2
2	Gas purification and drying unit	6
3	Ethane and NGL separation, nitrogen removal and nitrogen/helium concentrate production unit	6
4	Ethane metering unit	6
5	Gas fractioning unit	3
6	NGL treatment unit	3
7	Helium production unit[5]	3
8	Methane fraction booster compression stations	6
9	Methane metering unit	2
10	Flare system units	3
11	Tank farm for storing liquefied gases (commercial products)	3
12	Racks and a section of railway for loading exported liquefied gases	2
13	Fuel gas metering units	2
14	Fuel gas preparation unit	1
15	Air and nitrogen production units	3

The AGPP Project design provides for six process trains capable of processing 7 billion m^3 of natural gas per year. Another section of the Project site is reserved for process trains 7 and 8 should it prove necessary to increase gas export. The process trains operate independently of each other, but they are all necessary for ensuring that the volume and the quality of exported gas comply with the conditions of the Gas Purchase and Sale Agreement. A simplified natural gas processing flowchart is shown in Figure 2.2.

The incoming gas is metered on entry to the AGPP and supplied to the gas purification and drying units, where it is dried by a zeolite absorbent. The used absorbent is regenerated and re-used. The dried gas is further stripped of mercury and methanol contamination by an absorbent and is treated at the cryogenic ethane and NGL separation, nitrogen removal, and nitrogen/helium mixture production unit. Gas separation is achieved by cryogenic temperatures produced by expansion of gas in turbine expanders and also by means of heat pumps.

The products of gas separation at this stage are methane, hydrocarbons C2+B, and helium/nitrogen gas fractions. These fractions are further processed at the same unit:

- The methane fraction is compressed in the booster compression station; compressed methane is metered and fed into the export pipeline.

[5] Another three process trains are planned for the future.

- The nitrogen/helium fraction flows to the helium refining, liquefaction and packaging unit where it is separated at cryogenic temperatures into nitrogen and helium. Nitrogen is sent into the nitrogen management system, and any excess nitrogen is released into the atmosphere. The liquefied helium is transported to consumers in specially designed tanks either by road or by rail.
- Fraction C2+B is separated into NGL and ethane fractions:
  - NGL is stripped of mercaptan impurities by a zeolite absorbent and sent to the gas fractioning unit. NGL can be sold as a commercial product if necessary.
  - The ethane fraction is transported to the deep hydrocarbon conversion plant. Iinitially, ethane will be sent into the gas export pipeline until the deep hydrocarbon conversion plant is commissioned.
- NGL is further separated at the cryogenic gas fractioning unit into propane, butane, and pentane/hexane fractions. These fractions are loaded into specially designed tanks and sold as commercial products.

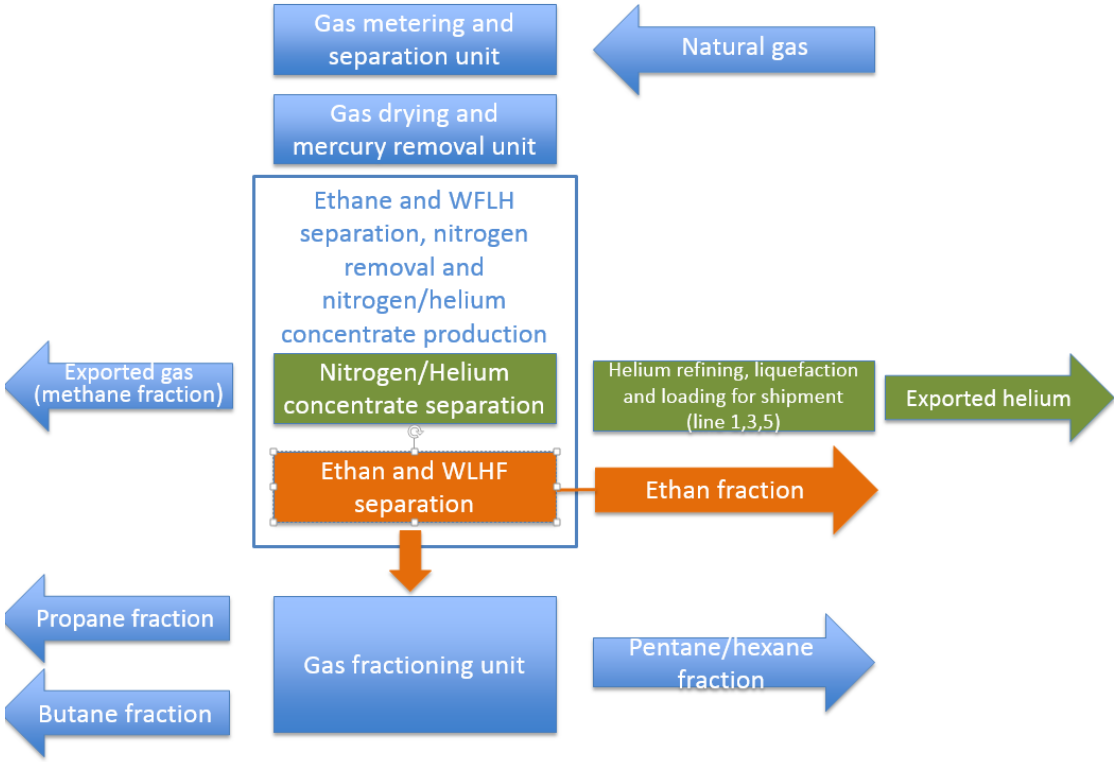

Figure 2.2: Natural gas processing flowchart

The Linde Group (Linde) will supply all core process equipment used for recovery of helium at AGPP. Linde will provide a license for the cryogenic gas separation technology, including its engineering aspects, and will supply units for ethane and natural gas liquids extraction and nitrogen rejection, as well as for helium purification, liquefaction, and storage. Linde will provide engineering support and supply such equipment.

2.3.4.2 Liquefied hydrocarbons storage and loading facilities

Marketable liquefied hydrocarbons are to be stored at the commercial products/feedstock base, which includes tank farms for propane, butane, propane/hexane fraction, technical propane/butane and NGL. Each tank farm is comprised of the following components:

- spherical tanks divided into groups (20 x 2,400 m^3 tanks);
- tank farm manifold room;
- tank farm pumping station;

- drainage and emergency tanks;
- flare separator.

Products are delivered to consumers using a loading/unloading rack. Products are loaded into railway tank cars with loading risers. The loading/unloading rack also includes a rack for inspecting and prepping tank cars for loading.

2.3.4.3 General plant process facilities

General plant process facilities include:

- flare systems ensuring safe operation of the GPP and receiving continuous, recurring or emergency discharges of flammable gases and fumes with their subsequent combustion. The AGPP flare system will be comprised of a common high-pressure flare system, special high pressure flare system, and common low pressure flare system. Flare systems are separated due to discharges of warm wet gas and cool dry gas, which, if combined, could produce ice in flare stack pipes thus lowering the throughput capacity of the flare system and possibly clogging individual pipes;
- nitrogen/oxygen station supplying technical nitrogen, technical air to the plant's units during their startup and operation;
- fuel gas treatment unit (FGTU) supplying it to the plant's units.

2.3.4.4 Key engineering support solutions

Key engineering support solutions include the power supply, heating, steam supply, water supply and wastewater removal.

Power supply. It was decided that electricity would be supplied to AGPP from the new "Amurskaya" thermal power plant (TPP). To distribute received electric power among AGPP's consumers, a 110 kV distribution substation, "AGPP", will be constructed at the plant site and connected to the 220/110 kV "Zavodskaya" substation by four 110 kV high-voltage transmission lines, each 3.9 km long.

Until the "Amurskaya" TPP is commissioned, electric power will be supplied by the Amur Electrical Grid. Two diesel power plants (3000 kW respectively) are to be used as a backup power source.

Heating. The main heating sources for the AGPP will be waste-heat boilers to be installed at the GPA-32 units in the compressor station areas of the booster compressor stations (BCS) for the medium-pressure methane fraction (MPMF). The heating water generated by the waste-heat boilers is heat-transfer agent used in the heat recuperation system.

Before commissioning of the BCS, heating water will be provided by hot-water boiler stations that will also provide some heating water during peak periods in winter. After all BCS have been commissioned, the hot-water boilers will be on stand-by. The boiler plant will use diesel fuel as main fuel during the construction phase, and once the fuel and pneumatic gas treatment unit is put into operation the water heating boiler plant will use gas as its main fuel.

Steam supply. Steam will be supplied from the "Amurskaya" TPP generating superheated steam at a pressure of 1.6 MPa and a temperature of 250°C. Steam will be used for periodic steaming of process installations. Steam will be available for use 24 hours per day throughout the year.

Water supply. The AGPP facilities will be supplied with water from the water intake station (WIS) located in the Bolshaya Pera River valley. The structure consists of three clusters located 180 m from each other. Two of the clusters have three wells each (two operational and one on standby), and the third cluster has a single monitoring well. The wells are 150 m deep.

A fence will be constructed around the perimeter of the first belt of the water intake site's SPZ (30 m). Water is treated at water treatment plant prior to being supplied to consumers. During the operation phase the capacity of the WTF will be 2,600 m^3/day.

Wastewater removal KOS-850 m^3/day wastewater treatment plants will be provided for treating domestic and industrial effluents and surface runoff from TBI sites. The modular KOS-850 units are

supplied by the Shtark group of companies. The KOS-850 unit is intended for operation in severe weather conditions at temperatures as low as -52°C, and provides full biological treatment of wastewater with subsequent ultra-violet decontamination and sediment dewatering. The maximum capacity of the WWTF is up to 850 m^3/day, and treatment efficiency is 98.99%, complex waste treatment plant - is up to 950 m^3/day.

Separate WWTPs will be provided for industrial wastewater (10 m^3 /day) and storm runoff (290 m^3/day), which represents a modular treatment plant with the nominal capacity of LWTP (local waste treatment plant)300.0 m^3/day, and treatment efficiency 99.74%.

Treated wastewater is to be discharged into the Bolshaya Pera River via a sewer. Wastewater deep treatment will ensure compliance with the standards applicable to waterbodies utilized for fisheries. The discharge location was chosen taking into consideration the existing surface water sources for nearby population centers.

Three types of drains are to be constructed at the AGPP site, i.e. industrial stormwater, storm runoff, and domestic, in order to send wastewater (depending on the type) to corresponding WWTF site. All the buildings and installations on the WWTF site will be delivered complete with corresponding equipment.

After treatment, industrial stormwater and storm runoff will be sent into the treated effluent tanks and then, whenever necessary, to the gas processing and helium production site into recycled water tanks for industrial and firefighting needs.

Saline wastewater from the boiler plants, circulation water pumping station, and filters will be fed into domestic wastewater sewers and then to the WWTF, with subsequent discharge of treated wastewater into the Bolshaya Pera River.

2.3.4.5 Workforce supply for construction phase

A significant number of staff will be required for construction of the Project facilities. Approximately 2,100 construction staff will simultaneously be present at construction sites. The workforce is expected to be provided through rotational shifts (about 80% of the qualified construction personnel), as well as traditional methods, which involves hiring workers from the local population (20%). Rotational staff are planned to be brought from Vladivostok, Krasnoyarsk, Irkutsk, Novosibirsk, Khabarovsk, Omsk, Tomsk, Surgut, Yakutsk.

A rotational camp will be provided at the TBI site for construction worker accommodation (see 2.3.3 above).

2.3.5 Stage 5: Residential district (microdistrict) in Svobodny

Operation of Project facilities will also require a substantial workforce. To accommodate AGPP personnel, it is planned to construct a residential housing (microdistrict) and social infrastructure facilities for 5,000 people in Svobodny, such as:

- Secondary general school for 900 students;
- Cultural and recreational center;
- Combined sports/fitness center;
- Two kindergartens with an indoor swimming pool for 500 children in total;
- A polyclinic with a pharmacy kiosk for adults designed for 220 visits a day and a children’s ward designed for 70 visits per shift;
- Department store with a consumer services center;
- Office center including a 50 room hotel, a 100 seat restaurant, and a sports/fitness block with a sauna;
- Commercial laundry, commercial kitchen, bathhouse;
- Garages for buses and communal vehicles;
- Fire depot designed for four to six fire engines;

- Two open multi-level parking garages with a car wash and a maintenance shop;
- 80 MW liquid fuel-fired boiler plant (to be subsequently converted into gas-fired);
- The housing project's water intake facilities, water treatment plant and sewage treatment facilities.

The land plot allocated for construction was chosen in accordance with the resolution of the council of people's deputies of the Municipal Entity Town of Svobodny dated April 4, 2013 "On Amending the General Urban Development Plan for the Town of Svobodny", and Resolution #1221 dated July 25, 2014 of the Municipal Entity Town of Svobodny on reserving land plots for mixed and residential development. Residential district (microdistrict) in Svobodny is not funded and managed by Gazprom pererabotka Blagoveshchensk LLC.

2.3.6 Stage 6: Solid Domestic and Industrial Waste Landfill

The capacity of the region's existing solid domestic waste landfills is insufficient to accept the amount of solid domestic and industrial wastes generated during Project implementation. Therefore, a SDIW landfill will be constructed for disposal of hazard class IV to V industrial wastes and thermal inseneration of hazard class III to V domestic and industrial wastes.

An SDIW landfill with an area of 19.6 ha is planned to be built 8 km southeast of the main AGPP site, 6.5 km east of the River Zeya (Figure 2.3). It is designed to receive 375,000 tonnes of waste during a 25-year period, including 168,000 tonnes of waste (6,700 tonnes per year) for burial and 205,000 tons (8,200 tonnes per year) for thermal inseneration.

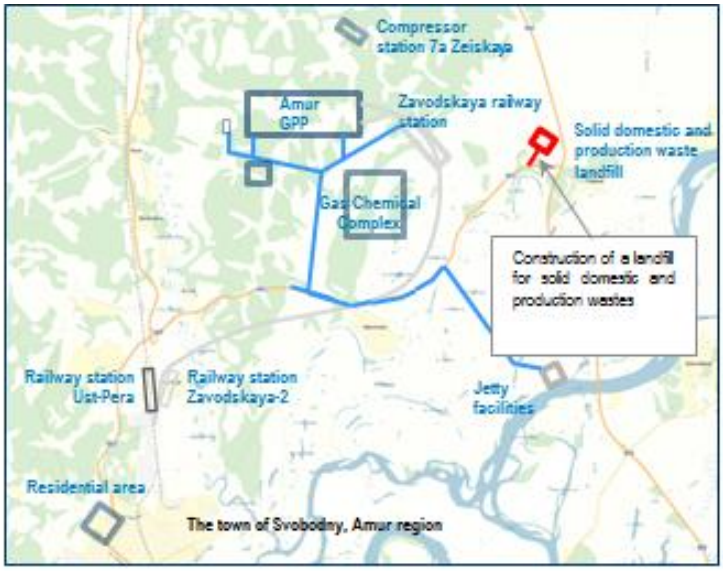

Figure 2.3: SDIW landfill layout

Eighteen cells for burying industrial wastes are planned for the landfill's main production area, including five cells for burying sewage sludge. The cells will be surrounded by earth bunding 2.5 m high, and will be protected with landfill liners and fitted with drainage and leachate collection systems.

Units with a capacity of 100 kg/h (installed in steel containers) and of 3,000 kg/h (located in a block-modular building) will be used for thermal decontamination of solid and liquid industrial domestic wastes. Natural gas will be used as fuel.

Wastes will be transported to the landfill by trucks. Garbage trucks are to be inspected and weighted at the landfill entrance. An automated monitoring system will be used to check all vehicles for radiation. A portable detector will be used to detect mercury vapors.

2.3.7 Project Decommissioning

It is planned that AGPP will function for as long as the "Power of Siberia" pipeline remains in operation, delivering raw gas to AGPP. The operation phase will last for at least 30 years, in accordance with the gas delivery contract between Gazprom and CNPC.

Project decommissioning documentation will be prepared in compliance with environmental legislation of Russia shortly before the scheduled end of the AGPP operation phase.

2.4 Area of Influence, Associated Facilities, Out-of-Scope Facilities/Activities

2.4.1 Area of Influence

The Project Area of Influence (AoI) on the natural and social environment will include areas both directly and indirectly affected during construction and operation of Project facilities.

The areas directly affected by the Project include those affected by direct impacts from emission sources, pollutant discharges, waste disposal, as well as physical impacts from the gas processing plant or associated auxiliary facilities within the Project site limits.

The following types of impacts may be considered as indirect impacts outside the Project site:

AGPP construction phase:

- Lights and visual impacts outside the construction area.
- Pollution of river water downstream of the temporary jetty on the River Zeya.
- Noise and air pollution produced by construction vehicles.
- Damage to local roads caused by heavy trucks and construction machinery.
- Socio-economic benefits to local communities and the whole Svobodnensky district.

AGPP operation phase:

- Lights and visual impacts outside the Project area.
- Noise and air pollution caused by AGPP operations.
- Noise and air pollution caused by AGPP export operations involving trucks or rail transport.
- Noise and air pollution caused by SDIW landfill operations.
- Socio-economic benefits for population of the Svobodnensky district and region in general.

2.4.2 Associated Facilities

According to the IFC Performance Standards, associated facilities are facilities that are not funded as part of the project, and that would not have been constructed or expanded if the project had not existed, and without which the project would not be viable.

The following associated facilities/activities have been identified for the Project:

- Trains, trucks or vessels designed for transporting liquefied gas/liquefied gas transportation;
- Logistics bases/terminals for servicing and distribution of isothermal tanks filled with liquefied gases;
- Sections of railway tracks linking together Project facilities; railway stations "Zavodskaya", "Zavodskaya-2", and "Ust-Pera";
- ""Amurskaya" thermal power plant and transmission lines/substations";
- KS-7a "Zeiskaya" compressor station;
- Residential housing project in Svobodny, including associated social facilities (medical center, secondary school, two kindergartens, a police station and a fire depot, a water intake structure and engineering infrastructure).

2.4.3 Out-of-Scope Facilities/Activities

Activities outside the Project AoI and beyond GPPB's control will not be addressed by the ESIA. In particular, the "Power of Siberia" gas pipeline is considered an out-of-scope facility since it is not directly owned, operated or managed by the Project; the Project does not include any section of the "Power of Siberia" pipeline (except the compressor station KS-7a "Zeiskaya").

Gas production facilities using "Power of Siberia" pipeline for gas distribution are also outside the Project's AoI.

Other examples of Project-related out-of-scope facilities/activities are given below:

- Quarries and borrow pits used by construction contractors during the construction phase under agreements with licensed quarry operators;
- Public roads/highways, bridges, ports and airports;
- The Amur Region electric power generation and distribution facilities (which supply power to the Project during construction phase and serve as backup during operation phase).

2.5 Mitigation in the Design

This Project has been developed in compliance with good industrial practices using state-of-the-art gas processing technologies. This approach allows for mitigation of impacts on natural and social environment and prevention of manifestation of adverse impacts associated with Project implementation. More detailed information on these aspects is provided in Sections 7 and 8 below.

3. LEGAL FRAMEWORK

3.1 General Information

The ESIA identifies and assesses the potential environmental and social impacts of the Project (on biophysical and human environments) and to set out measures to avoid, minimize, mitigate and manage adverse impacts to acceptable levels as defined by Russian regulatory requirements, international good practice and applicable international Lender requirements.

The Project ESIA builds upon an extensive body of studies and reports that have been prepared to support Project design and to meet the regulatory requirements of Russia. These include many environmental survey reports and "environmental protection" sections in Project design documentation (also referred to as the national EIA) that have been prepared as a part of the Russian permitting process. These provide information on existing environmental baseline conditions in the Project AoI, impact assessments, mitigation measures, environmental monitoring programme, and cost estimates for implementation of environmental measures and compensation payments.

In addition, the ESIA documents the results of the previous activities carried out during Stakeholder Engagement Plan development, which involved stakeholders potentially affected by Project implementation. The ESIA also summarizes how stakeholders have been informed and consulted on matters that could potentially affect them. As such, these materials provide valuable input to the development of the ESIA. These materials have been submitted to and approved by the Russian authorities for Glavgosexpertiza (General Board of State Expert) review (this is a formal expert review under the Russian planning approval process) within project design documentation for the proposed Project facilities/activities.

The scoping and stakeholder consultation processes aimed to determine the content and extent of matters that should be covered in the ESIA, and are integral elements of the ESIA development process. The scoping process for the Project has been completed and used as the basis for development of the ESIA, as well as a framework for future performance and support of meaningful engagement with stakeholders over the life of the Project.

3.2 Sanitary Protection Zone

In accordance with the Russian H&S legislation, it is required to establish Sanitary Protection Zones (SPZ) around certain industrial facilities. The SPZ size is determined to ensure compliance with applicable regulations with the aim of protecting human health from adverse impacts associated with air emissions, noise and vibration at the SPZ boundary. There are certain restrictions on economic activities established within the SPZ.

SPZs are to be established around the following Project facilities: the AGPP site (SPZ size - 1,000 m), the SDIW Landfill (500 m), and the jetty on the Zeya River (50 m). It is expected that all Russian regulations in force will be met at the boundary of every SPZ, and it is prohibited to locate any permanent residential facilities (e.g. for temporary accommodation of personnel) within their boundaries.

4. ANALYSIS OF ALTERNATIVES FOR PROJECT DEVELOPMENT

4.1 Approach to the Analysis of Alternatives

In accordance with IFC Performance Standard (PS) 1 "Assessment and Management of Environmental and Social Risks and Impacts[6]", the ESIA includes examination of technically and financially feasible alternatives to assess the respective impact sources and document justification of proposed solutions. The purpose of an analysis of alternatives is to optimize Project design and construction and operation of Project facilities on the basis of feasibility, taking into consideration environmental and social aspects.

As the AGPP Project is an integral part of Gazprom's EGP, the main alternatives and solutions have been adopted by Gazprom, which, to a certain degree, has shaped a plan of Project implementation.

The Project alternatives have been considered using a multiple-level approach:

- Analysis of preliminary alternatives for Project development as a whole, including the no-project alternative ('Zero' Alternative);
- Alternative process flow diagrams and processes;
- Analysis and selection of technical alternatives within the framework of the selected Project alternative.

4.2 "No Project" Alternative

The 'No Project' alternative ("Zero" alternative) means to give up the implementation of this Project, implying the following consequences:

- Failure to meet the governmental programme for construction of a united system for natural gas production, transportation and supply in Eastern Siberia and the Far East of Russia, including potential export to the markets in China and other countries of the APR;
- The RF will not be able to fulfill its obligations foreseen in the Agreement for supply of natural gas from Russia to China via the eastern route;
- Abandoning the extraction of ethane fraction required for operation of the deep hydrocarbon conversion plant financed by Sibur Holding for polyethylene production will result in the plant not being constructed;
- Helium contained in the natural gas transported via the "Power of Siberia" gas pipeline and required for Russian industry and research institutions will not be extracted;
- The potential failure to meet the long-term domestic demand for commercial-grade gas, helium and liquefied hydrocarbon gas for the needs of Eastern Siberia, Russian Far East and other regions of the RF;
- Loss of opportunities for regional economic development and attraction of domestic investment sources in the Amur region associated with the implementation of a major industrial construction project.

4.3 Alternative for location of the Project in the Amur Region

The construction of a gas processing plant in the Far Eastern Federal District is required due to adoption of State Program for construction of a united system in Eastern Siberia and the Far East of Russia for natural gas production, transportation and supply including potential export to the markets in China and other countries of the Asian Pacific Region.

The extraction of valuable fractions from the raw natural gas transported via the "Power of Siberia" gas pipeline is needed to supply gas fractions for export and to the domestic markets in the RF.

[6] https://www.ifc.org/wps/wcm/connect/550cc3004f08127f9910db3eac88a2f8/GN_Russian_2012_Full-Document.pdf?MOD=AJPERES

The agreement between the RF Government and the Government of the People's Republic of China on gas supply from the RF to China by the eastern route has confirmd the feasibility of the GPP site location in the Amur Region.

It should be noted that natural gas produced in Eastern Siberia and in the Republic of Sakha (Yakutia) is rich in helium. Helium is a unique product essential for development of many high-tech sectors of industry. Russia is one of few countries with significant helium resources. Therefore, through the organization of helium production by extraction of helium from natural gas, Russia has the potential to become the largest helium supplier to international markets.

In addition, AGPP products can be supplied not only throughout the Amur Region but also to other regions of the Russian Federation. In particular, liquefied hydrocarbon gas (LHG) will be in high demand in Amur Region, since the current gasification level in this region is estimated at around 40%.

Therefore, implementation of the GPP Project in the Amur region, the operational phase of which is to last for at least 30 years, aims to ensure long-term economic interests of the RF, as well as energy and technological security of the country.

Implementation of the Project will result in an increase in pressure on the natural environment. However, the Project provides for good international industry practice environmental protection measures, which will reduce adverse impacts to an acceptable level (for more details see Section 7).

Conclusion: as implementation of the Project will bring significant benefits to the economic and social development of the Far Eastern region and the RF as a whole, and related environmental pressures will not exceed permissible levels, the alternative for location of the GPP Project in the Amur region has been selected for further consideration.

4.3.1 Alternatives for AGPP site selection

During the initial stage of the AGPP Project development, the following sites were considered for the Project facilities in the Amur region:

- A site located 25 km north-east of the town of Belogorsk, in the central part of the Seryshevsky district, Amur Region, and 4.5 km south of the village of Vernoye;
- A site in Svobodnensky district, 13 km north of the town of Svobodny;
- A site near the village of Markov, Blagoveshchensk district.

Due to the absence of railway connections near the site next to the village of Markov, only the first two alternatives have been selected for further consideration, which has been carried out according to the following criteria:

- Land use and opportunities for project site selection;
- Available and accessibility of the existing infrastructure (including social infrastructure);
- Environmental aspects for the site selection alternatives.

4.3.1.1 Land Use and Opportunities for Project Site Selection

Both sites for the AGPP construction are located on farmland. According to the schematic layout map of the Svobodnensky district municipality, there are basically no limitations for the AGPP construction at any of the two sites.

4.3.1.2 Availability and Accessibility of the Existing Infrastructure

The following criteria were considered regarding the accessibility of the existing infrastructure:

- Vicinity of transport hubs: airports, river ports / navigable rivers, Trans-Siberian railway line;
- Availability of a well-developed system of access motor roads / access to federal highways;
- Availability of a power supply infrastructure;
- Vicinity of residential areas with well developed social infrastructure.

According to the expert assessment using the above criteria, a Project site in Svobodnensky district was deemed to be preferable, because as it is the direct vicinity of both the Trans-Siberian railway line and the Zeya River, which can be used for transportation of large pieces of equipment for the Amur GPP.

4.3.1.3 Environmental Aspects for the Site Selection Alternatives

The assessment has been performed using a system of points. Adverse impacts on the natural environment (e.g. atmospheric air, surface water bodies, landscapes and soils, vegetation and wildlife, specially protected natural areas) have been used as criteria.

Conclusion. The alternative with a Project site in Svobodnensky district has been determined to be preferable. In case of this alternative being chosen, the overall cost saving is estimated at 22 to 24 billion Rubles.

4.3.2 Alternative Gas Processing Technologies

The following criteria have been used in the process of assessment of the process flow diagrams and process technologies:

- Feasibility of compliance with GPPB criteria with regard to output volumes and product quality;
- Comparative characteristics of process flow diagrams and production processes;
- Comparative characteristics of the demand for basic types of resources for technological needs;
- Comparative analysis of the proposed solutions relating to water supply and wastewater management;
- Comparative analysis of the expected quantities, types and concentrations of industrial wastes, air emission and pollutant discharge to the environment.

GPPB set up a team for technical and economic assessments of the cryogenic gas separation technology, and of gas processing alternatives at the Amur GPP. At the same time, GPPB commissioned Linde/Peton and Air Liquide/Kriogenmash to develop alternative project design documentation.

4.3.2.1 Comparison of technologies for natural gas separation

The GPPB comparison of the cryogenic gas separation and helium extraction technologies proposed by Air Liquide and Linde/Peton concluded that the Linde/Peton technology is preferable against most criteria.

4.3.2.2 Assessment of the Main Types of Required Resources

The following heat-transfer agents are required for the operation of the process equipment: cooling water, heating water, medium-pressure steam and AMT-300 oil. In addition, fuel gas is used for purging of process pipelines. The main unique feature of the Linde/Peton technology is the use of air cooling in the process. The Linde/Peton process has significant advantages in respect to thermal oil requirements, and requirements for heating and ventilation of buildings. However, the Liquide/Kriogenmash technology involves the utilization of heating water for process needs, whereas, in case of the Liquide/Kriogenmash technology, heating water is not used in the processes.

An assessment made by GPPB experts regarding heat-transfer and cooling agent requirements concluded that the Linde/Peton alternative is less resource intensive.

4.3.2.3 Comparison of Environmental Characteristics of the Alternative Technologies

The comparison considered water supply and wastewater management, the amount of waste generated, and the disturbance of soil cover during construction. There is an insignificant advantage demonstrated by the Linde/Peton technology.

Conclusion. The comparison of the main environmental and non-environmental (i.e. technical, economic and logistic) aspects of the two alternative technologies for AGPP has identified significant advantages associated with the Linde/Peton technology. An assessment made by GBBP experts with the use of a detailed set of criteria concluded that the **Linde/Peton technology is preferable**.

4.3.3 Specific technical alternatives

During project design development, various alternative solutions for the following specific technical issues have been considered:

- Solid waste disposal;
- Electricity supply;
- Water abstraction and water supply system.

4.3.3.1 Solid waste disposal

As there are currently no landfills in the direct vicinity of the Project area for disposal of low-hazard solid wastes, the following alternatives for their disposal have been considered:

- Temporary storage of wastes in the Project area with subsequent transportation to the municipal waste disposal facilities existing in the subject region;
- Construction of a landfill within the Project's license area for disposal of low-hazard solid wastes;
- Incineration of wastes.

A decisive factor for rejecting the alternative implying waste transportation to a remote landfill is the logistic difficulties associated with transportation. The aspects mentioned above suggest that it would be preferable to have a combination of construction of the Project's own landfill and waste incineration (i.e. a combination of alternatives).

4.3.3.2 Organization of Electric Power Supply

Two alternatives have been considered for power supply, i.e. connection to the existing power supply system of the Amur Region and the United Electric Power Network of the East, or construction of the Project's own electric power generating facilities.

A decisive factor in the selection was the forecasts of possible electric power shortages from 2021, due to delays with commissioning of new generating capacities in the region. A decision has been made to construct an independent thermal power plant ("Amusrskaya" TPP) to supply electricity to the AGPP, using the external power supply network as a reserve power source. To enable this, the Project's own 220/110 kV substation "Zavodskaya" will be constructed and connected to the "Amurskaya" 500/220 kV substation.

4.3.3.3 Organization of Water Abstraction and Water Supply.

The normal water requirement for the operation of the AGPP will be 3,200 m^3 of water per day to be supplied by the WTP. It should be taken into consideration that the Project site is an area with complexd hydrogeological conditions at the junction of second-order structures of the Amur-Zeya artesian basin and the Mamynsky hydrogeological complex massif. There are many aquifers and complexes potentially suitable to serve as water supply sources for AGPP in this area.

Water in all potential water supply sources has high iron and manganese contents. The alternatives assessment considered parameters such as water yield of wells and aquifer usage for general and potable water supply. The water supply alternatives for AGPP have been assessed using a system of points.

The most attractive alternative for the water supply system for AGPP facilities will be the alluvial water-bearing horizon (aQIV) in the Bolshaya Pera River valley.

5. STAKEHOLDER ENGAGEMENT

Stakeholder engagement is required to ensure that the Project implementation is beneficial to local and regional stakeholders, and to discover and properly manage potential negative social impacts of the Project.

Initiating the stakeholder engagement process at the early stage of the Project, together with the adoption of appropriate communication mechanisms, helps to ensure:

- timely public access to all relevant information;
- that all 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).

As part of the ESIA package, Ramboll has prepared a Stakeholder Engagement Plan (SEP), which includes details on all topics discussed in this section.

5.1 Past consultation and engagement activities

For disclosing Project-related information and engaging with relevant stakeholders, the Company employs the following activities:

- Periodic press-releases;
- Participation in business forums and exhibitions such as the Far East World Economic Forum, and other similar events of regional and inter-regional significance;
- Individual negotiations with landowners in respect of land acquisition and temporary occupation;
- Regular meetings with local administrative authorities;
- Meetings with local businesses on procurement and employment opportunities;
- Meetings with various stakeholders at local and regional levels, including the following:
  - Regional and local authorities of the Orthodox Church (including in regards of the construction of a new church in Svobodny that will be sponsored by GPPB);
  - Hunters and fishermen.

In addution, during preparation of the National EIA, the Company also held statutory public hearings, as well as meetings with landowners whose land plots will be acquired or temporarily occupied for Project purposes.

The Company values the local knowledge; therefore, GPPB initiated the establishment of the Community Council to disseminate information about the Project. The participants of the Council are as follows:

- Representatives of local (Svobodny and Svobodnensky district) authorities;
- Representatives of non-governmental organizations and activists of Svobodny and Amur Region;
- Media workers;
- Workers of government-funded entities (e.g. schools, hospitals).

The role of the Council is as follows:

- Disseminate information about the Project and its impacts among the local and regional civil society;
- Seek advice and feedback on the Project and its impacts from the public through a number of independent, well regarded individuals;
- Discuss any specific issues as warranted by the implementation of the Project.

5.2 Compensation and Support Programs

As part of the engagement activities, AGPP reached formal cooperation agreements with several stakeholders reflecting the long-term Corporate Social Responsibility of the Company. The parties of the agreements are:

- Government of the Amur Region (two agreements signed);
- GKU Amuruprador, State Road Authority for the Amur Region;
- The Employment Service of the Amur Region;
- Ministry of the Amur Region for Education and Science.

5.3 Ongoing and Future Consultation and Engagement Activities

During Project implementation, various engagement and information disclosure methods will be used according to international best practice (IFC Standards) to ensure that different stakeholder groups are fully consulted and involved in the ESIA decision-making process. The principles of future stakeholder engagement include:

- Engagement will aim at providing local communities that are directly affected by the project and interested stakeholders with access to timely, relevant, understandable and accessible information.
- Stakeholder engagement will involve the following elements: stakeholder identification and analysis, stakeholder engagement planning, disclosure of information, consultation and participation, grievance mechanism, and ongoing reporting to relevant stakeholders.
- The requirements of Russian national law with respect to public information and consultation will be met.

Specific elements of future engagement activities and information disclosure format are described in the SEP.

GPPB has allocated stakeholder engagement responsibilities to one experienced specialist specifically in charge of stakeholder engagement, including liaising with local community organisations, local government agencies, mass media, in both Blagoveshchensk and Svobodnensky District. This specialist is based in Blagoveshchensk with frequent visits to the Svobodny area and reports to the General Director.

5.4 Free, prior and informed consent

No indigenous communities or groups reside in the proximity to the Project site or in the town of Svobodny. Therefore, at this point of the Project development it is not required to obtain free, prior and informed consent from indigenous communities.

5.5 Grievance Mechanism

The SEP prepared by Ramboll stipulates the key principles and elements of the grievance mechanism that was approved by the Company. The standards for the proposed mechanism include the IFC PS, EBRD Performance Requirements, Equator Principles and similar guidelines. The SEP defines the following steps in the grievance mechanism:

- Filing and registration;
- Allocation of a grievance for review and resolution;
- Review and resolution;
- Notification of the proposed resolution;
- Appeal (if applicable);
- Closure.

It is expected that grievance statistics will be generated quarterly based on a number of parameters as defined by SEP.

6. ESIA METHODOLOGY

6.1 Definition of Terms

Definitions of key terms used in this section are provided below.

- A Project **phase** is a series of related activities, which together form a distinct stage in the life of the Project. The following phases are considered in the ESIA (although for simplicity these may be combined in some sections of the ESIA where appropriate):
  - Construction,
  - 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 the following:
  - **Duration** The "duration" of impacts is a period, over which the source of impact occurs and also, for reversible impacts, the period, over which recovery may occur (see also 'reversibility' below). In terms of duration, the impacts fall into three categories: **short-term**, **medium-term**, and **long-term**.
    - **Short-term** impacts are predicted to last only for a limited period (e.g. during the period of a certain limited duration construction activity) but will cease either on completion of the activity or rapidly afterwards as a result of mitigation/reinstatement measures and/or natural recovery.
    - **Medium-term** impacts are predicted to last for a moderate period (around 2 years on average). Examples include impacts during the period of extended construction activities or impacts during limited duration activities but which extend for a moderate period after the their completion.
    - **Long-term** impacts are predicted to continue over a period of more than 2 years. These include impacts that may be intermittent or repeated rather than continuous if they occur over an extended time period (e.g. repeated seasonal disturbance of species as a result of annual maintenance activities).
  - The **extent** of the impacts depends on the nature of the impact and the receptor of the impact, as well as on operating mode (routine mode, non-routine situations and emergencies) and is characterized by indicators such as surface of affected area, impact magnitude and depth, affected population). In terms of extent, the impacts can be **local**, **regional**, **national**, and **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.
  - **Residual impacts** are those impacts that persist after all mitigation measures have been put in place.
- **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 measures aimed to reduce adverse impacts to acceptable levels. Mitigation measures can be provided for at the design stage or carried out additionally to mitigate the impacts identified within the ESIA process.

6.2 ESIA process overview

The impact assessment process is performed in several stages, comprising:

- Scoping assessment for the Project to identify those aspects of the Project that are of potentially greatest significance, which usually includes stakeholder consultation activities to ensure that concerns raised by stakeholders potentially affected by the Project are taken into consideration within the ESIA.
- Collection of baseline information on the aspects identified at the scoping stage as a foundation for assessment of potential or actual impacts. Data gathered is also used as a reference level for comparison / monitoring of subsequent changes caused by Project activities.
- Identification of impacts from Project facilities and assessment of their significance.
- Identification of mitigation and remediation measures.
- Reassessment of impacts from Project facilities based on scenario with implementation of mitigation measures.

6.3 Scoping and Consultation

Scoping is the process of determining the content and extent of the matters that should be covered in the ESIA and associated documentation. The scoping process aims to identify the types of environmental and social impacts, and to identify those aspects that are of potentially greatest significance. The primary methods for identification of potential environmental impacts are through:

- Review of existing Project assessments and information.
- The stakeholder engagement process, which is to be initiated early in the Project phases to ensure timely public access to all relevant information.
- "Source-pathway-receptor" analysis. Identification of potentially significant environmental impacts is also undertaken through structured consideration of the potential sources of impact, the pathways, through which they impact the natural environment and humans, and the nature of receptors (e.g. humans, flora and fauna etc.) that may be impacted.

6.4 Significance criteria overview

The ESIA adopted an approach to categorize impacts by significance, which is commonly used in preparation of large project ESIAs, making use of quantitative criteria where available, and where not available using qualitative criteria and expert judgement. The impacts are described consistently throughout the ESIA.

A standardised approach to impact assessment allows potential impacts to be categorised consistently across all aspects. This approach is applied to the assessment of impacts in all phases of the Project (i.e. construction, commissioning, operation and decommissioning).

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 magnitude of that impact.

Table 6.1 below details high-level generic magnitude criteria for adverse impacts. The generic criteria are by necessity qualitative in nature, as they are intended to cover a wide range of different environmental and social aspects. However, where appropriate, the qualitative generic criteria are supplemented by more detailed and quantitative criteria that are presented on a topic-by-topic basis in the ESIA Report.

Table 6.1: Generic (Qualitative) Magnitude 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[7] with MPC being slightly exceeded at work places, in air, soils, groundwater, and surface water. **Duration:** short term **Extent:** localised to immediate area **Reversibility:** reversible **Sensitivity of the receptor:** low sensitivity/value[8].
Moderate	Noticeable effect on personnel and natural environment with a systematic excess of MPC at work places, changes in the quality of air, soils, surface, and groundwater, vegetation and wildlife status both due to deterioration (pollution) and improvement of the state of environmental components (pollution reduction, reclamation, etc.) **Duration[9]:** 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	Significant effect on personnel and natural environment associated with significant changes in the state of natural habitats (changes in landscapes, poaching, emergencies/accidents, catastrophic pollution, necessity for sanitation of the area, rehabilitation of altered natural habitats, restoration of natural resources - e.g., reforestation) **Duration**: medium to long term **Extent**: local (high receptor sensitivity/value, protected habitats/species) or regional (moderate receptor sensitivity/value) **Reversibility**: limitedly reversible/irreversible **Sensitivity of the receptor:** high receptor sensitivity/value
Major	Considerable effect; continuous breach of the Project Standards. **Duration**: long term **Extent:** regional, national, international **Reversibility**: limitedly reversible/irreversible **Sensitivity of the receptor:** High receptor sensitivity/value

[7]The Project Standards include International Institutions' Performance Requirements (including IBRD's) and requirements of the national legislation of the Russian Federation (the most strict of the above standards are taken for each type of impact).
[8]For example, low sensitivity might refer to and abundant common species where the Project would not result in any local or regional threat to population numbers. The sensitivities of specific receptors are further described in the baseline characterisation section of the ESIA.
[9]The precise definition of the 'duration' and 'extent' of impacts is dependent on the nature of the impact and the sensitivity of the receptor. Generic terms are therefore used in this qualitative table, but more specific definitions are provided where appropriate in the topic-specific tables presented.

6.4.2 *Uncertain impacts and risks*

Where an impact is not certain to occur (e.g. due to the inherent stochastic 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 **magnitude** 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.

Table 6.2: Likelihood criteria

Probable	Events that are known to occur within the specific industry and likely to occur on multiple occasions with frequency over once a week. Probability of occurrence – more than 50%.
Possible	Known to occur periodically (including seasonally) 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 an 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 an occurrence – less than 1%.

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

Likelihood of impact	**Magnitude of impacts**				
	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	Low	Low

7. ENVIRONMENTAL IMPACT ASSESSMENT

7.1 Introduction

This Section summarizes the main assessments of the potential environmental impacts associated with the project, together with a description of the mitigation controls and monitoring measures that will be implemented throughout the lifecycle of the Project. The impact assessment has been undertaken in line with the ESIA process, and is structured as follows:

- Impacts on air quality;
- Impacts on landscapes, soils and land use;
- Impact on surface water bodies;
- Impact on the geological environment and groundwater;
- Noise and vibration;
- Impact on flora and fauna;
- Waste management;
- Environmental impact of potential emergency situations at the AGPP facilities.

For each of these aspects, the most important or interesting results of the ESIA has been pointed out in relation to:

- background characteristics;
- key receptors and potential impacts;
- impact control and mitigation measures undertaken;
- information on residual impacts and operational environmental monitoring organisation.

7.2 Impacts on air quality

7.2.1 Baseline conditions

In general, the Amur Region has high to very high atmospheric pollution potential, with highly unfavorable conditions for pollutant dispersion. High occurrence rates of surface and raised inversions, low average wind velocities and air stagnation prevent dispersion of harmful pollutants, and facilitates their accumulation and elevated dust concentrations in a number of residential areas.

Atmospheric air quality monitoring is performed in Amur Region by the regional center for hydrometeorology and environmental monitoring. There are three static stations for atmospheric air quality monitoring in the cities of Blagoveshchensk, Zeya and Tynda.

According to monitoring conducted in 2014 by the laboratory of the Center for Hygiene and Epidemiology, the integral Air Pollution Index API value was equal to 17.5 (“very high”) in Blagoveshchensk and 8.2 in the Amur Region. The main sources of air polluters in the city of Blagoveshchensk are industrial enterprises, coal-fired boiler stations and motor vehicles.

However, the industrial sector in Svobodnensky District is poorly developed and has virtually no influence on atmospheric air conditions. Baseline concentrations of pollutants from the Svobodny weather station in the Project area are presented in Table 7.15. Investigations aimed at determining air pollutant levels conducted during environmental engineering surveys within the Project area confirmed that their concentrations do not exceed the respective MPC_{mnr} levels.

The air quality standards adopted in the Russian Federation are more stringent than the WHO standards, on which the IFC standards are based (IFC EHS Guidelines). Therefore, the assessment of background air quality and impacts associated with Project emissions has been conducted using the Russian standards.

7.2.2 Impacts and receptors

Pollutant emissions and dispersion calculation data were included in the AGPP Project documentation in accordance with the requirements of the current regulatory guidance documents of the Russian Federation. The dispersion modelling and calculation of predicted air pollution levels (one-time maximum for 20 minutes) were carried out using software approved by the Voyeikov Main Geophysical Observatory and the *Atmosphere* Research Institute and certified by Gosstandart of Russia. The modelling includes atmospheric parameters, baseline concentrations of air pollutants, topographic features, and distance to the nearest settlement.

Impacts on ambient air quality associated with pollutant emissions have evaluated for all stages and the main Project facilities during construction and operation. The main receptors are residents of the nearest settlements, construction workers and Project personnel.

7.2.2.1 Impact on ambient air during construction

Air emissions during construction of the early works facilities

It is assumed that the duration of construction at this stage will total 17 months. Major sources of air pollution during construction will be construction and road building machinery, including vehicles. The following air emission sources will have internittent impacts during construction:

- exhaust emissions from diesel generators and internal combustion engines of vehicles and construction equipment;
- tree clearance sites where petrol-driven saws will be used;
- mobile welding machines;
- areas used for filling construction equipment from fuel trucks;
- areas of handling operations;
- concrete mixing plant;
- bitumen spreading areas;
- painting operations on open construction sites.

Major pollutants will be carbon monoxide (34.7%), nitrogen dioxide (23.8%), nitrogen (II) oxide (14.2%), and hydrocarbons (kerosene) (1.4%).

Two reference points selected for assessment of air pollution are located at the boundary of the nearest settlement, Yukhta, 2.3 km from the future AGPP construction site. The modeling results indicate that ground level concentrations of pollutants at the Yukhta boundary won't exceed the established limit values during construction.

Air emissions during construction of the railway infrastructure (Stage 2)

The estimated duration of the "Ust-Pera" station modernisation works is 15 months, and that of construction of "Zavodskaya" and "Zavodskaya-2" railway stations is 30 months. Pollutant emissions will occur from:

- welding operations;
- vehicle traffic delivering construction materials;
- operation of construction equipment and maintenance vehicles;
- painting of metal parts and marking;
- earthworks and site levelling.

Most pollutant emissions sources are of intermittent impact. Stationary sources of air emissions will include welding and painting shops and soil/fill material loading/unloading yards, while mobile ones will comprise vehicles, welding machines, fuel trucks and construction machinery.

The emission modelling was based on the worst-case scenario of maximum air emissions near residential areas. This scenario involves operation of grader and execution of earth and gravel moving works (site levelling or earth-moving works), maintenance vehicles, diesel power station, fuelling of vehicles, vehicular traffic, drilling works, and painting and welding operations.

Modelling of air pollution from all sources and for all pollutants generated data on distribution of maximum ground level concentrations within the area of influence of each railway infrastructure facility.

The modelling results indicate that during **"Ust-Pera" station** modernisation, the ground level concentrations of all pollutants and pollutant combinations (summation groups) at the reference points at the residential area boundary do not exceed 0.74 MPC, and 0.95 MPC within the construction site (background level included).

The "Zavodskaya" station under construction is located at 5.7 km from the Yukhta community allotments. The estimated maximum ground concentrations of major pollutants at the Yukhta residential area boundary will not exceed the established background values during construction of the station.

"Zavodskaya-2" station is located near the "Ust-Pera" railway station. The nearest stand-alone dwellings are situated at only 60, 100 and 190m from the station.

The operation areas will be scattered to avoid cross-effects. Operations associated with air pollutant emissions will not be carried out simultaneously. Stationary emission sources will consist of welding and painting shops, excavation and backfilling sites; Mobile sources will include vehicles, construction machinery, and railway maintenance vehicles. The calculations are based on 21 air pollutant sources, of which 20 are sources of fugitive emissions.

Preliminary modelling of ground level pollutant concentrations demonstrated that it was necessary to account for background levels of nitrogen dioxide, nitrogen oxide, black carbon, sulphur dioxide, carbon monoxide, and inorganic dust. The background values for pollutants named were received from the Amur State Hydrometeorological Service. The final estimates indicated that the highest ground levels would characterise summation group 41 (carbon monoxide + inorganic dust): 1.46 MPC within the construction site and 1.2 MPC within the residential area. The excess of limit values is to be attributed to the high background levels (69% for carbon monoxide, and 30.7% for inorganic dust).

However, it can be assumed that the actual levels for summation group 41 will not be as high as estimated because emission sources of pollutants comprising this group (inorganic dust from earth moving during earthbed construction and carbon monoxide from operation of the automatic tamping and levelling machine) will be operated sequentually rather than simultaneously.

Estimated ground level concentrations of other pollutants and summation groups within the construction site will not exceed 0.98 MPC for nitrogen dioxide and 0.7 MPC for inorganic dust at the residential area boundary, including background levels.

Air emissions during construction of the auxiliary facilities (Stage 3)

Construction will involve operation of construction vehicles and road building machinery. Electrical power and heat will be supplied to construction facilities from diesel power generators. Construction will be carried out in 12-hour shifts. The duration of construction will total 35 months.

The following air emissions sources will have intermittent impacts:

- exhaust emissions from diesel generators and internal combustion engines of vehicles and construction equipment;
- mobile welding machines and hand welding units;
- areas used for filling construction equipment from fuel trucks;
- handling operation areas;
- concrete mixing plant;
- bitumen laying areas;
- painting operation areas.

Major pollutants will be xylene (38.9%), carbon monoxide (16.2%), nitrogen dioxide (12.0%), and nitrogen (II) oxide (7.2%). Considerable xylene emissions are associated with the large amount of painting works.

The ground level concentration modelling was focused on two reference points at the boundary of the nearest settlement, Yukhta. The air pollution modelling was performed for the cold period of the year when emissions from vehicles and construction equipment are at their maximum; and for the warm period of the year when bitumen laying and painting operations are carried out. In all cases the estimated maximum ground concentrations of pollutants at the settlement (Yukhta) boundary do not exceed the established limit values.

Air emissions during construction of the temporary jetty on the Zeya River (Stage 3)

Major pollutant emissions will be associated with the operation of construction equipment and vehicles. In addition, dust emissions occur during earth-moving works, transportation and unloading of sand and other bulk materials, and from in-facility traffic. Sources of pollutant emissions also include deployment of various auxiliary equipment (e.g. welding stations) and the areas of operations involving special building materials (e.g. asphalt, bitumen).

The ground level concentration modelling indicates that the estimated maximum ground concentrations of pollutants at eight reference points at the boundary of the temporary jetty operations area will not exceed the established limit values.

Air emissions during construction and reconstruction of access motor roads (Stage 3)

Impact on ambient air quality will mainly be associated with pollutant emissions from operation of construction equipment, excavation and earth moving works, reloading of dust generating materials and soil, and painting and varnishing works.

Major pollutants will be nitrogen oxides (20.6 %), carbon monoxide (18.3 %), hydrocarbons C_{12}-C_{19} (32.2 %), xylene (4.6 %), and inorganic dust with $Si0_2$ content of less than 20% (6.7 %). The modeling result indicate that maximum concentrations of pollutants at the Yukhta boundary will not exceed the established limit values. The levels of most pollutants within the area of construction sites also would not reach their limit values.

Air emissions during construction of the Main Production Facilities (Stage 4)

Sources of air pollutant emissions during construction of the Main Production Facilities will be intermittent. Construction will be carried out in 12 hour shifts. The duration of the construction of each process train will be around 44 months.

The nearest settlements are Yukhta (2.3 km from the site) and the Yukhta community allotments area (1.7 km from the site).

Pollutant air emissions during construction of the main production facilities will total 11,361 tonnes. Major air polluting substances will be carbon oxide (24.9%), xylene (22.4 %), nitrogen dioxide (17.9%), nitrogen oxide (10.7%). Major sources of air pollution during construction will include construction equipment and vehicles.

The air pollution modelling was performed for the cold period of the year when emissions from vehicles and construction equipment are at their maximum and bitumen laying and painting operations are carried out; and for the warm period of the year. Pollutant emissions from areas used for reloading of loose construction materials and fuelling of construction equipment from fuel trucks were also included in the dispersion modelling.

The modeling results indicate that the estimated maximum ground level concentrations of pollutants at the GPP site, SPZ boundary and at the boundary of Yukhta and adjacent community allotments do not exceed the established limit values.

Air emissions during construction of the Housing Project in Svobodny (offices and residential buildings with associated infrastructure, the church) (Stage 5)

The estimated duration of construction of the Housing Project in Svobodny will be 24 to 26 months. The impact on air quality will be localised and short-term. Sources of air pollution will include construction sites and operation of construction equipment (excavators, mobile machinery, compressor unit, welding and painting shops). Emissions will include 15 pollutants and 4 summation groups.

The dispersion modelling results indicate that maximum ground concentrations of pollutants at the residential area boundary will not exceed 1 MPC_{mnr}.

Air emissions during construction of the Solid Domestic and Industrial Waste Landfill – SDIW Landfill (Stage 6)

The distance from the proposed SDIW landfill site to the nearest settlement (Gaschenka) is 3 km. The estimated duration of construction is 9 months. Air pollution will be associated with:

- operation of vehicles and construction equipment;
- operation of diesel generators (mobile power plants);
- earth-moving works and handling operations involving dust generating materials;
- filling of equipment and fuel storage tanks;
- welding operations;
- painting operations.

According to the modelling results, concentrations of pollutants at the boundary of Gaschenka settlement during construction phase will not exceed the MPC_{mnr} (SRLI) limit values for the air quality in settlements. The nitrogen oxide level of 1 MPC (including the background concentrations) will be reached 530 m from the construction site. The facility area of influence, i.e. the distance to the 0.05 MPC isoline (established for nitrogen dioxide without allowance for the background level), will be 5.9km for the construction period.

7.2.2.2 Impact on ambient air during operation

Impacts on ambient air quality during operation have been evaluated for all Project sites and discussed for the construction period, except for those for which responsibility will be passed on to third parties following completion of construction (e.g. the housing complex in Svobodny and associated infrastructure, and public railway infrastructure such as "Ust-Pera" railway station).

Air emissions during operation of temporary buildings and installations (TBI)

Major sources of air pollution will be:

- general infrastructure with a fire depot for four firefighting vehicles;
- temporary construction (mechanical) yard with an open parking for vehicles and special equipment;
- contractor's fuel storage facility with an oil tank farm (including diesel supply tanks, diesel pumping unit, diesel drainage tank, fuel dispenser);
- auxiliary area facilities:
    - boiler plant;
    - containerized diesel power plant (DES-630);
    - auxiliary diesel power plants (Energo D1000).

Stationary emission sources on the TBI site will comprise boiler plant smoke stacks, fire depot ventilation stacks, auxiliary diesel power plant exhausts, and diesel supply tank vents. Sources of fugitive ('uncontrolled') emissions on the TBI site will include the outdoor parking for vehicles and special equipment, diesel pumping unit and fuel dispensers.

Sources of instantaneous (peak) emissions could include exhausts of the containerized diesel power plant DES-630 during testing of the diesel engine, diesel supply tank vents, and diesel drainage tanks.

Major contributions to the total emissions will be made by carbon monoxide (34.0%), nitrogen dioxide (26.4%), and nitrogen oxide (15.7%) from diesel power plant exhausts and diesel-powered boiler plant smoke stacks.

Air dispersion modelling was performed for two reference points located at the boundary of Yukhta (1.4 km to 3.0 km from the TBI sites). The calculations were made for normal operation and peak emissions conditions (i.e., during testing of diesel power plants in the auxiliary facilities area). The modelling results indicate the concentration of pollutants during both normal operation and peak emissions conditions will not exceed the MPC_{mnr} (SRLI) limit values established for air quality in nearby settlements.

Operation of the Project's railway infrastructure

The main sources of air emissions from the **"Zavodskaya" railway station** are:

- Maintenance and test station (mechanical shop);
- Garage;
- Diesel-powered boiler plant (two boilers 3 MW and 1.5 MW);
- Diesel generators (DES) for emergency power supply;
- Diesel fuel storage;
- Locomotive depot with the associated office and amenity complex (OAC);
- Testing of diesel locomotives (emissions from full capacity tests of locomotives will be of a short duration (30 minutes) and will be conducted not more than 12 times per year in normal operation conditions).

A total of 42 air pollution sources were identified, including three sources of fugitive emissions. Reference points for assessment of maximum emissions are located at the residential area boundary.

In calculations without allowance for peak emissions, it was assumed that all emission sources cannot be in simultaneous use. The calculations were made for the winter period when the boiler plant is operated in accordance with the winter schedule. Modelling results indicate that the highest ground level concentrations of pollutants and pollutant combinations (summation groups) at the site will be 0.98 MPC (alkanes C_{12}-C_{19}), and will not exceed 0.48 MPC (carbon monoxide) at reference points at the residential area boundary, allowing for background level in both cases.

Calculations allowing for peak emissions indicate that while ground concentrations of all pollutants and pollutant combinations (summation groups) within the site may reach 13 MPC (soot) , concentrations of pollutants at the residential area boundary will not exceed 0.3 MPC, both including background levels.

The modelling of emissions during operation of **"Zavodskaya-2"** railway station was performed for five sources, including two sources of fugitive emissions (diesel locomotives). The ground level concentrations were modelled for the worst-case scenario when the diesel locomotive from the haul line approaches the "Zavodskaya-2" station and the impact on the residential area is at its maximum.

The modelling results indicates that ground level concentrations of pollutants at the residential area boundary will not exceed 1 MPC_{mnr}. The modelling results also indicate that ground level concentrations of pollutants at the haul line sanitary break will also not be greater than 1 MPC_{mnr}, which shows that the size of the haul line sanitary break (100 m on either side), based on chemical air pollution criteria, has been determined correctly.

Operation of the Auxiliary Facilities (motor transport department and general plant facilities)

Continuous emissions during normal operation will be generated by the following sources:

- ventilation stacks of the maintenance and repair shop, heated parking facilities, washing facility for vehicles and special equipment, tank truck parking facilities, and garage for handling equipment;
- vent valves of diesel and petrol storage tanks at the filling station, diesel supply tanks, fuel and lubricant storage facility;
- smoke stacks of water boiler plant;
- open areas for parking tracked vehicles (under cover) and the parking area at the filling station;
- pumping plant at the fuel and lubricant storage facility, etc.

Major pollutants will be carbon monoxide (32.6%), nitrogen dioxide (25.3%), nitrogen oxide (15.1%), and sulphur dioxide (11.0%) from boiler plant smoke stacks and auxiliary diesel-fuelled power plant exhausts.

The modelling results indicate that the estimated maximum ground concentrations of all pollutants at the boundaries of the SPZ and the nearest settlement (Yukhta) during normal operation of the Auxiliary Facilities will be below the MPC limit values. Maximum air pollutant concentrations will comprise 0.55 MPC for the sulphur dioxide and hydrogen sulphide summation group at the Yukhta residential area boundary, and 0.89 MPC for nitrogen dioxide at the boundary of the Amur GPP SPZ.

In the event of peak emissions associated with blackout and operation of the emergency diesel power plant, the estimated maximum ground level concentrations of pollutants at the Yukhta boundary will also be below the MPC limit values (0.55 MPC for the sulphur dioxide and hydrogen sulphide summation group), and will amount to 0.94 MPC for nitrogen dioxide at the boundary of the Amur GPP SPZ.

The area of influence of auxiliary facilities on ambient air quality was determined for the peak emissions of nitrogen dioxide. The modelling results indicate that the boundary of impact of the proposed facilities (isoline 0.05 MPC) during operation will be located 7.5 to 9.8 km from the Amur GPP site boundary.

According to the Russian legislation, the following dimensions are established for the standard SPZ of auxiliary facilities:

- 100 m for motor transport department as the facility for maintenance of cars and trucks;
- 100 m for fuel and lubricant storage facilities.

As the auxiliary facilities site will be located within the standard SPZ of the Amur GPP (1,000 m), no special SPZ allocation is required.

Operation of the temporary jetty on the Zeya River

The jetty will be operated periodically, without permanent personnel. Emissions of air pollutants will be produced by vehicles and transport equipment supporting jetty operation. No emergency or peak emissions of air pollutants will occur during the facility operation.

According to sanitary classification, the temporary jetty belongs to Class V. That is, the required size of the standard SPZ is 50m.

Two periods of the jetty operations have been assessed, i.e. navigation (4 months) and assembly of the equipment and installations of the jetty.

Major sources of air emissions during navigation are represented by exhaust pipes of diesel power plants, tugboat RT-600, tracked cranes, truck trains for transportation of oversized equipment shipped by barges, other types of vehicles, and parking lots.

The estimated maximum concentrations of pollutants at the temporary jetty operations boundary will not exceed 1 MPC (SRLI) for all pollutants. As the nearest residential area is situated 5 km from the jetty, no exceedance of the sanitary limit values is expected.

Operation of access roads

The reference point for modelling of pollutant dispersion for operation of the Project's AMR was set at the boundary of the nearest residential area of Yukhta, located 2.89 km away. The dispersion modelling

focused on the most intensively used roads: section 1 of AMR 1 and AMR 3 near Yukhta. The MPC_{mnr} for the air in settlements was used as the criterion for assessment of impact on the ambient air quality.

The modelling results indicated that ground level concentrations of pollutants at the residential area boundary during operation of the AMR sections identified will not exceed background levels, i.e. the level of 1 MPC will not be reached by any pollutant. Consequently, ARM operation will produce no material impact on ambient air quality within the subject area.

Amur GPP operation

All process operations at the AGPP will continue uninterrupted for 365 days per year. However, the equipment operating procedures provide for scheduled shutdown periods for routine preventive inspection and maintenance, or for conversion to standby. These periods will be associated with controlled emissions of natural gas, which are classified as peak emissions.

Continuous air emissions (both controlled and fugitive) during operation of the main production facility will be produced by the following sources:

- gas drying and mercury removal unit;
- ethane and NGL separation, nitrogen removal and nitrogen-helium concentrate production unit;
- gas fractionation unit;
- NGL treatment unit;
- methane fraction compression plant;
- general plant process facilities;
- flare system facility;
- commercial product and feedstock facility;
- loading/unloading rack.

Sources of **peak** emissions will potentially include:

- methane fraction compression plant;
- power generation sites;
- flare system facility;
- commercial product and feedstock facility;
- general plant process facilities.

For emergency situations at the AGPP facilities, the Project design provides for discharge of gas from the process system to flares. An emergency situation may occur if external power supply is cut off causing activation of emergency power plants.

Sources of **emergency** emissions are:

- power generation sites (diesel generator exhausts if the main power supply source is cut off);
- flare system facilities (the flare of the plant flare system in the event of emergency shutdown of production facilities);
- ethane and NGL separation unit, nitrogen removal and nitrogen-helium concentrate production unit;
- commercial product and feedstock facility, loading/unloading rack, and general plant facilities (exhausts of diesel generators if the main power supply is cut off).

Total emissions of pollutants from the the proposed AGPP facilities during operation of six process trains will total 3,320.9 tonnes per year. Major pollutants will be carbon monoxide (33.7%), nitrogen dioxide (25.4%), nitrogen oxide (15.2%), and methane (11.2%).

Air emissions modelling was undertaken for all modes of the AGPP process equipment operation. Six reference points were selected to evaluate air pollution levels at the AGPP SPZ boundary and the boundary of the nearest settlement, Yukhta.

The modelling results for all conditions of plant process equipment operation indicate that ground level concentrations of all pollutants at the SPZ boundary, as well as at the boundary of the Yukhta community allotments and its residential area, will be below the MPC_{mnr} limit established for air quality in settlements.

The area of influence of the AGPP proposed facilities' emissions on the ambient air quality was determined for the normal operation of the Project facilities at the 'full development' stage. The modelling results indicate that the size of this area will vary from 6.7 to 8.1 km for the mixture of natural mercaptans (odorant).

Operation of SDIW landfill

The following operations will be performed at the landfill:

- thermal destruction of industrial waste of Hazard Class III and IV (including oily), solid domestic waste of Hazard Class IV and V, and industrial effluents of Hazard Class IV;
- receiving, storage, and separation of industrial waste of Hazard Class IV and V, including effluent sludge of Hazard Class IV.

Solid domestic waste will be brought in by waste trucks, and industrial waste will be delivered by dump trucks and skip trucks.

Air pollution during landfill operation will be primarily associated with the following processes:

- waste disposal;
- operation of vehicles;
- entry and exit of garbage trucks and other waste management vehicles;
- fuelling of equipment;
- operation of waste incineration units.

Air dispersion modelling was performed for the summer period when air emissions will be at their maximum. The modeling was conducted for reference points at the boundary of the Gaschenka Village (3 km from the landfill site) and at the SDIW landfill's SPZ boundary (500 m from the landfill).

The modeling results indicate that the estimated maximum ground level concentrations of major pollutants at the boundaries of the landfill's SPZ and the Gaschenka residential area will not exceed the established limit values during operations. The nitrogen oxide level of 1 MPC for nitrogen dioxide will be reached at the distance of 250 m from the landfill site. The level of nitrogen dioxide at the Gaschenka residential area boundary will be 0.16 MPC.

The boundary of the area of influence, defined by the nitrogen dioxide level of 0.05 MPC, will be located 2.8 km from the landfill site.

7.2.3 Mitigation measures

7.2.3.1 Impact mitigation measures during construction

Air impact mitigation measures during construction will be primarily associated with reduction of harmful emissions from construction equipment and vehicles. Special measures (embedded controls) aimed at reduction of adverse impacts during construction activities will include:

- strict compliance with construction and installation process requirements established in the Construction Management Plan (CMP) and Work Execution Plan (WEP);
- use of state-of-the-art construction machinery equipped with engines complying with the European emission standards Euro III - Euro IV;

- preventive maintenance and technical inspections of construction machinery, mechanisms and vehicles, including control of exhaust gases from internal combustion engines at least once a year (scheduled monitoring) and after each repair and service of engines;
- prohibition of operation of machinery/vehicles which are not subject to technical inspection and exhaust gases monitoring;
- avoidance of idle operation of engines when not in use;
- use of state-of-the-art diesel power plants which meet the Project's emission requirements;
- operation of diesel power plants in accordance with the operating manual;
- use of low sulphur diesel fuel;
- avoidance of simultaneous traffic of construction machinery and vehicle traffic to/from construction sites;
- sequential operation of machinery and equipment that are not involved in one continuous technological process;
- prohibition of construction waste burning (e.g. cable insulation, wood waste, oiled rags) unless special incinerators are used;
- use of sealed containers for storage of fuels and lubricants;
- storage of volatile chemicals and loose materials in sealed containers and within closed premises;
- use of canvas covers for transportation of dust generating materials;
- use of dust suppression techniques in loose material loading and unloading areas.

The general conclusions concerning the character and scale of impacts of Project construction on ambient air quality in surrounding area may be summarized as follows:

- Maximum concentrations of pollutants at the boundary of settlements at all construction stages will not exceed the MPC_{mnr} (SRLI) limit values for the air quality in settlements. These levels will be used as the Maximal Permissible Emmissions (MPE) limit values for the Project construction period. The Project does not include establishing SPZ at construction sites for the construction period.
- Major pollutants that will impact on ambient air quality will be nitrogen oxides, carbon monoxide, methanol and particulate matter (suspended solids).

Overall, adverse impacts on ambient air quality during construction can be assessed as **short-term**, **local**, **reversible,** and of **low magnitude**.

7.2.3.2 Impact mitigation measures during operation of the AGPP

In order to minimise pollutant emissions from Project equipment, the Project design includes implementation of the following general embedded controls:

- ensure optimal operational mode of equipment in compliance with process regulations;
- installation and use of gas contamination control systems with automatic gas supply cut-off in production premises where gas processing equipment is installed;
- maximum level of containment of the production process, including use of stop valves of leakage class 'A';
- use of pipes and fittings designed for maximum possible working pressure;
- maximum process automation, including a computer-aided process control system to reduce the probability of accidents/ emergency situations;
- discharge of liquid products (flammable and combustible liquids) from vessels and pipelines into drainage tanks before shutdown of this equipment for maintenance;

- use of equipment in which the level of NOx and CO in exhaust gases does not exceed 150 mg/m^3 and 100 mg/m^3 respectively; the exhaust equipment must provide for dispersion of air pollutants during simultaneous operation of gas compressor units and booster plant to levels permissible for the working area and natural environment;
- use of process equipment with pressure relief valves (in case pressure exceeds levels provided for normal operation conditions) or equipment designed for the maximum operating pressure;
- use of power-operated shut-off valves at the boundary of each process unit to enable isolation of individual process blocks if necessary (response time of power-operated valves should not exceed 12 seconds);
- prohibition of opening and purging of process vessels and tanks in adverse weather conditions;
- use of a closed flare system for safe flaring of all discharges;
- selection of the optimal height of flares to facilitate dispersion of combustion products;
- monitoring of pollutant emissions and ambient air quality at emission sources and in nearby residential areas.

Each process unit will meet all safety requirements Explosion Hazard Category I facilities. The required level of explosion safety for the units of Category I will be provided through selection of adequate equipment, shutoff devices and places of installation, monitoring/ control, and protection devices.

Development of special air protection/emission reduction measures for adverse weather conditions is not required, as the AGPP facilities will be in continuous operation. According to Russian regulatory requirements, permanent sources of air pollution will require development of measures of general character such as:

- enhanced control of compliance with the requirements of process regulations;
- enhanced control of instrumentation and performance of computer-aided process control systems;
- prohibition of purging or cleaning of equipment, gas ducts, and tanks which were used for storage of pollutants;
- maintenance and repair works associated with air emissions of harmful substances;
- suspension of equipment tests associated with adjustment of process conditions resulting in increased air emission of pollutants.

Recommended measures for operation in adverse weather conditions for sources of intermittant impacts comrpise suspension of works associated with pollutant air emissions, such as test start-up of diesel power plants, shutdown of process equipment with discharge of gas to flare.

Responsibility for implementation of air protection measures during adverse weather conditions will rest with the facility manager.

According to the impact assessment criteria used in this ESIA, adverse impacts on ambient air quality during normal operation of the Project facilities are assessed as **long-term**, **local**, **reversible**, of **low magnitude**, and of **moderate overall impact risk significance**.

For peak emissions and emergencies, adverse impacts are assessed as **short-term**, **local**, **reversible** and of **moderate magnitude**. ***The likelihood of emergency occurrence is assessed as 'unlikely', so the overall impact risk significance is 'negligible'.***

7.2.4 Residual impacts and monitoring

Residual environmental impacts associated with pollutant emissions during the **construction phase** (see Section 7.2.3.1 above) are assessed as **negligible** after implementation of impact mitigation measures.

The impact mitigation measures provided for the AGPP **operation phase** will enable minimization of such impacts, and thus they are considered **acceptable.**

Despite the negligible impacts on ambient air, the Project design includes an Operational Environmental Control/ Monitoring (OEC) Programme for both construction and operations phases of the Project facilities.

During the construction phase, the OEC Programme will be developed for every facility under construction. There will be air sampling schedule/intervals for the control points. The monitoring points will be selected on site, considering the following:

- reference points must be located to allow for the influence of existing infrastructure (motor roads, railway) on ambient air quality;
- control points must be located within the nearest settlement with reference to the facility under construction.

The sampling process includes measurements of air temperature and humidity, wind velocity and direction, atmospheric pressure, and description of weather conditions. Air quality monitoring results will be included in OEC reports that will be submitted to the AGPP administration and contractors for construction process management.

The primary objectives of OEC during operation of the AGPP are:

- regular and prompt (including automated) acquisition of and provision of reliable information about the environmental situation at Project facilities and in the area of influence to the Company's management and other stakeholders;
- demonstration of compliance with the environmental protection requirements established by the national legislation, Gazprom and International Finance Institutions;
- support for implementation of activities aimed at environmental protection, sustainable management and restoration of natural resources.

The OEC Programme involves control and monitoring of air emissions ambient air quality (including during adverse weather conditions), and defines the sampling points, monitoring parameters and frequency. After the first year of plant operation, the Monitoring Programme may be revised.

7.2.5 Greenhouse gases

The AGPP Project was developed with a view to limiting emission volumes of greenhouse gases (GHG) by choosing suitable highly-efficient equipment and performing measures aimed at mitigation of GHG emissions. However, is expected that greenhouse gases will be emitted into the atmosphere at all stages of the Project implementation.

The main sources of GHG emissions during the operation of the Amur GPP are the main process facilities where natural gas will be used. Moreover, use of purchased electrical power for Project implementation will cause indirect greenhouse gases emissions, however, their share after the commissioning of the first start-up AGPP complex will not exceed 0.02% of total greenhouse gases emissions. The amount of greenhouse gas emissions will gradually increase over the course of construction and commissioning of new production facilities, reaching a peak in 2026. Consolidated data on the volumes of greenhouse gas emissions during Project development are presented in Table 7.1. These values are calculated based on direct greenhouse gases emissions related to natural gas combustion for AGPP needs, and indirect emissions related to purchased electrical power consumption.

Table 7.1: Summarized data on greenhouse gas emissions from the Project facilities

Year	Direct emissions		Indirect emissions		
	Use of natural gas for own needs, '000 m^3	Total direct emissions, CO_2 equivalent, '000 t/ year	Amount of purchased electrical power, MWh	Total indirect emissions, CO_2 equivalent, '000 t/year	Total CO_2 equivalent, '000 t/year
2017			1,701	0.001	0.001
2018			19,322	0.014	0.014
2019			35,425	0.025	0.025
2020			38,058	0.027	0.027
2021	130,000	263	100,864	0.072	263.072
2022	320,000	648	242,202	0.173	648.173
2023	410,000	831	293,533	0.210	830.952
2024	540,000	1,094	357,922	0.256	1,094.404
2025	730,000	1,479	406,832	0.290	1,479.416
2026	880,000	1,783	406,832	0.290	1,783.346
2027	880,000	1,783	406,832	0.290	1,783.346

As evident from Table 7.1, the annual volume of greenhouse gas emissions will be approximately 1,780,000 tonnes CO_2-equivalent per year, which is significantly higher than the reporting threshold of 50,000 t CO_2-equivalent set by RF Government Directive No. 716-r dated April 22, 2015. The value also exceeds the reporting threshold of 25,000 CO_2-equivalent set by the IFC Performance Standards. Therefore, the Project will prepare annual statistical reporting on the actual volumes of greenhouse gas emissions, and such reports to be submitted to the relevant IFIs.

7.3 Impacts on landscapes, soils and land use

7.3.1 Baseline conditions

The AGPP Project AoI is located in the Amur-Zeya mountainous trough region near the boundary between two landscape provinces, i.e. the Middle Zeya province with Far Eastern sub-taiga forests and the Zeya-Bureya province with broad-leaved forests[10]. The historic prevalence of forest landscapes within this Area has been replaced by predominantly secondary forests with differing degrees of disturbance, and with various types of localized valley landscapes (including meadows and bogs), farming land and built up areas.

The use of these lands is generally not associated with forestry management. The nearest forest fund land areas in the vicinity of the AGPP site are protective forests of the green belt (Compartment No.12 of the Svobodnensky forestry department [11]adjoining the right-of-way strip of the access railway track line) and the merchantable forests at a distance of 10 to 15 km north-east of the AGPP site (Compartment No.167 of the same forestry department).

A major part of the land allocated for the Amur GPP Project was categorized as 'farming land', situated within two municipalities of the Svobodnensky District within Amur Region, i.e. Zheltoyarovsky and

[10]Map of physical geographical zoning of the USSR. Scale 1:8,000,000. Moscow, GUGK, 1986.
Landscape map of the USSR. Scale 1:4,000,000. Ed,. by A.G. Isachenko, Moscow, GUGK, 1988.
[11]Forestry management conditions defined by the GKU of Amur Region "Svobodny Forest Department", town of Svobodny: Subsidiary of GFUP "Roslesinforg" - AmurLesProyekt, 2015. Document is displayed in electronic format on the web-site of the Ministry of Agriculture and Fire Safety of Amur Region: http://www.amurleshoz.ru/

Dmitrievsky Rural Councils[12]. A large part of Svobodnensky District is occupied by elevated aggradational / denudational plains with absolute elevations from 300 to 480 m. A dense deeply embedded network of gullies with cutting watercourses has created a complex ridged and flat hilly terrain with narrow and tortuous watershed areas.

In the system of geographical soil zoning of the RF and Amur Region, the Project area belongs to the Eastern soil and bioclimatic region of brown and forest soils, brown soil and podzolic brown soil zone of mixed coniferous – broad-leaved forests and broad-leaved forests, the Zeya-Bureya province of slightly unsaturated brown soils and slightly unsaturated podzolized and meadow – chernozem-like soils, Amur-Zeya district of slightly unsaturated brown soils (including podzolized ones) clayey and sandy silt soils underlain by sand and silty sand ground, as well as gleyic and gley brown soils, clayey and heavy sandy silt soils over lacustrine-alluvial deposits[13]. According to the surveys preceding Project design development, varieties of brown forest soils constitute the main soil fund of the Zeya and Bolshaya Pera terrace complex. Associated intrazonal soils are peaty bog soils, and zonal soils are diverse alluvial soils of variable particle size distribution.

The disturbed condition of the soil cover within the Project area is attributable to farming activities and operation of various technical facilities. No signs of chemical pollution of these soils have been detected during the surveys. At the same time, elevated natural concentrations of several trace elements (e.g. zinc, nickel and arsenic) have been revealed in the lithogeochemical background of soils. According to a tentative scale for assessment of contamination hazards based on the integral chemical contamination indicator (Zc), the contamination level of soils in the subject area can be categorized as "permissible"[14].

No rare soils and soils requiring special protection have been identified within the construction area. Soils disturbed by human activities and anthropogenic ground exist in the area for the planned construction of accommodation facilities in the town of Svobodny.

An important circumstance for the Project is the absence of any legally protected nature areas of local, regional or federal significance within and near the planned AGPP site. There are also no land areas subject to traditional use of natural resources. This has been confirmed by official letters from the relevant authorities.

However, there are several archeological sites in the immediate vicinity of the planned construction sites which had been discovered earlier and require further conservation (According to Letter Ministry of Culture and Archival Affairs of the Amur Region No.09-18/1421 of 27.06.2014). Additional investigations conducted by GAU "CSN Amur Region" in 2015 permitted an assessment of the conservation status of the archeological sites identified earlier. In addition, four new archeological sites were discovered (Table 7.2).

Table 7.2: Archaeological sites (AS) located within the zone of the planned Amur GPP facilities and measures aimed at their conservation

AS description	Amur GPP facility nearest to the AS	Distance between the AS and the planned Amur GPP facility	Remarks
Ancient settlement "Ust-Pera-1"	Water pipeline and wastewater sewer line from the GPP site	200 m to the east-north-east	Archaeological investigations conducted in 2015 indicated that the site is located at a safe distance from the boundary of the planned activities
Ancient settlement "Ust-Pera-2"		230 m to the north-west	

[12]Municipality "Zheltoyarovsky Rural Council", Svobodnensky district, Amur Region. Official website: http://www.zeltsvob.ru.
Municipality "Dmitrievsky Rural Council", Svobodnensky district, Amur Region. Official website: http://www.дмитриевский сельсовет.рф

[13] Map of environmental soil zoning of the Russian Federation. Scale 1:2,500,000. Moscow, Moscow State University, 2013.
Unified State Register of Soil Resources of the Russian Federation. Moscow, V.V. Dokuchayev Institute of Soils, Russian Academy of Agricultural Sciences, 2014.

[14] Annex 1 to SanPiN 2.1.7.1287-03

AS description	Amur GPP facility nearest to the AS	Distance between the AS and the planned Amur GPP facility	Remarks
Ancient settlement "Ust-Pera-3"		800 m to the north-west	
Ancient settlement "Ust-Pera-4"		1170 m to the north-west	
Ancient settlement "Ust-Pera-5"	Water pipeline from the water abstraction facility to the GPP site	10 m to 20 m to the west	AS discovered in the course of investigations conducted in 2015. The Project provides for special measures for the AS conservation.
Settlement "Ust-Pera-1"	Access railway track lines from the "Zavodskaya" station	Running along the southern boundary of the archaeological site	
Nomad camp "Chernigovka-6"	Access motor road to the temporary jetty on the Zeya River	Running along the western boundary of the archaeological site	The AS was not identified in the course of the archaeological investigations conducted in 2015, which indicated that the site was destroyed in the process of previous farming activities.
Burial site "Chernigovka-1"		200 m to the south	Archaeological investigations conducted in 2015 indicated that the site is located at a safe distance from the boundary of the planned activities.
Ancient settlement "Yukhta-1"	TBI at the GPP site	Approximately 50 m to the west	AS discovered in the course of investigations conducted in 2015. The Project provides for special measures for the AS conservation.
Ancient settlement "Yukhta-2"	GAZ No.9 at the GPP site	10 m to 20 m to the south	

In addition to the archaeological sites, there are some important land use restrictions applicable to the area allocated for the AGPP facilities related to water and fishery protection zones (50 to 200 m wide) of the rivers Zeya, Bolshaya Pera, Gashchenka, Rakusha, and other permanent watercourses (see Section 7.4 for further details).

7.3.2 Impacts and receptors

Project implementation will unavoidably result in adverse impacts on lands, soil cover, and landscapes of the affected area and adjacent areas during construction. The most sensitive receptors during the construction phase will be archaeological sites.

There will be no additional related adverse effects during operation of the Project facilities.

7.3.2.1 Impact on lands

The principal adverse impacts on land associated with Project implementation will result from the acquisition of land plots for non-linear and linear facilities, changes of land category, and changes in land use practices of local populations.

The land area required for construction of non-linear facilities will be 938.4 ha, of which approximately 80% (750 ha) have been acquired through long-term lease agreements with reclassification of the land categories to land for industrial, transport and communications needs. The remaining 20% will be acquired on a short-term basis with subsequent land reclamation and return to the lessor. Construction of

linear facilities will involve the use of a total land area of 275 ha. The land for linear facilities will be acquired on a 55% permanent and 45% temporary basis, or 150 ha and 124 ha respectively.

The main part of this land is situated in the Zheltoyarovsky and Dmitrievsky Municipalities. The proportion of acquired land with resepct to the total land areas of those municipalities is not significant (45,842 ha and 285,638 ha respectively).

As mentioned above (see Section 7.3.1), a major part of the land allocated for the AGPP Project is categorized as 'farming land'. During preparations for Project design development, the municipal planning schemes were updated and their current revision provides for construction and operation of all Project facilities with appropriate changes in the land use terms and conditions within affected areas.

Withdrawal of farming lands for industrial purposes can lead to losses suffered by users of agricultural land. However, as the areas acquired for the allocation of AGPP facilities had not been used prior to the commencement of Project design, there will be no associated commercial damage.

The AGPP site and other associated non-linear facilities will be built up and fenced to restrict access by unauthorized persons. The use of areas adjoining the AGPP site will be also modified to comply with regulatory requirements applicable to operation and protection of the facilities.

Construction of access motor roads and railway track lines connecting the AGPP site with other planned Project facilities and elements of the existing transport system will inevitably lead to reduction of potential of natural landscapes (e.g. forests, meadows, bogs) due to inevitable fragmentation and creation of new zones with special terms and conditions of their usage. At the same time, the construction of transport infrastructure will improve the accessibility of the subject area for the population.

During earth-moving works monitoring activities and other special actions were conducted in order to ensure integrity of the archaeological sites located in close proximity of certain Project sites (see Table 7.2). Current Project works do not pose threat to integrity of the archaeological sites.

The overall impact of the Project implementation on lands can be assessed as **local**, **irreversible**, **long-term**, and of **moderate magnitude**.

7.3.2.2 Impact on soils

During Project implementation, impacts on soils will include[15]:

- Acquisition of lands (with respect to soil areas);
- Mechanical disturbance and destruction of the soil cover;
- Disturbance of the fertile topsoil layer associated with potential blending with the underlying layer;
- Potential contamination and littering of the construction sites with construction and domestic waste, as well as associated with temporary storage of stripped soil;
- Potential contamination of soil cover with substances affecting the biological, physical and chemical properties of the soils.

Prior to Project implementation, most of the areas to be acquired for AGPP facilities largely comrpised waste land, forests and derilict technical facilities, and were not used for commercial purposes. Due to this, the commercial losses caused by acquisition of these land areas for construction of Project industrial and transport facilities will not be significant.

During installation of the off-site engineering networks, road construction and installation of the main and auxiliary non-linear facilities, the soil and vegetation cover, which is the basic biological component of the subject area, will be impacted. In case of mechanical soil cover disturbance, fragmentary destruction of the fertile humus and aggradational soil horizons is possible, as well as blending of materials from different soil horizons resulting in deterioration of the natural fertility of the soil. Movement of

[15] Amur Gas Processing Plant. Project design documentation. Environmental Impact Assessment. Volume code: 4700-0095-OBOC. Ufa: Research Design Institute of Oil and Gas (RDI OG PETON), 2015.

construction machinery within the construction strip can partially or completely destroy the soil cover. Wind and water erosion processes in the areas with disturbed soil cover, resulting in the loss of fertile topsoil may also occur.

The soil cover may be contaminated due to secondary migration of pollutants present in the soil and in the geological environment. This could be induced by construction work or due to distributed (with atmospheric precipitation) or concentrated (e.g. spills, leakage) release of pollutants in the process of pre-construction, construction and installation works.

Based on available information related to planned industrial activities, it is assumed that any changes in the chemical composition of soils in the Project AoI are unlikely to exceed threshold limits, which will ensure conservation of the natural status of the local soils. No significant additional impacts of the construction sites on soil cover and land status in the adjacent areas (e.g. increase in the phyto-toxicity, release of pollutants to groundwater) is expected.

In general, impacts on soils during Project implementation are assessed as **local**, **long-term** and of **moderate magnitude**.

7.3.2.3 Impact on landscapes

The Amur-Zeya, Zeya-Bureya, and Lower Zeya landscapes are located within the Project AoI. Due to acquisition of land for construction of Project facilities, the proportion of forests within the Project area will be reduced to a very high degree in the local landscape. Within the area allocated for the Project facilities, and within the protective and fire prevention strips, the forests will be completely replaced with industrial facilities, pavement and secondary meadows. This includes forest areas of white and river birch, bush-clover (Lespedeza) and reedgrass areas with typical brown soils, mor-humus brown soils and pseudo-fibrous brown soils. Such landscapes are dominant in the terrace complex of the Zeya and Bolshaya Pera valleys[16]. The loss of numerous natural secondary forest-meadow complexes will also be significant. These include wormwood-graminoid assemblages with willow, pine and birch undergrowth on brown soils that was formerly ploughed.

Modification of landscapes will also occur in bogs with plant assemblages consisting of reedgrass, cotton grass and sedges, as well as shrubs on eutrophic peat soils and associated soil types. Taking into consideration the relatively poor drainage of the subject area and its tendency to be exposed to floods and swamping, it is expected that bogs of technogenic origin would form in the local landscape structure due to blockage of surface and subsoil drainage.

Unstable landscape forms of floodplain willows on alluvial grey humus soils with variable particle size distribution will be affected to a lesser degree. These forms will predominantly be affected by river jetty construction, and at crossings of watercourses by linear Project facilities.

Short-term (during the construction phase) and long-term adverse visual impacts will be insignificant for local communities, as the Project facilities are located outside of the direct visibility range of the nearby residential and recreational areas.

However, the overall decrease in forested areas, which is the most characteristic landscape form, in addition to background fragmentation of slightly and moderately transformed natural landscapes will result in the loss of forest-meadow landscape character. This may also initiate mechanisms causing further gradual transformations due to the abruptly changed conditions.

Part of the planned facilities (e.g. the residential settlement and transport facilities) will directly affect the periphery of the residential areas. However, local communities in general agreed to the existing layout plans in the process of the public hearings.

However, due to Project implementation and simultaneous economic development of the region, it is expected that the concentration of industrial and transport facilities constructed within the area will be high, including the “Power of Siberia” gas pipeline and a major hydrocarbon conversion plant. Taken

[16]Schematic map of the natural environment situation in the Amur Gas Processing Plant area. Saratov VNIPI Gazdobycha, 2016 (survey materials and project design documentation)

together, this will unavoidably result in a rather high degree of transformation and fragmentation of the local landscape.

Implementation of this Project will result in formation of highly modified landscapes within the Project area and moderately modified landscapes in the adjacent areas. In the local landscape forms of the Zeya-Bureya physical geographical province, the proportion of forests within the Project area will be reduced to an especially high degree. Within the land area allocated for Project facilities and within the protective and fire prevention strips, the forests will be completely replaced with industrial facilities, pavement and secondary meadows. It will be partially compensated for by artificial restoration of meadow communities during reclamation of the land used for the Project needs on a short-term basis.

Therefore, the impact of Project implementation on landscapes can be assessed as **local**, **long-term**, and of **high magnitude**.

7.3.3 Mitigation measures

For protection and rational use of land resources, the dimensions of sites allocated for the AGPP facilities were determined by the organization in charge of Project design to ensure minimal land acquisition and the optimal width of the construction strip. For two or more engineering networks using the same corridor, the dimensions of the allocated area were determined with due consideration of their relative positions. The location of the planned facility has been preliminary agreed upon with the respective land users and fixed in the Site Selection Protocols.

Construction phase:

To prevent land degradation and soil contamination during the construction phase, the following measures have been included in the Project design:

- Construction works shall be performed in strict compliance with the construction time schedule and strictly within the boundaries of the allocated land area, preventing any excessive use of additional areas;
- Stripping of the fertile topsoil layer and its transportation of the stripped soil to a temporary stockpile prior to the beginning of construction activities;
- Formation of a sod layer over the soil stockpile to prevent blowing by wind and washing out of nutrients and conservation of the fertility of the stockpiled soil;
- Compliance with Project requirements relating to clearing of sites and removal of woody plants;
- Refueling of transport vehicles strictly within designated areas equipped with vessels for collection of spent fuel and lubricants, and oiled rags;
- Refueling and lubrication of construction equipment and machinery only at operation sites and routes in an adequate manner to prevent spills of fuel and lubricants to the ground surface;
- Prohibition of equipment and machinery washing at construction sites;
- Prohibition of any Project traffic off the approved transport routes;
- Storage of construction materials strictly in designated areas and within the boundaries of the approved construction sites;
- Sound and consistent use of material resources, minimization of waste generation, appropriate waste disposal and treatment;
- Prohibition of burning of spent tires and other combustible waste (e.g. wood, oiled rags/wiping material), both within and outside of Project sites;
- Improvement of the land plots used on a long-term basis and not occupied by process equipment, including fertile topsoil restoration, seeding of lawns in areas with open ground surface, planting of trees and shrubs.

The following activities are planned to prevent disturbance and contamination of soils **during drilling of boreholes**:

- Supervision of the condition and adequate sealing of drilling equipment during drilling operations;
- Storage of fuel and lubricants required for the operation of drilling equipment in special vessels, which should be tested prior to filling to make sure that there is no leakage and that the vessels are equipped with level gauges;
- Delivery of chemicals and clay powder to the drilling site in manufacturer's packaging (e.g. polyethylene bags and rubber-cord containers) and storage in covered premises;
- Use of a close water supply system, i.e. excess clay mud should be used during the drilling of future boreholes;
- Timely collection and removal of construction debris and domestic solid waste.

The Project design also includes the following measures aimed at the **conservation of archaeological sites** within the Project area of influence:

- Archaeological supervision at the respective sites during the construction and operation phases of the Project;
- Installation of temporary warning signs at the boundaries of the archaeological sites during the construction phase;
- Provision of written information for construction contractors relating to the presence of archaeological sites, applicable restrictions and requirements relating to the use of the areas of the archaeological sites;
- Submission of archaeological site protection obligations to the agency in charge of cultural heritage protection during the construction period.

Operation phase

To prevent contamination of soils during the operation phase of the Project, the following technical solutions have been inlcuded in the Project design:

- The main equipment is to be installed in buildings and in modular units;
- The floors in the buildings shall be properly sealed and equipped with valves for drainage and collection of spills, and accidental spills shall be collected in special vessels;
- Underground drainage and spill collection vessels shall be installed in by-pits to prevent ground contamination in case of leakages;
- Provision of secondary containment trays under diesel fuel tanks and installation of the latter in areas with secondary containment barriers;
- Hard pavement and secondary containment bunding of any process areas, where leakage of process fluids, fuel and lubricants is potentially possible, and drainage of surface runoff from such areas to the stormwater sewer network and further to the sewerage treatment facilities;
- Regular inspections and checks of the tanks and pipelines in accordance with a time schedule approved by the plant manager;
- Industrial wastes shall be stored on a short-term basis in special areas designated for this purpose and in conformity with the applicable environmental regulations.

A set of measures aimed at restoration of land areas disturbed during the construction period has been developed for soil cover restoration. Accounting for the soil and climatic conditions of the subject area and

the commercial use of the Project area, it is planned to carry out land reclamation of the disturbed land areas in two stages[17]**:**

- Technical restoration involving stripping of the fertile topsoil layer, stockpiling it on a temporary basis prior to the beginning of the construction works and subsequent returning of this soil after the construction completion;
- Biological restoration aimed at restoration of the soil fertility by addition of an integrated complex of mineral fertilizers and preparation of a restored area for its further commercial use as intended.

The thickness of the topsoil layer to be stripped is determined depending on the fertility of the soil. In the subject area it is on average 20 to 30 cm. The topsoil layer is to be stripped, if possible, to the full thickness by a single pass. The land restoration should be carried out only during the warm season of the year. Excess fertile soil can be used for site improvement.

Technical land restoration (e.g. removal of construction debris and wastes and logging residues, grading of the area within the construction right-of-way) shall be performed immediately after construction completion by the same construction contractor.

Biological land restoration shall be performed to attain the following goals:

- Reduction or prevention of technogenic disturbance of the soil and vegetation cover;
- Ensure suitability of the land for farming purposes (in case of farming land);
- Soil protection from water and wind erosion;
- Creation of landscapes meeting the relevant sanitary, hygienic and esthetic requirements;
- Maximum possible rehabilitation of vegetation and wildlife habitats.

Restoration of disturbed land areas aims to enable properties to meet farming and environmental requirements. In some areas, depending on an agreement with lessors, it will be required to carry out reforestation, land reclamation for construction purposes (i.e. without biological restoration) or sanitary and hygienic remediation (in areas of historic contamination and within the SDIW landfill site).

Based on the species composition of graminoid plants suitable for land restoration, the Project design foresees the use of native and zoned plant species (e.g. meadow clover, awnless brome) that are highly resistant to frost in winter and night frost in spring and forming a dense sod.

The biological restoration shall be carried out by specialist contractors having at their disposal appropriate equipment and machinery both for earthmoving operations and agricultural techniques. The biological restoration can be also performed by the land users at the expense of the Project.

Land areas acquired on a short-term basis during the construction phase will be restorated and returned to the respective lessors, taking into account their requirements regarding land conditions and their plans for the future use of the areas reclaimed.

7.3.4 Residual impacts and monitoring

Implementation of measures to mitigate impacts on lands, soils and landscapes will enable their minimization down to an **acceptable level**. in addition, implementation of land reclamation measures will allow for partial restoration of disturbed landscapes and artificial restoration of meadow plant assemblages in the land areas used on a short-term basis.

Monitoring of the physical integrity and chemical pollution of soils, and of landscape conditions within the Project AoI will be carried out as a part of OEC. This will include:

- compliance with applicable requirements for topsoil stripping and stockpiling operations;
- quality and schedule for implementation of land restoration activities;

[17] Amur Gas Processing Plant. Project design documentation. Environmental Impact Assessment. Volume code: 4700-0095-OBOC. Ufa: Research Design Institute of Oil and Gas (RDI OG PETON), 2015.

- physical integrity and chemical pollution of the soil cover;
- transformation of landscapes within the Project AoI;
- conditions of sites where land restoration activities have been completed.

7.4 Impact on surface water bodies

The largest surface watercourses near the AGPP site and housing complex (microdistrict) are the Zeya River and its tributaries, including the Bolshaya Pera River and the Rakusha River. There are a lot of small lakes and some swamps.

The Zeya River rises on the southern side of the Stanovoi Range 30 km south of the Minor Toko Lake, and flows into the Amur River at the city of Blagoveshchensk. The Zeya River has 640 tributaries, most of which, especially in its upper reaches, have numerous rapids. The Zeya River has stable high-water resources. Its flow regime is characterized by clearly-defined spring flood and summer flash floods caused by heavy rainfall.

To prevent contamination, pollution and siltation of surface water bodies and depletion of water reserves, and to protect habitats of aquatic biological resources, wildlife and vegetation, water protection zones are established in conformity with Article 65 of the RF Water Code along shorelines (boundaries of water bodies). In addition, riverside protection belts are established within the water protection zones. Special regimes are established for any commercial and other types of activities within water protection zones and riverside protection belts.

Water protection zones of the following widths have been established for surface water bodies located within the Project area:

- Zeya River- 200m;
- Bolshaya Pera River- 200m;
- Malaya Pera River- 200m;
- Gashchenka River- 100m;
- Klyuchevaya River - 100m;
- Oxbow Lake Petlya - 100m;
- Rakusha River - 100m;
- Obratny Klyuch River- 50m;
- Baikal Lake (the headwaters of the Rakusha River) is 50m.

Based on the Federal Law "On fishing and conservation of aquatic biological resources" and the Resolution of the Amur territorial department of Rosrybolovstvo (Federal Agency for Fishery), the highest fishery category has been assigned to the Zeya and Bolshaya Pera Rivers, which are used or can be used for extraction of aquatic biological resources. Fishery Category I was assigned to the Klyuchevaya, Gashchenka, Petlya, Rakusha and Obratny Klyuch Rivers. Fishery protection zones of the following widths have been established:

- Zeya River- 200m;
- Bolshaya Pera River- 200m;
- Malaya Pera River- 200m;
- Gashchenka River- 100m.

7.4.1 Baseline conditions

The assessment of the environmental status of major water bodies in the Zeya river basin was made based on monitoring data provided by the Far Eastern Hydrometeorological Service Center. The

assessment used criteria characterizing the degree of water contamination and the scale of disturbance of the average annual surface runoff due to water abstraction.[18]

The most informative integrated assessment of the water quality is based on such indicators as the specific combinatorial index of water contamination (SCIWC) and the water quality class (i.e. water quality levels expressed by numerical values of water properties and composition characterizing water suitability for a particular type of use).[19]The SCIWC value is determined on the basis of the frequency and the factor of exceedance of MPC levels using several indicators, and it varies in waters of different contamination degrees from 1 to 16 (0 for clean water). The classification of water quality on this basis permits categorization of surface waters into the five following water quality classes:

- Class I conditionally clean;
- Class II slightly contaminated;
- Class III contaminated;
- Class IV dirty;
- Class V extremely dirty.

With respect to an integrated set of hydrochemical indicators, water quality in the Zeya River corresponded to Class III and grade 'b' (as 'very contaminated') in 2013; in 2014, it was assessed as grade 'a' ('contaminated')[20].Especially adverse impact on the environmental status of the water in the Zeya River have heavy metals (copper, total iron, zinc, lead), phenols, and petroleum hydrocarbons.

To determine the hydrochemical indicators and identify potential contamination of surface waters, water samples from the Zeya, Bolshaya Pera, Rakusha, and Gashchenka Rivers and the Baikal Lake (the headwaters of the Rakusha River) in the Project AoI have been analyzed during the environmental engineering surveys. Surface waters in the Zeya River in the area allocated for construction of the Project facilities have been contaminated with industrial and domestic wastewater. However, no critical water contamination levels have been reported in the Zeya River near the town of Svobodny. The water in the other water bodies located within the Project area are categorized as "conditionally clean".

The grain size distribution of bottom sediments samples collected in the Rivers Zeya and Bolshaya Pera is represented by medium-grained sandy silt, silty sand and gravelly silty sand. Contamination of bottom sediments with heavy metals, phenols and petroleum hydrocarbons was not recorded.

7.4.2 Impacts and receptors

The types of potential adverse impacts on surface water bodies during construction and operation of Amur GPP include:

- abstraction of water from natural sources;
- pollution of surface water bodies associated with wastewater discharge;
- possible disruption of natural drainage lines;
- formation of zones with elevated degree of water turbidity due to construction works performed in the waters and on the banks of the waterbodies.

Impacts on surface water bodies have been assessed for the construction and operation phases of the AGPP Project.

[18] RD 52.24.643-2002. Methodological Guidelines. Method for integrated assessment of contamination degree of surface waters on the basis of hydrochemical indicators. Moscow, Hydrochemical Institute of the RF Federal Service of Hydrometeorology and Environment (Roshydromet), 2004

[19]GOST 17.1.1.01-77. Nature protection. Hydrosphere. Use and protection of water resources. Basic terms and definitions.

[20]Norms for permissible levels of impact for the Amur river basin: Zeya River. FGUP (Federal state unitary enterprise) "Russian Research Institute for Integrated Use and Protection of Water Resources", Khabarovsk, 2012.

7.4.2.1 Impacts during construction

Abstraction of water from natural sources

During construction, water from natural sources will be used for domestic/drinking needs of personnel and for industrial needs (e.g. making drilling muds for drilling water wells; mixing mortar and concrete; pipelines and tanks hydrotesting).

Prior to the main and auxiliary Project facilities being commissioned, it is planned to use water delivered from Svobodny in tank trucks as a source of water supply for construction sites. When the Project water intake structure is put into operation, the groundwater will be used as a source of water supply for the Project facilities. Water supplies for construction of the housing complex in Svobodny is to be provided from the urban water supply network. Therefore, abstraction of water from surface water bodies during construction is **excluded**.

Pollution of surface water bodies associated with wastewater discharge

The types of wastewater generated during construction are domestic and industrial wastewater, and stormwater.

All types of wastewater from the **early work facilities**, and wastewater from hydrotesting of pipelines and tanks, will be collected in storage tanks installed on construction sites and then transported in designated tank trucks to the Khoz-Alyance wastewater treatment plant in Svobodny.

The following types of wastewater will be generated during construction of the **auxiliary facilities (TBI)**:

- domestic wastewater from construction sites and temporary rotational camp;
- industrial wastes from hydrotesting of pipelines and tanks and TBI infrastructure facilities (water treatment facilities, boiler plant, heating system flushing);
- stormwater, removed from the diked fuel and lubricant warehouse area.

Domestic wastewater at the construction sites will be collected in storage tanks and then removed by special-purpose vehicles to Svobodny; Domestic wastewater from the temporary rotational camp will be sent to the TBI biological wastewater treatment plant (including aftertreatment using filters and ultraviolet irradiation).

Industrial wastewater from hydrotesting (8,629 m^3 per year for the entire construction period), and stormwater and meltwater from the TBI site, will be removed to the TBI mechanical wastewater treatment plant. The process of mechanical treatment will include thin-layer settling, flotation, filtering through a granular medium, aftertreatment with sorption filters, and decontamination by sodium hypochlorite.

Treated wastewater is to be discharged into the Bolshaya Pera River. The WWTF will enable reduction of petroleum hydrocarbon and suspended solid concentrations in the treated wastewater to levels that ensure compliance with the fishery requirements for the river water quality.

Domestic wastewater generated at the construction sites during construction of the **main production facilities** will be collected in storage tanks and then removed by special-purpose vehicles to Svobodny. Domestic wastewater from the temporary rotational camp will be removed by special-purpose vehicles to the biological wastewater treatment facility at the TBI site. Industrial wastewater from hydrotesting will be partially removed to the mechanical WWTF at the TBI site. The remaining industrial wastewater from hydrotesting, alongside stormwater from construction site, will be sent to be treated at AGPP WWTF (a unit designed for stormwater treatment).

The WWTF effluent treatment efficiency is 98.98% for domestic wastewater, and 90.32% for industrial wastewater. Treated wastewater shall be released to the Bolshaya Pera River through two outlets, from the WWTF for BTI after biological treatment and from the AGPP WWTF after mechanical treatment. The characteristics of wastewater released into the Bolshaya Pera River are presented in Table 7.3. These will ensure the river water quality requirements for fisheries are met at the wastewater release point.

Table 7.3: A characteristic of wastewater from the construction of the main production facilities released into the Bolshaya Pera River

Wastewater release point	Wastewater amount m^3 / y	Polluting substance (PS)	PS concentration, mg/dm^3
Release from the TBI WWTF site – discharge into the Bolshaya Pera River	543.4	suspended solids	3
		Total BOD	3
		ammonia nitrogen	0.4
		nitrates (N)	40
		nitrites (N)	0.08
		phosphates (P)	0.2
		total iron	0.1
		petroleum hydrocarbons	0.05
		anionic detergents	0
		dry residue	400
		chlorides	35
Release from the AGPP TBI WWTF site – discharge into the Bolshaya Pera River	48.3	suspended solids	3

During construction of the **temporary jetty on on the Zeya River**, domestic (black) wastewater will be collected into sewer manholes and then removed by specialist companies to decontamination facilities. Collection and treatment of stormwater is not provided during this stage.

It is planned to install four 250 l chemical toilets for sewage collection during **SDIW landfill** construction. Domestic wastewater and stormwater will be transported to a sewage treatment plant in Svobodny.

During construction of the **residential housing in Svobodny**, all wastewater generated at the construction site is to be sent to the urban sewage system.

Altogether, the potential contamination of surface water bodies during the construction phase due to wastewater discharge can be assessed as **local** and **insignificant**.

Possible disruption of natural drainage lines

Impact on the surface water bodies during construction may lead to a disruption of natural surface drainage, thereby speeding up bank erosion, transporting suspended solids from the construction site along with snowmelt and storm runoff. In the meantime, a non-organized discharge of pollutants from the construction sites along the natural downward grade of the terrain into roadside ditches and gullies outside the construction sites risks pollution of the aquatic environment by fuel and lubricants spilled due to improper storage or use.

Considering the rather limited duration of construction activities, such impacts may be assessed as **local, short-term**, of **low magnitude**.

Formation of high turbidity zones during construction activities in the water areas

Construction of the temporary jetty on on the Zeya River and the railway bridge across the Bolshaya Pera River will inevitably result in formation of high turbidity zones. However, this impact is of **local** and **short-term** nature.

7.4.2.2 Impacts during operation of the AGPP facilities

Impacts on the surface water bodies during the operation of the AGPP facilities may be associated with failure to observe regulations regarding operation of the WTP , emergency leaks of wastewater and process chemicals from pipelines and tanks.

TBI facilities (early works facilities)

The following sewer systems will be operational at the early works facilities site during their operation: sanitary (domestic) sewer system (K1), storm water sewer system (K2), general purpose sewer system for "conditionally clean" wastewater (K3), industrial sewer system (K4). Domestic and industrial wastewater are to be removed from buildings and installations via designated sewer systems (sanitary and industrial) and subsequently pumped to the proposed biological WWTF equipped with "Adsorber" units.

Industrial sewer system (K4) is intended for treatment of storm water from especially polluted areas (e.g. the open motor vehicle and construction machinery parking lot, the temporary production and consumption waste disposal site, the diked fuel and lubricant warehouse area), which is then to be pumped to WWTF site for industrial wastewater/storm water treatment. The treatment of such effluents is based on "UniRain" unit technology, and involves thin-layer settling, flotation, filtering through a granular medium, after-treatment with sorption filters, and decontamination by sodium hypochlorite.

The expected wastewater treatment efficiency at the WWTF is up to 98.99% for domestic wastewater, and up to 99.74% for industrial wastewater, which makes it possible to discharge wastewater treated into the Bolshaya Pera River. The characteristics of wastewater released into the Bolshaya Pera River is presented in Table 7.4.

Table 7.4: A characteristic of wastewater from the TBI site (early works facilities) released into the Bolshaya Pera River

Wastewater release point	Wastewater amount m^3/day '000 m^3/year	Polluting substances in wastewater at each release point	Concentration of polluting substances discharged with wastewater, mg/dm^3	MPC(fishery) mg/dm^3
Release point (outlet) #1 – discharge of treated domestic, industrial wastewater and stormwater into the Bolshaya Pera River	- 1,091.430/ 297.166			
		suspended solids	3.000	+0.25 to background
		mineralization	343.650	Not regulated
		Total BOD	3.000	3.0
		ammonia nitrogen	0.290	0.5
		nitrates (N)	6.530	40.0
		nitrites (N)	0.015	0.02-0.08
		phosphates (P)	0.150	0.05
		chlorides	25.230	300
		total iron	0.073	0.1
		petroleum hydrocarbons	0.050	0.05
		anionic detergents	0.073	

As it is evident from the Table above, concentrations of polluting substances in the treated wastewater will not exceed the MPC values established for water bodies of fishery significance. As a consequence, discharges of the wastewater **will have no adverse impacts** on the quality of river water.

Railway infrastructure facilities

It is planned to install a cesspool in the form of a steel tank for collection of sanitary and sewage wastewater, which will be removed periodically to the SDIW landfill on the basis of an agreement conclude with a specialist company ("SpetsAvtoKhozyaistvo" LLC).

All wastewater generated at "Zavodskaya" and "Zavodskaya-2" Stations sites will be pumped to the wastewater treatment plant of the AGPP.

Auxiliary facilities (TBI)

The following sewer systems are provided for collecting wastewater: sanitary, storm water drainage, saline wastewater, and industrial/storm water sewer systems. Domestic wastewater and industrial wastewater with similar composition are to be treated using the "KSmolensk" unit (with wastewater treatment efficiency of 98%). Industrial wastewater and stormwater will be treated with the "BM" unit (with efficiency of 90 to 99.97%), and storm water with the "BM" unit (with efficiency of 85 to 99.90%).

Part of the treated wastewater (31,158 m^3/y) will be re-used for the needs of the AGPP facilities, and the remainder will be discharged into the Bolshaya Pera River. The characteristics of wastewater before its discharge into a waterbody is given in Table 7.5.

Table 7.5: A characteristic of released wastewater from the Amur GPP auxiliary facilities

Wastewater release point	Wastewater amount '000 m^3/year	Polluting substances in wastewater at each release point	Concentration of polluting substances discharged with wastewater, mg/dm^3	Amount of polluting substances discharged with wastewater, tonnes/year
Release point – discharge of treated domestic, industrial wastewater and stormwater into the Bolshaya Pera River	- 302.492	suspended solids	3.000	0.907
		Dry residue	14.279	4.319
		Total BOD	3.000	0.027
		Ammonium ion	0.012	0.004
		nitrates (N)	1.195	0.361
		nitrites (N)	0.0020	0.001
		phosphates (P)	0.006	0.002
		chlorides	0.504	0.152
		total iron	0.008	0.002
		petroleum hydrocarbons	0.050	0.015
		anionic detergents	0.073	0.022

Temporary jetty on the Zeya River

During operation of the temporary jetty, the only type of wastewater will be surface runoff produced by the 2.868 ha catchment area. Дождевые и талые стоки с площадки собираются и отводятся в 8 накопительных емкостей, далее вывозятся специализированной организацией.

The average annual volume of surface runoff from the jetty site is estimated at about 28,708 m^3. The concentration of suspended substances in treated wastewater is to be 3 mg/l, that of petroleum hydrocarbons - 0.05 mg/l, and that of BOD_{20} - 3 mgO_2 / l (i.e. within the MPC limits for fishery water bodies).

Domestic wastewater from office and amenity buildings equipped with modular toilet cabins will be removed by specialized company to decontamination facilities.

Main production facilities of the Amur Gas Processing Plant

The operation of the AGPP main production facilities will result in the generation of domestic wastewater, industrial wastewater/stormwater, and stormwater runoff that will be collected by sewer systems and sent to the proposed AGPP WWTF site for further treatment.

The total volume of wastewater is estimated at 46,854 m^3/day (929,000 m^3/year), including:

- 315 m^3/day (114,000 m^3/y) of domestic wastewater;
- 8,400 m^3/day (229,000 m^3/y) of industrial wastewater;
- 38,500 m^3/day (586,000 m^3/y) of storm runoff.

The wastewater treatment facilities include industrial wastewater and stormwater treatment facilities (using "BM" unit) and domestic wastewater treatment facilities block (using "KSkomplekt" unit). Each of these include mechanical treatment equipment (automated screw screen, grit chamber), biological treatment equipment (aeration and sedimentation tanks), aftertreatment equipment (suspended-growth aeration tanks, sorption filters), and a decontamination unit (ultraviolet irradiation).

Treated domestic watewater will be discharged into the Bolshaya Pera River.

After treatment, 272,604,000 m^3/y of treated industrial wastewater/storm water and stormwater runoff (including 258,030,000 m^3/y from the Project main production facilities), whenever necessary, will be fed into recycled water tanks for industrial and firefighting needs (i.e. reuse) of the AGPP and helium production plant. Excessive treated wastewater (up to 30,000 m^3/day or 958,179,000 m^3/y) will be discharged into the Bolshaya Pera River.

The total volume of wastewater from the AGPP facilities discharged into the Bolshaya Pera River will amount to 300,000 m^3/day (1,007,120,000 m^3/y). The characteristics of treated wastewater released into the Bolshaya Pera River is presented in Table 7.6.

Table 7.6: A characteristic of wastewater from the Project main production facilities released into the Bolshaya Pera River

Wastewater volume m^3/day//thou. m^3/y	Polluting substances	Hazard class	Polluting substance concentration, mg/dm^3 actual	Polluting substance concentration, mg/dm^3 HDS
Amur GPP total: 300,000.00// 1,017.120	Suspended solids	4	3.00	3.250
	Total BOD	4	2.900	
	Ammonium ion	4	0.010	0.4000
	Nitrate anion	4	0.956	40.000
	Nitrite anion	4	0.0019	0.0800
	phosphates (P)	4	0.005	0.200
	anionic detergents	4	0.008	0.100
	petroleum hydrocarbons	3	0.050	0.050
	dry residue		11.204	N/A
	total iron	4	0.001	0.0100
	chlorides	4	0.461	300.000

Due to the proposed wastewater treatment measures, water quality will comply with the requirements for fishery waterbodies at the point of wastewater release to the Bolshaya Pera River. The permissible discharge standard (PDS) values provided in the Table above were calculated based on this assumption.

Residential housing area (microdistrict) in Svobodny will be connected to the urban sewage system.

As the quality of surface runoff pollution strongly depends on the sanitary condition of the relevant catchment areas, the following organizational and technical measures are provided for the residential housing area:

- regular cleaning;
- timely road repairs;
- enclosing green areas with barriers preventing the soil from being washed off by rain and carried onto road surfaces.

SDIW landfill

The following sewer systems will be constructed at the SDIW landfill site:

- sanitary sewer system (K1);
- storm drainage system (K2);
- pressurized storm drainage system (K2N);
- industrial sewer system serving industrial wastes burial sites (DR, K3);
- pressurized industrial sewer system (K3N).

Domestic wastewater is to be collected in designated tanks, from where it will be transported to the WWTF alongside with black water from the bio-toilets.

Storm and snowmelt runoff from the management and industrial areas of the landfill will be sent from receiving sewage pumping stations into the storm water containment pond, and then pumped to the WWTF site for further treatment. Treated wastewater will be used for dust suppression at the landfill site.

Overall, in view of the degree of treatment provided for all types of wastewater from the Project facilities which is to be discharged into the Bolshaya Pera River, the impacts from such discharges on surface water bodies is assessed as **negligible**.

Implementation of appropriate protection measures (see below) will enable prevention of impacts on surface water bodies caused by emergency leaks of wastewater and process chemicals from pipelines and tanks, as well as littering of the riparian areas.

7.4.3 Mitigation measures

7.4.3.1 Construction phase

Measures to protect surface water bodies during construction of Project facilities include:

- to keep strictly within the borders of the proposed construction sites;
- performing preparatory work for construction sites exclusively in winter (to minimize surface runoff);
- clear snow and ice from construction sites and remove them to designated areas to prevent runoff during snowmelt period;
- placing a ban on washing motor vehicles and other machinery outside designated areas with waterproof surfaces;
- refueling of construction equipment and machinery in designated specially equipped areas using fuel trucks with a hose connection and a shut-off valve at the outlet end, as well as secondary containment trays to prevent any fuel spills;
- Installation of hermetically sealed containers for collecting liquid domestic wastes. As they fill up, they should be removed to existing treatment facilities;

- to make sure that construction debris and domestic garbage is collected in a designated area with a hard surface and stored in hermetically sealed containers. Garbage should be removed on a regular basis by a specialized company;
- to make sure that all machinery and mechanisms involved in construction operations are in good repair and have been properly inspected and repaired to prevent fuel and lubricants from spilling onto the ground. Road vehicles and construction machinery will be serviced and washed at the owner's production facilities;
- Installation of a required number of culverts under the embankments of designed linear facilities to allow surface runoff to pass;
- Perform soil excavation operations considering the time of year, the level of water in the river, the condition of soil;
- Set up welding, pipeline sections insulation sites, parking lots, filling stations and motor vehicle repair shops outside floodplain areas;
- Minimization of the time that pipe trenches stand open before pipe-laying;
- Removal of construction debris and waste, as well as unused materials after the construction work completion and cleaning of the adjacent catchment area;
- Construct dikes around, and install waterproof surfaces on, the production sites;
- Perform construction work in the Bolshaya Pera buffer zone as quickly as possible during the minimum flow period;
- Unload pipes without dragging them over the ground, install temporary end caps (on individual pipes or pipe sections during temporary storage) to prevent snow, water, dirt from getting inside the pipelines;

In general, if the above measures are implemented, the residual impact on surface water bodies during construction may be assessed as **short-term** and **low**.

7.4.3.2 Operation phase

The following measures aim to prevent pollution of water bodies with wastewater and storm runoff (including emergencies) during operation of the Project facilities:

- Continuous monitoring of WWTF operations;
- Automated monitoring of the volume of wastewater discharges by installing flow meters in pumping stations;
- Regular site cleaning;
- Timely repair of roads surfaces;
- Enclosing green areas with barriers preventing the soil from being washed off by rain and carried onto road surfaces;
- Technical measures to prevent fuel, lubricants and wastewater filtration and emergency leaks;
- In the process of the operation of the railway bridge across the Bolshaya Pera river, it is required to remove contaminants systematically and timely from the ballast layer; in spring, prior to snow melting, the ballast section at the bridges must be cleaned to remove contaminated snow.

During operation of the engineering infrastructure facilities, aside from the measures mentioned above, it is also proposed:

- make sure that garbage, leaks and spills from transported cargoes are cleared from railway tracks. No wastes should be buried within the construction site;
- make sure that the culverts and sewers are inspected in a timely and regular manner, restored to operability, if necessary, to avoid scour or silting, and cleared from rubbish;

- collect storm water into the station's existing storm water drainage system;
- all underground utility lines should be laid in metal pipes with anti-corrosion coating or in polyethylene pipes.

To prevent adverse impacts on surface water bodies during operation of linear facilities, it is planned to perform seasonal maintenance and inspections of culverts according to a tailored schedule.

7.4.4 Residual impacts and monitoring

In general, considering implementation of technical and environmental measures planned, the impact on surface water bodies is assessed as **low** and **negligible**.

Monitoring of impacts on surface water bodies is a part of the OEC Programme, which includes monitoring of WWTF operations efficiency and the quality of wastewater discharged, as well as hydrochemical monitoring of surface waters and bottom sediments (including location of the railway bridge across the Bolshaya Pera River) and monitoring of the water protection zone status.

7.5 Impact on the Geological Environment and Groundwater

7.5.1 Baseline conditions

The geological setting in the area selected for the AGPP Project and associated facilities is characterized by the following conditions important for assessment of the impacts by planned operations:

1. Association of the subject area with the floodplain terrace complex of the right bank of the Zeya River and its tributaries determines that the upper horizons of the cross-section are composed of alluvial deposits with limited proportions of lacustrine, bog, deluvial and proluvial ground.
2. The hydrogeological conditions of the subject area are characterized by an elevated water content in rocks, with extensive occurrence of interstitial and stratal/interstitial water-bearing horizons. Svobodnensky District is characterized by eight aquifers with large underground water resources. An independent area with good prospects for exploitation of groundwater resources is the Zeya River valley and the riparian zone of the Zeya water reservoir, where there is no permafrost ground due to the warming effect of the surface waters and it is possible to construct water abstraction facilities of the infiltration type. The groundwater is not contaminated by industrial and domestic wastewater discharge.
3. Out of hazardous endogenous geological processes, the most characteristic feature of this region is high seismic activity, i.e. up to 7-8 points of the OSR-97C Scale, which means hazardous and very hazardous categories according to the terminology used in SNiP 22-01-95.
4. Among other hazardous exogenous geological processes, especially significant are erosion and aggradational processes (moderately hazardous category according to SNiP 22-01-95), flooding (moderately hazardous category according to SNiP 22-01-95) and frost heaving attributable to deep ground freezing (down to 0.8m to 3m according to SP 50-101-2004 (hazardous category according to SNiP 22-01-95).
5. There are no proven mineral resources in the area selected for construction of the AGPP and associated facilities.

The subject area is located at the southern boundary of the permafrost ground zone, which occurs in this area in the form of sporadic islands. According to the drilling data, the permafrost ground is reported within relatively small areas in the boggy parts of the Bolshaya Pera River valley under the stratum of biogenic accumulations with high heat-insulating properties.

Under the given conditions, the stability of the geological environment in relation to any technogenic impacts is predetermined to a significant degree by the fact that the underground waters are well protected from contamination. During the Project design phase, this was assessed for the exploited

Buzulinsky aquifer, which is classified as reliably protected due to its deep occurrence and the protection provided by the overlying thick horizon with low permeability.

Currently, the sanitary and epidemiological situation in the subject area has been assessed as favorable because there are no potential sources of groundwater pollution.

7.5.2 Impacts and receptors

7.5.2.1 Construction phase

The main part of inevitable adverse impacts on the geological environment is associated with drilling, excavation, earthmoving, piling, and other operations, which may result in:

- direct physical and mechanical disturbance of the integrity of the ground layer and water-bearing horizons;
- a complex set of static and dynamic ground loads;
- surface relief transformation;
- removal of a part of local ground and filling of imported ground;
- ground compaction due to the loads imposed by heavy construction machinery, buildings, installations and hard pavement;
- redistribution of the surface runoff and subsoil drainage streams, including barrage and drainage effects.

The impacts will be mostly of physical and mechanical nature, and facilitate development of exogenous geological processes. The typical dangerous impacts in the subject area will be erosion and aggradational processes, ground saturation with water and swamping and frost heaving of the ground. Furthermore, suffosion might also take place (in the railway station "Zavodskaya-2" area), as well as other engineering processes within the outlines of ground constructions and excavations.

In addition, construction and subsequent operation of the planned facilities will impact the thermal regime of the ground. However, due to the local and insular nature of permafrost ground, the thermal impact will be limited to changes in the seasonal freezing and thawing of the ground, and it is not expected that they would induce development of any hazardous exogenous geological processes and hydrologic phenomena.

An exception is some areas identified during the surveys is characterized by chilled and frozen grounds, e.g. the sewer line route sections ПК 13+35 – ПК 16 and the railway bridge across the Bolshaya Pera River. In such areas, new permafrost ground areas can form and result in intensification of frost heaving of the ground.

Adverse impacts on geology can also occur due to emergency situations, e.g. spills and leakage of fuel, lubricants, and other technical fluids resulting in their penetration into the geological environment with formation of infiltration bodies in the ground and in underground water contamination, penetration of leakage from water supply networks into water-bearing horizons, contamination of groundwater in case of flooding.

In terms of significance, impacts on the geological environment are assessed as follows:

- Non-linear transformation of the ground stratum as a result of earthmoving and associated operations (including fertile topsoil layer stripping, technical land reclamation) - **moderate**;
- Vertical transformation of ground stratum due to drilling and piling operations - **negligible to low;**
- Loads imposed on ground stratum - **low to moderate;**
- Development of hazardous exogenous geological processes and hydrologic phenomena (HEGP & HP) - **low to moderate**; along man-made embankments - **to high** (flooding and swamping);
- Chemical and biological contamination of the uppermost shallow water-bearing horizon - **moderate to high;**

- Contamination of the exploited aquifer - **low**;
- Thermal impacts - **low**.

7.5.2.2 Operation phase

During the operation phase of the AGPP Project, certain stable transformations and tendencies will inevitably take place in the geological environment in connection with the following factors:

- Water abstraction from the exploited aquifer;
- Redistribution of the surface runoff and subsoil drainage streams due to buildings, construction and hard pavement;
- Changes in the thermal regime of the ground;
- Barrage and infiltration effects of technogenic soils and ground and other construction, especially linear facilities, and boreholes and wells drilled for different purposes.

Water abstraction from the aquifer

Water supply for the AGPP main production facilities during their operation will use the groundwater intake structure with a capacity of 5,760 m^3/day at the Amur GPP TBI site. The total water use at all the Amur GPP main production facilities will be 1,550 m^3/day (Table 7.7), which includes:

- 339 m^3/day (119,347,000 m^3/y) for domestic and sanitary needs;
- 1212 m^3/day (366,275,000 m^3/y) for industrial needs.

Table 7.7: Water use by the Amur GPP facilities during operation phase

Facility	Volume of water used, m3/day// m3/y		
	Total	including:	
		domestic/drinking	industrial
Gas Processing Plant			
Main production total	**1,550.335+120.0* //485,622**	**338.69//119,347**	**1,211.645+120.0* //366,275**
Amur GPP auxiliary facilities			
TBI site	982.00//345,013	786.75//289,530	196.090//55,483
Auxiliary production facilities	397.911+120.00* //126,632	88.001//32,121	309.910+120.0//94,511
"Zavodskaya 1" railway station	173.630//20,600	50.470//11,300	123.160//9,300
"Zavodskaya 2" railway station	6.490//1,950	4.49//1,650	2.00//300
Ust-Pera station	0.57//13	0.57//13	
Jetty	0.26//95	0.26//95	
SDIW landfill	0.827//302	0.827//302	
Previously designed facilities total	**1,562.528//501,863**	**931.368//342,317**	**631.160//159,517**
Facilities total	**3,112.863+120.00* //987,456**	**1,270.058//461,664**	**1,842.805+120.00 //525,792**
KS-7a site	200.00//73,000	200.00//73,000	
Total required water intake	**3,312.863+120.00***	**1,470.058//535,664**	**1,842.805+120.00//**

Facility	Volume of water used, m3/day// m3/y		
	Total	including:	
		domestic/drinking	industrial
	//1,060,456		//525,792

The water quality compliance with the applicable requirements of SanPiN 2.1.4.1074-01 has been confirmed for the proposed aquifer by experts' statement issued by the Amur Region Center for Hygiene and Epidemiology (No.5593 of 13.10.2015). The planned water abstraction will not impose any significant impact on the groundwater condition because it will not exceed the permissible limit for natural recovery of water resources and cause any depletion of the 'elastic' groundwater reserves.

In accordance with SanPiN 2.1.4.1110-02, the design of the sanitary protection zone (SPZ) of the future water abstraction facility of the AGPP provides for the following dimensions: Belt 1: 30 m wide for each water well; Belt 2: 260m and 280m wide, downstream and upstream, respectively; Belt 3: 1330m and 2300m, respectively. Since the distance between the AGPP facilities and the water abstraction facility is approximately 1 km, some of those facilities will be within Belt 3 of the sanitary protection zone, where it is possible to have fuel and lubricant depots, accumulating ponds for industrial effluents, and other production facilities posing a threat of chemical pollution of groundwater only if special measures are taken to protect the aquifer from pollution.

The likelihood of groundwater depletion as a result of water abstraction for the Project needs is assessed as **low** (unlikely).

No other types of impacts and loads on the geological environment additional to those anticipated for the construction period are expected during the operation phase.

7.5.3 Mitigation measures

7.5.3.1 Construction phase

The mentioned impacts on the geological environment and development of HEGP & HP have been taken into consideration in the process of development of a set of measures aimed at protection of the geological environment. Most of the planned measures have only indirect relation to the geological environment and are related to the components having contact with geological structures: soil and vegetation cover, surface water bodies and constructions. The Project design includes the following measures:

- Execution of work strictly within the boundaries of the land areas allocated for construction; sound and consistent use of land and soil resources;
- Compliance with the construction time schedule considering the seasons suitable for execution of certain types of work;
- Use of only environmentally safe drilling mud types for borehole drilling; use of drilling technology not requiring any mud pits;
- Delivery of chemicals and clay powder to the drilling site in the manufacturer's package, polyethylene bags and in rubber-cord containers and their storage in covered premises;
- Strict control over the working conditions and leak-tightness of drilling rigs during drilling;
- Storage of fuel and lubricants in special tanks that are tested for leak-tightness before use and equipped with gauge tubes;
- Use of recycled water during drilling; use of spare drilling mud for drilling subsequent wells;
- Compliance with the norms and rules applicable in the RF for handling construction materials, fuel and lubricants, paints and wastes;

- Implementation of an integrated complex of anti-erosion measures (reinforcement of slopes) and measures for surface runoff management (e.g. drainage, stormwater drainage system, treatment of stormwater runoff);
- Establishment of a sanitary protection zone around any underground water supply source;
- Installation of water flow meters on the WTF water supply system;
- Construction of embankments for the sites and roads;
- Refuel motor vehicles only in designated areas;
- Technical and biological land reclamation after the construction completion in areas allocated on a short-term basis;
- Site improvement and greenery planting within the AGPP sites located outside of buildings and installation;
- Monitoring of the geological environment within the framework of the overall operational environmental monitoring and control (OEC) Programme for construction and operation of the AGPP facilities.

In addition, the special measures should be taken at the site of the railway bridge across the Bolshaya Pera River, where permafrost ground still exists:

- ensure maximum possible degree of conservation of, and for disturbed areas restoration of, the organogenic surface soil horizons within the floodplain complex of the Bolshaya Pera River valley;
- ensure water passing under the bridge structure is concentrated; if necessary install a frost shield using cooling devices; prevent prolong accumulation of water along embankments and under the bridge;
- reinforce the river bed bottom to prevent washout and deformation within the bridge construction area;
- if the piles are driven within permafrost and chilled ground, ensure their penetration below the level of maximum possible ground thawing, i.e. down to a depth where they can withstand the design loads, including the frost heave force;
- locate the pile elements outside the underground ice or highly icy grounds; where it is impossible, the piles should be piled throughout the entire thickness of such ground.

A set of anti-seepage measures to prevent pollution of groundwater with drainage water from the SDIW landfill site is provided, such as the use of geomembrane and bentonite mats for waterproofing, etc.

7.5.3.2 Operation phase

The main measures aimed at subsoil resources protection are associated with the exploitation of the designed water intake facility and are predominantly of preventive nature:

- Systematic monitoring of the water level and chemical composition to identify timely any trends toward depletion and/or contamination of the exploited aquifer;
- Systematic supervision over the compliance with the applicable requirements relating to the SPZ of the water abstraction facility to identify and eliminate timely any sources of chemical and biological contamination;
- Site improvement within Belt I of the SPZ and compliance with the applicable requirements to all three belts of the SPZ around the underground water abstraction facility.

To monitor the condition of the groundwater level and to forecast processes associated with its changes, operating, stand-by, and monitoring wells at the water abstraction facility site shall be installed. Additional observation hydrologic wells are also to be drilled in most informative areas (e.g. flooded and boggy areas, high groundwater level).

7.5.4 Residual impacts and monitoring

Taking into consideration the implementation of measures aimed at geological environment protection, the associated adverse impacts during the construction and operation phases of the Amur GPP Project will be mainly **local**, i.e. associated with the respective technical sites and utility lines, and **insignificant** with regard to their magnitude in comparison to the scale of the engineering geological district and sub-district.

It is anticipated that secondary activation of HEGP & HP, erosion/aggradational processes, saturation of the ground with water and cryogenesis will be especially significant. Such processes can impact areas adjacent to Project sites. In case of intensive development of secondary exogenous processes, their expansion would be limited in the west, south and south-east by the river valleys, and in the north and north-east by the natural ascending slope surface. The lateral component of the migration streams of pollutants into the geological environment can be associated with the first and second shallow water-bearing horizons discharging to the gully and valley network.

The main tool for assessing the geological environment condition and monitoring of its modifications, as well as supervision over the execution and assessment of the sufficiency of Project design solutions relating to the condition of the subsoil resources during the construction and operation phases of the Project, will be monitoring of the geological environment as a part of operational environmental monitoring (OEC).

The core objectives of the geological environment monitoring will be:

- Monitoring of the geological environment condition and development of hazardous geological processes, both existing and induced by the construction and operational processes at the AGPP sites;
- Analysis, processing and storage of collected data;
- Development of recommendations aimed at conservation and sound use of the geological environment and protection from impacts of HEGP & HP;
- Optimization of the monitoring network.

7.6 Noise and vibration

Noise and vibration will occur at all phases of the Project's lifecycle; although, environmental impacts associated with them will significantly vary in duration, extent, and amplitude at each phase of the Project's lifecycle.

Impact of noise on humans is assessed by comparing it to the noise standards adopted by the Project (Table 7.8). The extent of noise impact is assessed and controlled within the sanitary protection zones (SPZ) around the Project's main facilities to be set up in accordance with (among others) the RF regulations in the field of protecting human health from noise (see also Section 9.2). SPZ within the Project area will be established for the AGPP and SDIW landfill. In addition, sanitary gaps will be set up for the railway station "Ust-Pera". These will possess SPZ status but will not require a special design for their arrangement.

Table 7.8: Project's allowable noise standards (equivalent continuous noise level, LA eq, dB(A))

Category	Daytime (07:00 – 23:00)	Nighttime (23:00 – 07:00)
Residential areas /dormitories	55	45
Office buildings	60	
Industrial facilities	80	

Noise impact modeling was performed to predict noise levels in places where receptors are located, and to determine the size of the SPZs was performed according to the methodology described in SNiP 23-03-2003 "Noise protection", and using the *Ekolog-Shum* software developed by *Integral*.

7.6.1 Baseline conditions

Prior to commencement of construction works, constant noise sources within the Project implementation area were local motor and railway roads. The 2015 measurements of actual noise levels showed that the maximum noise levels at the control locations on the sanitary gaps boundary exceeded allowable standard levels in the daytime.

The only sources of vibration that may potentially affect the residents within the territory of the Project implementation are operations of rail transport at "Ust-Pera" station, which causes noticeable ground vibrations. Vibration spreads through both ground and construction structures fading relatively slowly. The 2015 vibration levels measurements showed that the actual levels were above the allowable ones.

7.6.2 Impacts and receptors

During the Project implementation, noise and vibration will have potential impact on:

- People employed by the Project, both during the construction and operation of the Project facilities; such impact includes:
    - Noise impact associated with occupational health and safety matters,
    - Noise impact affecting the rotational camps at the TBI site (during construction phase);
- The residents of the nearest settlements and people living near highways and railway lines that will be used for transporting cargoes and equipment (during the construction phase) and exporting finished products (during the operation phase);
- terrestrial fauna, including birds and terrestrial animal species, due to noise affecting their habitats (see Section 7.7 below).

7.6.2.1 Construction phase

During construction of the proposed facilities, the main noise sources will include road building machinery, motor vehicles and diesel power plants operating at construction sites. A substantial number of noise sources of various acoustic power are concentrated on the construction machinery. They form the overall acoustic field of the environment.

Amur GPP and TBI construction site

Noise pollution was calculated for the noise sources located within the Amur GPP and TBI sites and on the roads accessing those sites. The period of work with the maximum number of road construction machinery and vehicles was considered in the acoustic calculations.

Noise pollution levels were determined at the boundary of the nearest residential area, the settlement of Yukhta, and within the work area, the construction site, in a total of four control locations. The calculation results show that the maximum noise levels will not exceed:

- 78 dB at the modular dorm boundary;
- 41 dB at the border of the Yukhta setttlement.

In view of this, the standards established for noise impacts on the areas of temporary accommodation of construction personnel will be slightly exceeded.

Railway infrastructure facilities

During the upgrade of "Ust-Pera" station, the main sources of noise will include construction machinery and areas where crushed stone will be unloaded from dump trucks.

Considering that the residential structures at "Ust-Pera" station are located 35 to 85 m from the existing railway tracks, the following two sites were selected for assessment of noise pollution during construction: near residential house #2 and near residential house #3. As railway traffic will not be

halted during the station upgrade, the noise from passing trains was considered as background noise. The calculation results demonstrated that the equivalent noise levels at the control locations at the boundary of the residential area did not exceed the allowable daytime and nighttime standards. Nevertheless, at control locations near residential houses #1 and #3 the allowable daytime standards are not met, and at control location #4 the equivalent noise level reaches the allowable standard values at night.

Due to that fact, it is required, that special measures aimed at protection of people from noise impact are implemented to reduce noise impacts on residential houses.

The proposed "Zavodskaya" railway station is an intricate set of buildings and installations interconnected by technological processes. Construction work are performed simultaneously on the entire station area.

To assess the noise level, a calculation was performed of noise pollution at the boundary of the nearest residential area (Yukhta, 5.7 km from the construction site). The calculation results demonstrated that the equivalent noise levels will be below the allowable standards, both daytime and nighttime, and will equal 13.3 – 14.6 dBA.

The estimated equivalent noise level at the construction site will be below 63 dBA, which is lower than the standard value (80 dBA). The estimated maximum noise level will also be below the allowable standards.

The proposed "Zavodskaya-2" station is designed to serve as the railway terminal of the AGPP and is located parallel to the public railway station of "Ust-Pera".

Construction work will be performed throughout the entire station area. The construction procedure comprises a sequence of operations. An especially large number of construction machinery shall be employed during the second and the third month of the construction phase, when site clearing and roadbed construction are to be performed. The highest noise level is associated with clearing of the site using stubbing machines, bulldozers, tractors, and operation of other machinery.

Acoustic calculations of the noise pollution levels have indicated, that the indoor noise levels during construction might potentially exceed the maximum permissible levels in the residential houses located near the "Ust-Pera" station. The background noise level exceeding the permissible values also has a significant effect. Therefore, implementation of special measures is required to reduce noise down to an acceptable level.

Auxiliary production facilities construction

The period of work with the maximum number of road construction machinery and vehicles was considered in the acoustic calculations. The calculation determined the sound pressure levels (SPLs) at the AGPP SPZ boundary, at the boundary of the nearest residential area (Yukhta settlement), and within the work area at the construction site.

The calculations indicate that noise levels at the SPZ boundary, at the boundary of the nearest residential area in Yukhta, and within the work area at the construction site were below the allowable standard values.

Construction of the temporary jetty on the Zeya River

Noise pollution is associated with the operation of construction machinery and vehicles. Since they are not a stationary source of noise and can be stationed anywhere within the work area the assessment of the equivalent noise level was performed for an assumed noise source with an aggregate noise characteristic placed in the acoustic center of the site. The calculation results indicated that the equivalent and maximum noise levels at the control locations within the construction site were not to exceed the allowable standard values.

Construction of access roads

The main sources of noise will include construction machinery vehicles. For calculation of the noise levels, the following conditions were assumed:

- the period of maximum equipment load was taken into consideration;

- the calculation was performed for daytime conditions, in accordance with the working hours at the construction sites;
- simultaneous operation of all the noise sources was assumed.

The calculations were performed for two construction sites located near Yukhta and the village of Tchernigovka. The equivalent and maximum noise levels at the boundaries of the residential areas (Yukhta and Tchernigovka settlements) are not to exceed the allowable standards.

Construction of the gas processing plant

The period of work with the maximum number of road construction machinery and vehicles was used in the acoustic calculations. The sound pressure levels (SPLs) at the Amur GPP SPZ boundary, at the boundary of the nearest residential area (Yukhta settlement), and within the work area at the construction site were determined. The calculations were performed for nighttime conditions since the intensity of construction work was assumed to be constant during the day, and the allowable noise levels for nighttime conditions were stricter that the ones for the daytime.

Seven control locations were defined to assess the estimated sound pressure levels, including:

- Four locations at the Amur GPP's SPZ boundary;
- Two locations at the Yukhta boundary;
- One location within the construction site.

The calculation showed that the equivalent noise levels at all control locations were below the allowable standards in the nighttime.

Construction of the residential district (microdistrict) in Svobodny

The noise level during construction was calculated for one stage of construction when the number of construction machines simultaneously in operation will be the highest. The calculations showed that the equivalent noise levels during the construction of the residential district in Svobodny will not exceed 37 to 40 dBA and will be below the allowable standard level set for residential areas in the nighttime (45 dBA).

Construction of the SDIW landfill

Calculations of noise sound pressure levels were performed to assess the equivalent noise level at the border of the nearest residential area (Gashchenka settlement) located at a distance of 3 km from the SDIW landfill border. The calculations showed that the equivalent noise level at the Gashchenka boundary would be 18.9 dB, which is below the allowable level for night time and daytime conditions.

In general, the noise impact during the construction phase is assessed as **negligible,** with the exception of the Ust-Pera station, for which it is assessed as **low**.

7.6.2.2 Operation phase

Railway infrastructure

The main noise impacts during operation of the engineering infrastructure facilities will be associated with **Ust-Pera railway station** operation due the close proximity of the residential housing to its railway tracks.

To reduce noise impacts down to the allowable standard levels during railway transport operation, there will be sanitary gaps set up at the railway lines. The Project provides for the following sanitary gaps set up at the existing Ust-Pera station:

- up to the boundary of the residential area from the east side of the station (residential houses are located at a distance of 36, 65, and 83 m from the railway tracks);
- 100 m from the railway tracks from the west side of the station.

Equivalent and maximum noise levels were calculated at the following control locations to assess the noise level on the sanitary gaps boundary:

- Two meters from the facades of the residential houses;

- Two meters from the facades of the station's administrative buildings;
- At the sanitary gap boundary west of the station.

The calculations show that noise impact levels at all the control points does not exceed the allowable standard levels either at night or during the day.

The main source of vibration during "Ust-Pera" operations will be the existing railroad. To reduce vibration levels in the residential and administrative buildings nearest the railroad, the Project provides for construction of an anti-vibration screen in close proximity to the protected structures.

There are a lot of noise sources within the "**Zavodskaya" station** area, both indoors and outdoors, including:

- Railway tracks and road trains;
- Ventilation systems (mechanical exhaust fans);
- Process equipment (machine-tools, washing equipment, cranes' electric motors, compressor units, diesel power plants, diesel fuel pumps, transformer substation);
- Rheostat shop test facility where locomotives' diesel engines are tested after repair.

The calculations of equivalent and maximum levels indicate that, if the proposed technological and organizational noise reduction measures are implemented, the estimated daytime and night time noise levels at the "Zavodskaya" station and inside the buildings and premises will not exceed the allowable standard values.

Two scenarios for moving trains and railway cars have been considered to assess the noise pollution level during the **"Zavodskaya-2" station** operation.

The results of the noise pollution estimation have indicated that the boundary of the sanitary zone at the station shall be located:

- 100 m from the outside rail along the entire length of the station at the station's eastern side;
- Parallel to the outside rail of the station at 28 to 65 m from the station's outside rail - at the station's eastern side.

Noise-abatement 3 m tall shields shall be installed along the boundaries of the station both at its eastern and western sides, which will ensure the reduction of the equivalent and maximum noise levels at the boundary of the sanitary gap, within the residential areas, and inside the production facilities down to the acceptable daytime and night time standard levels.

The main source of vibration impact during the "Zavodskaya-2" station operation will be the existing railway facilities at the "Ust-Pera" station. Since the planned track lines of the "Zavodskaya-2" station shall be located on an embankment and the traffic speed and intensity will be much lower than those at the "Ust-Pera" station, the expected level of vibration caused by the planned track lines will be significantly lower than the existing one. However, a set of special measures is in place for mitigation of vibration impacts (see Section 7.6.3 below).

Auxiliary production facilities operation

The sources of continuous noise during the operation of the AGPP auxiliary production facilities include the transformers of the integrated unit transformer substations and Energo-D1000/10.5 diesel power plant block containers.

The sources of recurring noise impact within the area adjacent to the AGPP construction site include rooftop ventilators and air conditioner units (for heated parking garages for buses, cars, trucks, special machinery, and tank trucks) and DES-1000 and DES-1600 emergency stationary diesel power plant block containers (during periodic diesel motors start-up) located at the infrastructure facilities.

All sources of continuous and recurring noise impacts were taken into account for acoustic calculations during the operation of the auxiliary facilities. Seven control points were chosen to determine the sound

pressure levels (SPLs) generated by the sources of noise in the work area, at the residential area boundary, and at the boundary of the Amur GPP's SPZ.

The analysis of the acoustic calculation results showed that during the operation of the auxiliary production facilities, continuous noise sources, and recurring noise sources and during routine checks of the emergency diesel power plant the noise level at AGPP's SPZ boundary, at the border of the nearest population center, Yukhta, and inside the work area at the industrial site would not exceed the allowable standards.

Operation of the temporary jetty on the Zeya River

Roadway traffic will be the main source of noise, including road trains transporting oversized equipment. Noise pollution level calculations show that the equivalent noise levels on the boundary of the temporary jetty site are 45 to 80 dB, which is below the allowable standard values.

Operation of access roads

The following factors affect the level of noise during the operation of access roads:

- Traffic speed;
- Longitudinal slope;
- Coarseness of the road surface;
- Traffic intensity;
- Traffic flow composition;
- Character of adjacent areas; and
- Geometric design of the road.

The receptors of noise impact are residential areas, next to which these roads have been constructed. The acoustic calculations indicate that the sound pressure levels at the boundary of the nearest residential area (Yukhta) will not exceed standard limit values, and will total 16.1 dB during the day and 13 dB at night.

Gas Processing Plant operation

The noise and vibration sources at the AGPP site include regulating and safety valves, pumps, GPA-32 gas compressor units, air coolers and integrated unit transformer substations which will constantly be in operation.

The design documentation provides for use of control and safety valves whose noise characteristics do not exceed the allowable standards for noise in industrial zones and residential areas. Safety valves do not produce continuous noise since they are only triggered in emergencies, the likelihood of which is extremely low as suggested by the practice of designing similar facilities.

The sources of recurring noise impacts are:

- Feedstock base pumps: propane fraction and NGL pumps, tank farm #1 propane/butane fraction pumps; tank farm #2 butane fraction pumps;
- Tank farm #3 NGL pumps;
- Rooftop ventilator and air conditioning units;
- Container blocks of emergency stationary DES-1000 and DES-1600 deisel power plants (periodic diesel startups) located at energy blocks, feedstock base, loading racks and infrastructural facilities sites.

All sources of continuous noise and all the sources of recurring noise impacts were considered for acoustic calculations during operation. Seven control points were chosen to determine the sound pressure levels (SPLs) generated by the sources of noise in the work area, at the residential area boundary, and at the boundary of the Amur GPP's SPZ.

The analysis of the calculation results showed that given the 24-hour operation of the proposed AGPP main production facilities, the sound pressure levels within the work zone, at the SPZ boundary and at the boundary of the nearest residential area would not exceed the allowable standard values.

Operation of the residential district (microdistrict) in Svobodny

During operation of the residential district in Svobodny, the noise sources will include temporary and visitors' parking lots and roadway traffic. Acoustic calculation of equivalent and maximum noise levels was performed at 42 control points to assess noise levels. They indicate that the equivalent noise levels during the operation of the residential district in Svobodny would be 45 to 46.6 dBA, and would thereby exceed the allowable levels set for residential areas in the nighttime (45 dDA). Special measures to reduce the noise impact to allowable levels have been developed by the Project for operation of the residential district in Svobodny (see Section 7.6.3).

Operation of SDIW landfill

The main sources of noise during the operation of the SDIW landfill will include mechanisms necessary for receiving, stockpiling, and isolating wastes, self-contained thermal destruction units (TDU), the integrated unit transformer substation (IUTS), and sewage pumping stations. This equipment contains a substantial number of noise sources of various acoustic power, which form the overall acoustic field of the environment.

To assess the noise sound pressure levels, acoustic calculations was performed for the following control locations: one at the boundary of the village of Gashchenka (3 km of the landfill) and eight at the boundary of the landfill provisional SPZ (500 m from the landfill border).

The calculations showed that during the operation of the landfill, the equivalent noise levels were below 37 dBA at the SPZ boundary, and 14.8 dBA at the Gashchenka boundary, which is significantly lower than the allowable noise level, 45 dBA for nighttime conditions.

The results of the vibration level measurements performed at the workplace of the KTO-100.K40.P and KTO-2000.PS units operator were used to assess whether the impact level is allowable in terms of vibration. The measurements showed that the overall vibration at the incinerator operator's workplace does not exceed the allowable levels.

In general, noise and vibration impact levels during operation of Project facilities are assessed as ***low***, with the exception of the residential district (microdistrict) in Svobodny, where noise impacts within the boundaries of the residential area are assessed as being of ***moderate magnitude*.**

7.6.3 Mitigation measures

7.6.3.1 Construction phase

A set of noise protection measures aimed at reduction of noise related environmental impacts from the Project facilities during construction is in place.

Railway infrastructure

To reduce background levels of noise, it is planned to perform rail polishing activities using a special rail-grinding train prior to the commencement of the "Ust-Pera" station renovation, which will result in reduction of estimated noise levels by 15 dB below the allowable standard levels.

To mitigate the noise impact on the residential houses during **"Ust-Pera"** station renovation, two 2.5m-high temporary wooden barriers (one 180 m and one 300 m in length) will be erected near the houses.

To ensure compliance with the sanitary norms during construction of the **"Zavodskaya-2"** railway station, four temporary 2.5m tall fences are to be installed at the construction site.

The equivalent noise levels generated in the process of the "Ust-Pera" station renovation and "Zavodskaya-2" station construction will comply with applicable regulatory requirements, provided that the planned noise abatement measures be taken (installation of provisional fencing and rail grinding).

SDIW landfill

To reduce the noise levels during the landfill construction, the following measures aimed at control of the noise sources during their operation were proposed:

- temporary shutdown of equipment used during construction;
- performing the noisest work during the daytime;
- placing equipment in sound-proofed premises;
- operating equipment fitted with soundproof hoods and enclosures.

7.6.3.2 Operation phase

Railway infrastructure

A set of the following technological and organizational measures aimed at mitigation of noise and vibration impacts at all the railway stations is in place[21]:

- Rail polishing on a regular basis to prevent rail corrugation;
- Use of crushed stone for the track bed filling;
- Compliance with the applicable speed limits and technical specifications of the railway equipment;
- Technical inspections of maintenance vehicles on a regular basis;

In addition, the following measures are planned at **"Ust-Pera"** station:

- Direction of the longest and heaviest trains to the track farthest from the residential houses;
- Use of the tracks,that are the closest to the residential buildings for long-time train stoppages;
- Preventing trains from being directed to spur tracks 21 and 22 during nighttime;

At the "**Zavodskaya"** station the following measures are planned[22]**:**

- Reducing aerodynamical and mechanical noise of the ventilation units;
- Equipping indoor compressor units with enclosures (casings);
- Locating the rheostat testing unit as far from the office premises as possible;
- Conducting rheostat testing in the daytime only. During testing, the operation of outdoor pumps will be halted, no routine maintenance will be carried out on the diesel power plant, roadway traffic and shunting will be limited;
- Use of PPE (ear plugs or headphones) by employees conducting rheostat testing;
- Fencing of the station area with 3m-high concrete concrete fence;

Non-simultaneous passage of trains through the existing ("Ust-Pera" station) and planned ("Zavodskaya-2" station) track lines is also provided for the **"Zavodskaya-2"** station.

Gas Processing Plant

To reduce noise levels during plant operation, space-planning solutions are being developed and appropriate soundproofing is being provided for in the Project design. Especially noisy machines and units will be installed in enclosures. Windows and joints between windows and walls will be adequately soundproofed. In addition, several technological and organizational measures will be implemented to mitigate the noise produced by equipment and roadway traffic during their operation.

[21] 4700П2-1.00.П.05.ООС1.ПЗ (1). Volume 7.1 Rev. 1 Stage 2. Railway lines and installations. Development of public railway infrastructure at station Ust-Pyora of the Trans-Baikal Railway, a branch of OAO Russian Railways. Project design documentation. Part 7. Environmental protection measures. Part 7.1. Explanatory note.

[22] 4700П2-2.00.П.05.ООС1.ПЗ (1). Volume 7.1 Stage 2. Railway lines and installations. Development of the railway infrastructure of uncommon use; Project design documentation. Part 7. Environmental protection measures. Part 7.1. "Zavodskaya" railway station. Book 7.1.1. Narrative

To reduce the level of noise produced by ventilation equipment the following measures have been proposed:

- All equipment should comply with the sanitary noise level standards;
- Suction and exhaust pipes of ventilator units will be connected to air ducts with flexible connectors;
- Ventilator units vibroinsulated using vibroinsulation spring pads;
- Ensure ventilator units operate at maximum efficiency;
- Ensure ventilator units operate with no excessive pressure created;
- Preventing the air velocity in air ducts, air distributors, and ventilation grilles from exceeding allowable values.

The following has been proposed to reduce the level of noise produced by the gas compressor units (GCU):

- Installing silencers on suction and exhaust piping of the gas compressor units;
- Covering suction air ducts, exhaust gas ducts, and aboveground piping of the compressor units with soundproof material;
- Equipping the GCU with soundproof enclosures (casings);
- Providing the GCU design with elements of a sound suppression system;
- Keeping the level of sound pressure in a free space 1 m from a GCU enclosure below 80 dBA;
- Keeping the level of sound pressure in the unit's exhaust and suction piping below 45 dBA at the distance of 700 m.

Residential district (microdistrict) in Svobodny

Implementation of the following special measures will ensure reduction of the noise impact in the residential district in Svobodny down to allowable standard levels:

- Limiting the speed of roadway traffic:
- Setting up speed limit traffic signs;
- Planting of greenery;
- Soundproofing building elements (replacing windows);

SDIW landfill

Organizational measures aimed at reducing noise levels during landfill operation are identical to those provided for the landfill construction period. To ensure vibration-safe working conditions, the following organizational and technical measures will be implemented:

- preventing workers from contact with vibrating surfaces outside their workplaces;
- making sure that all vibrating equipment is properly secured according to its operating instructions;
- ensuring vibroinsulation of mechanisms by their installation on foundations, by using special shock absorbers and anti-vibration gels;
- using personal protective equipment for operators' hands and feet.

7.6.4 Residual impacts and monitoring

Overall, in view of implementation of the above measures aimed at protection from noise and vibration, noise and vibration impacts on construction workers during the construction phase are assessed as ***low***, and on the population of the Project area of influence as ***negligible***.

Provided that recommended mitigation measures during the commissioning and operation of the AGPP are to be implemented, noise and vibration impacts on Project and service contractors' personnel are assessed as ***low***, and on the population of the Project area of influence as ***low*****.**

Noise and vibration impact monitoring shall be conducted as a part of the OEC. This includes recommendations for vibration studies (vibration acceleration) to determine the actual vibration parameters at the control points once the anti-vibration screen is set up at the railway stations.

7.7 Impact on flora and fauna

7.7.1 Baseline conditions

In Amur Region, an overlapping combination of several flora types is present, including Manchurian, Okhotsk-Kamchatka, East-Siberian, Pacific and Mongolian-Daurian. This means that plant species characteristic of three climatic belts grow in the same area, i.e. subarctic, moderate and subtropical climatic belts.

Most of the Project AoI is in the East-Asian region of coniferous and broad-leaved forests. The flora in Svobodnensky district comprises 1,257 plant species of 496 genera and 133 families, which accounts for 71.3% of the overall flora of Amur Region[23].

There are no legally protected natural sites or areas within the land allocated for construction. The following protected areas are clostest to this area:

- Iverskiy state zoological reserve of regional significance, located 45 km northeast of the main Project site;
- Ykhta Pine Forest natural landmark of regional significance, located 10 km northwest of the main Project site;
- Buzuli Green Wood natural landmark of regional significance, located 25 km north of the main Project site;
- Nylynga ant colony natural landmark of regional significance, located 37 km northeast of the main Project site;
- Pine Forest on the River Zeya natural landmark of regional significance, near the village of Bardagon, 15 km south of the main Project site;
- Malaya Sazanka White Hills and Pine Forest natural landmark of regional significance, located 22 km south of the main Project site;
- Korsakov riverbend on the Amur natural landmark of regional significance located 90 km southwest of the main Project site;
- Section of the River Golubaya natural landmark of local significance, located 37 km southwest of the main Project site.

Remote sensing during the Project area studies indicated that the main AGPP construction site and the SDIW landfill site occupy previously transformed habitats (overgrown fallow lands) located on a former tank-testing range. Forests are but a small part of the entire land allotment. Land disturbed by anthropogenic activities comprises approximately 65 to 70% of the Project area.

There are some areas of arable lands within the Project AoI (in the eastern part of the AGPP site and towards the middle of the site for a distance of 560 m). In areas without cultivated fields, the land is covered by meadow vegetation (e.g. clover, sagebrush) and shrubs.

In Svobodnensky District, there are 28 plant and animal species listed in the RF and Amur Region Red Data Books[24]. In addition, certain protected plant and fungi species have been identified or may occur in

[23]EIA for construction of the Amur Gas Processing Plant. (Research and Design Institute for Oil and Gas "Peton", 2015.)

[24]Reference information provided by the Amur Oblast Department for Wildlife and Habitats Management, Monitoring and Regulation (No. P1 1393 of 15.08.2015)

valley and floodplain plant assemblages or in shrub growth in the Project area (Table 7.9). However, no populations or individual plants of rare and protected species were found during the environmental engineering surveys carried out directly within the area allocated for Project facilities.

Table 7.9: List of protected plant and mushroom species that might potentially occur in the Project area

Protected plant species in the Project area	Mushrooms reported in the vicinity of Blagoveshchensk and Svobodny
Eleutherococcus *(Eleutherococcus senticjsus (Rupr. et Maxim.)*	Auricularia (*Auricularia polytricha*)
Gromwell (*Lithospermum erytrorhizon Sieboldet Zucc.*)	Auriscalpium (*Auriscalpium vulgare*)
Balloonflower (*Platycodon grandifloras (Jacq.) A. DC.*)	Hericium (*Hericium erinaceus)*
Japanese dioscorea (*Dioscorea nipponica Makino*)	Hericium (*Hericium coralloides*)
Swertia (*Swertia veratroides Maxix. ex Kom.*)	Inonotus or 'birch fungus' (*Inonotusxobliquus*)
Krishum iris (*Irisensata Thund.*)	Rough boletus (*Leccinum chromapes*)
Lily (*Lilium pumilum Delile.*)	Climacodon (*Climacodon septentrionalis*)
Turchaninov's pasqueflower (*Pulsatilla turczaninovii Kryl. et Serg.*)	Clavaria delphus (*Clavaria delphus pistillaris*)
Chinese magnolia vine (*Schisandr chinensis (Turcz.) Baill.*)	Mutinus (*Mutinus caninus*)
Caltrop or water chestnut (*Trápa nátans*)	

The wildlife in Amur Region is rich and diverse, with a unique combination of northern and southern animal species differing from each other by their geographical origin. The northern animal species inhabit the forests, and the southern animal species originating in South-East Asia populate the forest-steppe land in the south of the region. A total of 64 mammal species, over 320 bird species, nine reptile species, six amphibian species and over 70 fish species have been reported in the Amur Region. The insect and invertebrate populations of the region are particularly diverse.

Terrestrial invertebrates are dominated by beetles (family of Carabidae) and Hymenoptera (mainly ants). The terrestrial invertebrate assemblages of the Amur Region include five species of dragonflies, three species of Neuroptera and 101 species of Lepidoptera. Some habitats of the following insects listed in the Amur Region and RF Red Data Books are located within the Project area, including four dragonfly species and beetles such as *Osmoderma davidis Fairmaire* (David's hermit) and *Callipogon relictus Semenov* (Relict Capricorn beetle).

Amphibians (Asiatic salamanders (*Hynobiidae*), treefrogs, true frogs (*Ranidae*), toads and reptiles (*Lacertidae*, water snakes, *Crotalidae*) are also well represented in the Amur Region.

No special ornithological surveys have been conducted in the AGPP Project area in the past decade. Therefore, the description presented her is based on information collected in the 1990s, the RF and the Amur Region Red Data Books, and data obtained in during environmental engineering surveys carried out for the AGPP Project.

In the region, nesting species (including non-migratory species) comprise 64.6% of bird populations, and migratory and transient species comprise 35.4%[25]. The Project AoI is crossed by flyways of migrating and

[25]Amur Gas Processing Plant. Stage 3.1. Auxiliary production facilities. Project design documentation. Technical report on the engineering surveys. Section 2. Environmental engineering surveys. Volume 3

migratory bird species. Most migrating brids (aproxximately 60.0%) leave the region at the end of summer for wintering in other regions. Spring migrations begin in the second half of March. Around the same time, large birds of prey (e.g. white-tailed eagle) begin to appear.

The most common species in the Project AoI are waterfowl such as common sandpiper, gray heron, teals (common teal and garganey), common goldeneye, mallard, goosander, tufted duck, falcated tealand bean goose. Most of these migrate in the second 10-day period of September.

According to available data, 21 bird species listed in the RF and Amur Region Red Data Books have been reported or can potentially occur in the Svobodnensky District. Nineteen of these are game bird species, and the most abundant are hazel grouse and pheasant.

The most common habitat types used by wildlife communities within the Project AoI are the areas disturbed by human activities and areas covered with shrubs and young trees.

The terrestrial fauna of the study area includes approximately 40 mammal species belonging to six orders and 13 families on a permanent or seasonal basis. The most common mammals are shrews (*Sorex*), hedgehogs, *Chiroptera* species, hares, *Rodentia* species (e.g. flying squirrels, common squirrels, mice), *Carnivora* species (e.g. fox, wolf, raccoon dog, ermine, alpine weasel, least weasel, Siberian weasel, sable, American mink and river otter) and Artiodactyla species (e.g. wild boar, Siberian roebuck, Manchurian deer). Of all mammal species, seasonal migrations of hoofed mammals are especially prominent.

There are many residential areas on both banks of the Zeya River exposed to considerable anthropogenic impact, which cause disturbance to wild animals. Predation of stray dogs and cats is also a significant factor near such residential areas. Averse impacts on wildlife occur from intensive farming, including land plowing, spring agricultural burning and the livestock sector.

Intensive hunting occurs in the Zeya River valley. The main game species are waterfowl birds and wild boar, and, in some years, roebucks migrating to this area from the Iversky reserve. Information related to the game species, their population sizes and density in Svobodnensky district of the Amur Region in the areas (total 699,000 ha) adjoining the Project sites is presented in Table 7.10.

Table 7.10: Population, size, and density of game animals populating the areas adjacent to the Project sites

№	Species	Population	Density (specimen per 1,000 ha)
1.	Moose	36	0.05
2.	Manchurian deer	409	0.58
3.	Roebuck	1,912	2.73
4.	Wild boar	1,329	1.90
5.	Common fox	259	0.37
6.	Lynx	65	0.09
7.	Siberian weasel	1,486	2.12
8.	Gray wolf	46	0.06
9.	Squirrel	143	0.20
10.	Mountain hare	3,756	5.37
11.	Brown bear	94	0.13
12.	Racoon dog	193	0.27
13.	Mink	81	0.11
14.	River otter	794	1.13

№	Species	Population	Density (specimen per 1,000 ha)
15.	Badger	232	0.33
16.	Black grouse	2026	2.89
17.	Hazel grouse	1,089	1.55
18.	Pheasant	8,254	11.80
19.	Waterfow	7,801	11.10

Among the mammals reported within the Svodonensky District, three species that are listed in the RF and Amur Region Red Data Books may be present in the Project AoI(i.e. Amur hedgehog / *Erinaceus amurensis*, bi-colored bat / *Vespertilio murinus*, and alpine weasel / *Mustela altaica raddei*).

The Zea River is characterized by fairly high level of species diversity when it comes to phytoplankton, zooplankton, and benthicfauna. Benthic species are characterised by an extensive range of mayflies (15 species), trichopterans and chironomids (9 species each), and one species of stoneflies. Mayflies dominate population size and biomass (74.0% and 45.4% respectively), and other important groups include chironomids (15.6% of benthic populations) and molluscs (36% of benthic biomass).

The ichthyofauna of the Zeya River comprises 12 families. Among the 44 species reported in the Zeya River, the most numerous is the carp family (21 species). Due to the harsh natural conditions, aggravated by adverse impacts of river discharge regulation at the hydropower dam, the population size and frequency of fish species classified as rare have tremendously decreased over the last 33 years (e.g. kaluga, Amur sturgeon, Amur whitefish, Khadary sisco, skygazer, silver carp, European carp and Chinese perch (aukha)).

There are rare and protected fish species reported in the Zeya River listed in the RF and the Amur Region Red Data Books, i.e. Amur sturgeon and kaluga (*Huso dauricus*). Common taimen (Hucho), a species of salmon, is also listed in the RF Red Data Book as an endangered species.

The ichthyofauna of the Bolshaya Pera River is characterised by fish such as Siberian taimen, common and Amur grayling, Amur catfhish, snub-nosed lenok, Amur pike, Amur nerfling (chebak), Chinese crucian carp and minnow.

No protected species of terrestrial animals have been reported during field studies within the Project AoI.

7.7.2 Impacts and receptors

Impacts on flora and fauna from the construction of Amur GPP facilities include:

- Direct effects result in the irreversible and reversible loss of habitats, mortality of, or damage to certain plants and animals, habitat fragmentation, migration routes blockage or change;
- Indirect effects through air and soil pollution, loss of habitats or reduction of access to habitats.

During the assessment of impacts on flora and fauna, special attention was given to the following environmental receptors of high value of of high sensitivity:

- protected areas;
- endangered species listed on the IUCN Red List and the Red Data Books of the Russian Federation and Amur region;
- critical habitats defined in accordance with IFC's Performance Standard 6 and based on important environmental features (e.g. presence of significant migratory bird populations);
- natural habitats defined in accordance with IFC's PS 6;
- places or species deemed as significant in terms of provision of ecosystem services (e.g. fish).

7.7.2.1 Impacts on flora and fauna during construction

Permanent or temporary acquisition of land plots for Project implementation (hence, loss of habitats of plants and animals) during the construction phase will cause the most significant adverse impact on flora and fauna.

Impacts on specially protected areas

Most of the specially protected natural territories listed above (see 7.7.1) are quite distant from the project construction site, and no direct impact on them is anticipated. At the same time, the nearest protected areas, the Buzuli Green Wood and the Pine Forest on the River Zeya near the village of Bardagon, are relatively close to the Project facilities and may be exposed to several indirect impacts associated with air pollution caused by construction machinery and motor vehicles.

Even low concentrations of nitrogen oxides in exhaust gases (about 0.01 mg/m^3) may disrupt nitrogen metabolism in plants and suppress protein synthesis. Their continuous impact suppresses development and causes plant mortality. However, atmospheric air pollution outside the sanitary protection zone is expected not to exceed the standard values. Thus, the impact on the legally protected areas is considered ***negligible***.

Endangered species listed on the IUCN Red List and the Red Data Books of the Russian Federation and Amur region

No rare or protected species of plants and animals has been found within the Project AoI.

Impacts on critical habitats

Within the Project AoI, there are no habitats that might be classified as "critical" according to the definition provided in IFC PS 6.

Impacts on natural habitats

The most common types of vegetation communities adjacent to Project construction sites are areas covered with shrubs and young trees. Natural habitats that are exposed to the highest negative impact include:

- river birch-lespedeza;
- white birch- lespedeza-calamagrostis forests;
- valley-floodplain complexes.

The most common types of habitat used by animal communities within the areas adjacent to the Project sites are those covered with shrubs and young trees and areas disturbed by human activities. Natural habitats have remained along the floodplains of the Zeya and Bolshaya Pera Rivers.

The loss of vegetation communities will inevitably lead to the degradation of habitats and population declines . The range of habitats that will be lost during the construction of the AGPP facilities includes the area occupied by the Project production sites and roads connecting them.

The main impacts on natural habitats are associated with mechanical disturbance and chemical impact (pollution).

Mechanical disturbance is related to destruction of vegetation cover during continuous cut and fill, and grading operations. Serious impacts on vegetation cover may be also caused by off-road construction machinery and motor vehicles. Non-authorised disposal of solid construction wastes could also disturb topsoil density and impede recovery of vegetation cover.

A specific type of animal habitat transformation comprises burning out of vegetation due to human-caused fires, which mostly result from the negligence of Project staff, the absence of spark arresters, the presence of litter, and several other factors.

Given the considerable area allocated for Project facilities, the impact associated with the loss and transformation of habitats within areas allocated for continuous use is assessed as **local, long-term** and

of **high magnitude**. Implementation of designated environmental measures is required to lower this impact to moderate (see Section 7.7.3 below).

Mechanical impact on vegetation cover in areas allocated for construction purposes on a temporary basis will be severe, but of a limited duration and are assessed as ***medium-term*** *and* ***moderate***.

Chemical impacts on vegetation cover may be caused by failure to observe regulations applicable to storage of fuels and lubricants and refueling of motor vehicles, malfunctioning excavation machinery, motor vehicle maintenance and repair carried out outside designated areas. In addition, indirect impacts may occur due to pollution of the ambient air and surface waters and disposal of domestic and industrial wastes. Several measures aimed at protection of all environmental components are in place for the Project implementation period. Provided these measures are implemented, chemical impacts on habitats due to the considerable area allocated for construction are assessed as ***local***, ***medium-term***, and of ***low magnitude***.

Being closely tied to their habitats, invertebrates suffer greatly from the loss and transformation of habitats. Numerous invertebrate species directly depend on specific species of forage plants, destruction of which leads to extinction of invertebrates themselves. Invertebrate animals, particularly insects, are highly susceptible to chemical factors.

Although no generally accepted threshold exists for the significance of impact on invertebrates, given the extent of the direct loss of habitats the magnitude of impact can be assessed as is assessed as ***moderate***. Chemical pollution of vegetation cover will be local; therefore its impact on invertebrates may be assessed as ***low***.

Places or species deemed as significant in terms of provision of ecosystem services

Places or species that are significant for ecosystem services include forest and hunting grounds, pastures, medicinal and edible plants and mushrooms gathered by the local population, game animals and fish.

There are no hunting grounds and pastures within the immediate area allocated for Project implementation.

Types of adverse impacts on animals may be grouped as follows:

- Alienation and mechanical transformation of habitats;
- Changes in animals' living and reproduction conditions (e.g. loss of forage lands, breeding grounds, disturbance of migration routes) of animal species;
- Noise impacts (disturbance factor) causing, among other things, behavioral disorders.
- Chemical pollution of habitats due to emergency situations leading to forage base dwindling and directly to animal mortality.
- Poaching resulting in population declines and reductionof of species amount.

Amphibians, reptiles, mammals

Animals are exposed to impact from construction machinery, motor roads and construction staff. Habitat declines and transformation of biotopes (see above) could cause the most significant impacts. These could result in declines in amphibian, reptile and mammal populations in the areas acquired for construction purposes and in biodiversity reduction.

At the same time, as new territories are developed, a growth in the population of synanthropic animal species may be assumed (dogs, mice, brown rats, etc.). Stray dogs may also appear during construction in the vicinity of the construction sites, which will result in a shrinkage of the population of wild animals (e.g. many species of fur-bearers) due to complete destruction of their juveniles by dogs.

Middle-sized and large mammals will be more vulnerable to the disturbance factor.

Since all proposed facilities are located within an already developed area, impacts on terrestrial vertebrate animals associated with construction activities will be ***low***.

Birds

Construction impacts on birds will be largely associated with the loss of habitats, noise and visual disturbance. Bird habitats that may be lost during construction include lakes, rivers and streams for semi-aquatic species and nesting and feeding grounds for terrestrial species. Direct loss of bird habitats during Project implementation will occur over 50% of the total land allotment. Their loss will likely result in corresponding decline in population of bird species nesting in the area. The level of impact is assessed as ***high***.

In addition to the loss of habitats, the presence of humans, operation of construction machinery and motor vehicle traffic may also cause adverse impacts on birds.

Species with large body sizes (e.g. grouses, owls, a number of diurnal birds of prey and pigeons) may become endangered or locally extinct in all areas with tree and shrub vegetation. This may be caused not only by increasing disturbance, but also by destruction of vegetation suitable for nesting (e.g. cavity nesting birds) and depletion of forage resources. Of all species that lay in trees, only synanthropic crows benefit from the proximity of humans. The opening-up of habitats may lead to increases in the number of species which nest on the ground or in soil cavities.

Stray dogs may appear near the construction sites, which may result in a shrinkage of the population of ground nesters (e.g. grouses, certain duck species, waders).

Overall, adverse impacts on birds during construction can be assessed as ***high***.

Fish and other aquatic organisms

According to *AMURRYBVOD* data, the ichthyofauna of the River Zeya and its tributaries is very diverse. All fish species use the rivers as their feeding, spawning and wintering grounds. There are no wintering pits within the Project site.

Potential impacts on fish may be associated with reduction of habitats due to works performed in water areas of surface water bodies, as well as deterioration of aquatic organisms habitats in case of surface water pollution.

Dredging operations during construction of the sewer on the Bolshaya Pera River, the temporary jetty on the Zeya River, and the railway bridge across the Bolshaya Pera River will have the greatest impact on ichthyofauna. The Zeya and Bolshaya Pera Rivers' floodplains used by forage communities for fish for reproduction will be acquired by the Project during construction. Direct mortality of benthic forage organisms will occur in the disturbed layer of bottom sediments in the turbidity plume. There is also a risk of impacts on fish associated with pollution of surface water bodies with stormwater runoff from construction sites.

During riverbed disturbance associated with construction of the temporary jetty on the Zeya River, particulate matter released into water may affect the water's optical properties, adversely affecting the photosynthetic activity of planktonic algae. Zooplankton (crustaceans), especially in early stages of development, and saprophytes will be the most sensitive to the effects of suspended particles in water. Higher concentrations of suspended particles in water cause damage to filtration organs impeding nourishment and reproduction, changing zooplankton behavior, causing stress and mortality. Nor is ichthyoplankton less sensitive to elevated suspended solids. Development of eggs and juveniles is delayed in areas with higher turbidity levels. Given the high natural clarity of the River Zeya (3 mg/dm^3 of suspended solids), increased turbidity will inevitably have an adverse impact on the conditions of river's phytoplankton and zooplankton.

According to GosNIORKh data, riverbed disturbance is associated with destruction of bottom communities and mortality of benthic organisms where buried under a layer of bottom sediments thicker the vertical size of benthic organisms and sedimentation velocity exceeding 0.5 mm/day (Lesnikov, 1986)[26]. Given the size and behavior of dominant benthic organisms within the proposed dredging operations area, the following lethal threshold values for the thickness of bottom sediments common for the area's benthic community should be adopted: 1-5 cm (50% mortality) and over 5 cm (100% mortality). Those values

[26]Lesnikov L.A. Impact of transportation of soils on fisheries water bodies. // Collected research papers GosNIORKh, 1986 Issue 255 - P.3-9.

are adopted based on the precautionary approach (Medyankina, Cokolova, et al., 2010)[27]. The recovery time of the benthic forage community will be approximately three years from when adverse impacts cease.

No direct fish mortality is expected during underwater technical operations, as adult fish are likely to be scared off by operating equipment. No spawning grounds have been identified within the proposed construction site. Damage to aquatic bioresources is associated only with reductions in fish forage bases (e.g. zooplankton, zoobenthos).

Given the area of habitat loss is insignificant (0.03 km^2) and the dredging related operations will be over in 10 months, the magnitude of the impact on fish from the loss and degradation of habitats and reduction of forage base is assessed as ***moderate***.

Other adverse impacts on fish include uncontrolled fishing (poaching) used as a food supply for construction workers, which can result in depletion of fish resources. The impact is assessed as ***moderate*** in terms of magnitude.

During Project design, specialists from the Khabarovsk division of the Federal Pacific Fishery Research Institute (KhFTINRO) assessed impacts on aquatic bioresources and their habitats from construction activities in connection with construction of the railway bridge across the Bolshaya Pera River. According to the results of this survey, the destruction of floodplain areas and formation of high turbidity zones will cause certain damage to existing aquatic bioresources.

The overall impact on aquatic bioresources is assessed as ***local***, ***long-term*** and ***reversible***.

7.7.2.2 Operation phase

Natural habitats

No further loss of habitats (after the construction phase will have been completed) is expected during operation phase. Moreover, it is planned to implement land rehabilitation measures immediately upon completion of the construction, including biological measures (see Section 7.3 above), which will facilitate restoration of habitats.

Impacts on plants associated with air quality during the operation phase will be similar to those during the construction phase. Analysis of air emissions shows that the expected deposition levels are significantly below the critical load values for all sampling points. Overall, impacts on vegetation associated with NO_x concentrations and nitrogen deposition can be assessed as ***negligible*.**

Rare plants

No direct impacts on rare plant species are expected during the operation phase. Indirect impacts from air quality decline is unlikely since no critical load values will be exceeded.

Amphibians, reptiles, mammals

No adverse impacts on terrestrial animals are expected due to loss of habitat during the operation phase.

Impacts associated with disturbance will be similar to those during construction phase. Continuous noise sources will include process equipment and vehicle traffic. If the designed sound pressure levels are complied with, estimated noise levels outside the production sites will not exceed established standards; and the traffic intensity will be significantly lower during the operation phase than during construction. Therefore, noise impacts on terrestrial animals are assessed as ***low***.

Adverse impacts on mammals such as uncontrolled hunting (poaching) will remain through both construction and operation phases. If appropriate restrictive measures are implemented, the significance of this factor can be reduced.

Birds

[27]Impact of transportation of bottom soil on zoobenthic organisms from riverbed intervention (an overview). Medyankina M.V., Sokolova S.A., et al. // Contemporary issues and prospects of the fisheries complex. Practical research conf. p. 81-83.

No direct impacts on birds are expected during the operation phase. Disturbance factors will be the same as those during construction period, but potentially affected areas will be significantly reduced.

During the operation phase, an increase is expected in the number of synanthropic bird species, including crows, which will have negative impacts on the survivability of the offspring of other species in the areas adjacent to the AGPP facilities.

During the operation of high voltage power transmission lines there is a chance that birds will build nests on tower cross-arms near strings of insulators. Therefore, birds may be exposed to risks of fatal electrical shock. Large birds of prey are the most exposed to the risk. The impact is assessed as ***moderate*** in terms of magnitude.

Fish and other aquatic organisms

Since no engineering operations will be carried out within water bodies during the operation phase, impacts on aquatic bioresources will only be associated with discharges of treated wastewater (i.e. industrial, domestic and storm water) into the Bolshaya Pera. The Project has adopted a set of highly effective measures aimed at prevention of surface water pollution from wastewater discharge, which will ensure ***minimization*** of adverse impacts on aquatic organisms.

7.7.3 Mitigation measures

7.7.3.1 Construction phase

There are environmental mitigation measures provided by the Project for the construction phase, including measures aimed at minimization of loss of habitats and mitigation of adverse impacts on flora and fauna:

- Placing a ban on the off-road use of vehicles;
- Restoration of temporarily acquired areas immediately upon completion of the construction, including planting local plant species and fencing the restored areas with temporary fences to prevent trampling of vegetation;
- Complying with fire safety regulations to prevent forest fires, including ban on spring agricultural burning of grass leading to animal mortality;
- Strengthening road embankments by geogrids filed with crushed rock and turf;
- Construction of culverts across watercourses and drainage ditches to avoid swamping and waterlogging and to conserve natural plant communities;
- Clearing out felling residue and construction debris;
- Placing a ban on abandoning open trenches and pits for long periods of time to prevent small animals from falling into them;
- Use of anti-sedimentation barriers during excavation work conducted on riverbanks of surface water bodies to prevent soil washout into them;
- Use of biological preparations (biodestructors) to clean vegetation cover areas should oil spills occur;
- Riverbed intervention operations according to the schedule approved by fishery management authorities, and conducting continuous operational monitoring of compliance with the technical requirements for such operations;
- Designing the jetty site with a counter slope, in the direction opposite to the river, to prevent spontaneous discharges of surface water into the Zeya;
- Placing a ban on washing vehicles at the temporary jetty on the Zeya River;
- Placing a ban on keeping domestic animals at temporary accommodation camps, and exercising control over guard dog handling at the Project sites;

- Educating construction workers on environmentally friendly behavior and careful treatment of flora and fauna, as well as on necessity to implement environmental mitigation measures.

7.7.3.2 Operation phase

A list of measures aimed at mitigation of impacts on vegetation and wildlife during the operation phase includes:

- Placing a ban on pursuing animals, damaging or destroying bird nests or sanctuaries, illegal hunting for the Project personnel;
- Installing chain link fences around Project sites to prevent animals from entering them;
- Fitting all tanks at all the facilities with protective screens to prevent animals from getting into them;
- Educating personnel involved in operation of the Project facilities on environmentally friendly behavior and careful treatment of flora and fauna, as well as on importance of environmental mitigation measures;
- Monitoring of bird deaths due to electrical shock from high voltage power transmission lines, equipping towers with bird protection devices if necessary.

In addition, measures aimed at compensation for the damage caused to aquatic bioresources shall be implemented in coordination with the fishery management authorities during Project operation.

According to the *Amurrybvod* data, the extent of potential fish losses during temporary jetty construction will be 255.89 kg; To to compensate such losses, it is suggested to implement measures involving artificial reproduction of fish resources by releasing 10,171 common carp juveniles weighing 3 to 5 kg into the Zeya River basin.

According to the Khabarovsk division of the Federal Pacific Fishery Research Institute (KhF TINRO), the extent of damage caused to aquatic resources during construction of the railway bridge across the Bolshaya Pera River can amount to 225 kg. The estimated quantity of young fish of European carp required for restoration of the disturbed condition of the aquatic bioresources by means of artificial fish hatching will be 11,000 fishes (5 g each).

7.7.4 Residual impacts and monitoring

Based on the data on the area of habitats that will be lost during construction, impacts on flora and fauna from the loss of habitats may be assessed as ***moderate***, taking into account implementation of measures described above.

Implementation of organizational and technical measures planned, as well as artificial reproduction of aquatic aquatic biological resources, will reduce residual impacts on aquatic biological resources to ***low***.

To assess the actual impact of dredging operations on the state of river biota, regular monitoring activities should be carried out using the same observation points as are used for monitoring the quality of surface water within the Project site.

Within the OEC Programme framework, monitoring of bird deaths in result of electrical shock from high voltage power transmission lines and monitoring of impacts on aquatic organisms' condition from dredging operations will be conducted.

7.8 Waste management

7.8.1 General information

Construction and operation of the Project facilities is associated with generation of various wastes which have the potential for adverse environmental impacts. In accordance with the national legislation, all industrial waste (IW) and domestic solid waste (DSW) are classified according to the following criteria:

- source;
- conditions of generation (specific operations or technology);

- chemical and/or component composition;
- state of matter; and
- physical shape.

This information is entered into the Federal Classificatory Catalogue of Wastes (FCCW).

The FCCW identifies five hazard classes which differ from those used in other countries, E.g. in the EU waste is divided into 'hazardous' and 'non-hazardous' groups. Table 7.11 provides a summary comparison of the FCCW hazard classes with the typical 'international' classification.

Table 7.11: Comparison of the national and international waste classifications

Waste hazard classes used in the RF			International classification equivalent
Hazard class	**Hazard level**	**Examples**	
I	Extremely hazardous	Devices and other products containing mercury: fluorescent lamps, thermometers, manometers, barometers, etc.	Hazardous
II	Highly hazardous	Batteries containing lead or sulphuric acid solution, alkali, alkalis, halogenated solvent, lead-acid batteries, dry batteries, etc.	
III	Moderately hazardous	Petroleum waste and oiled materials such as waste oils, waste car oil filters, oily rags, etc.	
IV	Low hazardous	Household rubbish, non-ferrous metal scrap, certain chemicals, certain construction waste, wastewater treatment sludge, treated medical waste, water-based drilling fluids, etc.	Non-hazardous
V	Practically non-hazardous	Inert waste: plastics, ferrous metal scrap, inert construction waste, food waste, brushwood, untreated wood waste	

Impacts associated with the waste management has been evaluated for the construction period of all Project facilities as a whole (considering construction operations and waste generated being identical) and for the operation period of the following facilities:

- Early Works Facilities;
- Auxiliary facilities;
- Temporary jetty on the Zeya River;
- Main Production Facilities;
- Residential district (microdistrict); and
- SDIW landfill.

Regarding waste management in during Project implementation, receptors will include construction and service personnel, the natural environment, and third parties such as organizations receiving wastes for disposal and treatment.

7.8.2 Waste management during construction

Waste will be generated during site planning and preparation and main construction operations. Key waste generation sources at this stage will be:

- site clearance and construction operations;
- operation of vehicles and construction equipment;
- process equipment maintenance and personnel life-support.

Operation of vehicles and construction equipment during construction and commissioning works will be associated with generation of waste such as waste batteries, tyres, ferrous metal scrap, waste filters and various lubricating oils and oily rags. Waste generated from personnel activities will include office and household garbage, sewage from cesspools, food waste, cloth shreds and scraps, and worn-out work footwear.

Industrial waste includes waste generated:

- from wood clearance;
- from drilling of water wells;
- from use of products and materials during facility construction;
- from mechanical treatment of wastewater from hydrotesting of tanks and pipelines;
- from maintenance and repair of vehicles and equipment; and
- from worn-out work clothing.

The total quantity of waste that will be generated during the AGPP construction amounts to 74,310 tonnes. Most waste will belong to Hazard Class IV (44.5%) and V (52%) (Table 7.12).

Table 7.12: Waste generation during the AGPP construction

Construction stage/facility	Waste generation, tonnes			
	Hazard Class II	Hazard Class III	Hazard Class IV	Hazard Class V
Early Works Facilities;	8	12	1,460	1,267
Temporary jetty on the Zeya River;	0.6	3	52	1,394
Railway infrastructure facilities		89	19,171	4,590
Access roads			211	14,311
Auxiliary production facilities	10	241	2,162	2,959
Main Production Facilities;	31	1,599	10,213	15,696
SDIW landfill construction	1	8	128	80
Total	**50.6**	**1,952**	**33,397**	**38,911**

It is proposed to store waste produced during construction within construction sites and TBI. Temporary storage conditions will depend on the type of waste and its Hazard Class. Transport of waste will require the following conditions to be met:

- certificates for waste of Hazard Class II, III and IV must be in place;
- waste will be carried by specially equipped vehicles with appropriate signage;
- safety requirements for the transportation of waste of Hazard Class II, III and IV will be met;
- license for transportation and handover of waste of Hazard Class II, III and IV is in place.

The frequency of waste removal for disposal/treatment will depend on the waste type:

- domestic/household waste – every three days during the cold period and daily during the warm period;

- waste such as undamaged lead batteries containing electrolyte – as accumulated in quantity suitable for shipment; and
- other waste types – at least every six months.

Collection of waste with their further recycling, decontamination, and disposal is planned to be managed by the following licensed contractors:

- *OOO Spetsavtokhozyaystvo* (Svobodny)
- *OOO AVTOSITI* (Blagoveshchensk), and
- *OOO Konsul* (Blagoveshchensk).

Solid domestic waste landfills operated by *Spetsavtokhozyaystvo* and *AVTOSITI* are listed in the State Registry of Waste Disposal Facilities.

The overall waste related impact on construction workers and environment during construction of the Project facilities is assessed as ***low***, and on waste treatment facilities owned by the Project and third parties as ***moderate***.

7.8.3 Waste management during operation

Early Works Facilities

Waste generation during operation of the Early Works Facilities will total 2,989.903 tonnes, including:

Hazard Class II – 4.919 t;

Hazard Class III – 112.366 t;

Hazard Class IV – 2,680.481 t;

Hazard Class V – 192.142 t.

Waste storage methods and procedures will be similar to those druing construction.

Auxiliary facilities

Accommodation and meals for AGPP personnel will be provided in a residential complex in Svobodny. Waste generated by operation personnel will consist of waste from offices and amenities (Table 7.13).

Table 7.13: Quantity of waste generated during operation of the Project Auxiliary Production Facilities

Waste, tonnes			Total, tonnes/year
	Consumption/Domestic	Production/Industrial	
Hazard Class II		1.759	1.759
Hazard Class III		87.542	87.542
Hazard Class IV	1,079.932	936.457	2,016.389
Hazard Class V		17.110	17.110

The design provides for a temporary waste storage area at the auxiliary facilities site, with the surface sealed with reinforced concrete road slabs and perimeter fenced with wire mesh. The area will be curbed and drainage for stormwater and snowmelt into the stormwater sewer will be provided.

Transportation of waste generated during operation of the auxiliary facilities will be at the following frequency:

- domestic/household waste – every three days during the cold period and daily during the warm period;
- waste such as undamaged lead batteries containing electrolyte – as accumulated in quantity suitable for shipment; and

- other waste types – at least every 11 months.

Further recycling, decontamination, and disposal of waste will be managed by the following licensed contractors:

(1) OOO AVTOSITI (Blagoveshchensk), OOO TDM (Blagoveshchensk, Svobodny), OOO LOMPROM (Belogorsk) – waste brake pads; copper scrap and waste; aluminium scrap; nonferrous metal scrap; insulated cable and wire waste;

(2) Konsul LLC (Blagoveshchensk) – waste mineral oils, waste lead batteries, and waste tyres.

Railway infrastructure facilities

The following amounts of waste will be generated during operation of the railway infrastructure facilities ("Ust-Pera", "Zavodskaya" and "Zavodskaya-2"): 952.6 t/year of wastes of Hazard Classes III to V, of which 67% are wastes of Hazard Class IV and 30% of wastes of Hazard Class IV.

Municipal solid waste and sweepings from the sites will be collected in metal containers installed in specially designated areas, then waste will be removed by **Spetsavtokhozyaystvo**, a licensed waste management contractor.

Liquid waste will be collected in metal containers and removed by a dedicated vehicle once every three days during the cold period and daily during the warm period.

Other waste will be accumulated in metal containers installed in sealed surface areas. Waste will be removed from the site as the containers fill up, but at least every six months.

Prior to commissioning of the SDIW landfill for the AGPP and associated facilities, it is planned to commission a specialist company ("*SpetsAvtoKhozyaistvo*" , Svobodny) on a contractual basis.

Temporary jetty on the Zeya River

Waste that will be generated during operation of the temporary jetty will total 57.635 tonnes, including:

- 1.9 tonnes of Hazard Class III;
- 55.724 tonnes of Hazard Class IV.

All waste from the jetty operation will be transferred to specialised contractors or to the "Spetsavtokhozyaystvo" landfill for disposal.

Gas Processing Plant operation

Solid domestic and industrial waste that will be generated at the main facilities will total 4,447.7 tonnes per annum, including:

- 0.392 tonnes of Hazard Class II;
- 836.2 tonnes of Hazard Class III;
- 3,372.5 tonnes of Hazard Class IV.
- 238.6 tonnes of Hazard Class V.

All waste generated will be stored in specially designated areas similar to those provided for waste storage at the auxiliary facilities. Waste will be stored in:

- closed metal containers on sealed surface;
- sealed chemically resistant containers in covered areas with sealed surface (sorted by types).

Temporary waste storage areas will be equipped with ian mpermeable membrane and a mesh wire fence. The frequency of waste removal will be similar to that planned for the construction period.

Collection, recycling and disposal of waste will be managed by the following licensed contractors: *Spetsavtokhozyaystvo* (Svobodny), *AVTOSITI* (Blagoveshchensk), *TDM* (Blagoveshchensk, Svobodny), *LOMPROM* (Belogorsk), and *Konsul* (Blagoveshchensk).

Solid Domestic and Industrial Waste (SDIW) Landfill

The solid domestic and industrial waste (SDIW) landfill will be constructed as a part of AGPP facilities, and will be used for disposal of industrial waste of Hazard Class III-V and for thermal decontamination of solid municipal/domestic waste of Hazard Class IV-V and industrial waste of Hazard Class III-V.

The overall amount of waste accommodated by the landfill during the overall period of operation will total 371,000 tonnes, of which 166,000 tonnes will be buried and 205,000 tonnes will be incinerated (including waste generated by the landfill operation). These data are for the entire life cycle of the landfill.

The operational area, which occupies most of the landfill, is divided into the waste burial zone and thermal destruction zone.

Industrial waste and bagged wastewater sludge will be unloaded by dump trucks into specially equipped cells enclosed within earth bunds and equipped with an impermeable membrane and a drainage system. The landfilling will be carried out by the 'floatover' method.

Incineration of industrial waste of Hazard Class III and IV (including oily), solid domestic waste of Hazard Class IV and V, as well as medical waste is to be carried out in the incinerator, which includes:

- area for containers with the landfill waste;
- unloading area for thermal destruction waste; and
- three incineration units KTO-100.K40.P.

Incineration of landfill industrial effluents (of Hazard Class III) and liquid industrial waste (of Hazard Class III-IV) from the AGPP is to be carried out in the industrial effluent treatment area, which will include:

- thermal destruction unit KTO-2000.PS.;
- industrial effluents tank V=100 m^3;
- liquid waste tank V=10 m^3;
- sewage pumping station for the transfer of industrial effluents to KTO unit;
- sewage pumping station for the transfer of liquid waste to KTO unit;
- reserve tank for industrial effluents V=25 m^3.

Table 7.14 provides a summary of the types, quantity and management methods for waste that will be delivered to the landfill from the AGPP facilities, and waste generated from the landfill operation.

Table 7.14: Waste quantity and treatment methods at the SDIW Landfill

Waste types and management methods	Quantity	
	tonnes/year	Total for 25 years of operation, tonnes
Thermal destruction:	8,192	138,053
liquid waste of Hazard Class III-V	5,522	138,053
solid waste of Hazard Class III-V	2,268	66,709
medical waste	1.4	33.8
Landfilling (burial) in cells:	6,658	371,255
Sewage sludge of Hazard Class IV	979	24,467
Industrial waste of Hazard Class III-V	5,680	166,459
Total	**14,850**	**371,255**

A reinforced concrete tray for decontamination of wheels of unloaded vehicles will be installed at the exit from the operations area. The tray will be filled with sawdust impregnated with 0.5% solution of virucidal disinfectant.

The overall waste related impact on personnel, natural environment, and third-party waste treatment facilities is assessed as ***low***.

7.8.4 Mitigation measures

The following organizational and technical measures aimed at mitigation of environmental impacts from waste generated, as well as their impact on health and safety of people are provided for the Project during implementation:

- Regular separate collection of waste by licensed contractors;
- Disposal/recycling of most waste at licensed (specialised) facilities; timely conclusion of contracts with them;
- All third-party facilities must be entered in the State Register of Waste Management Facilities.
- Minimisation of waste generation (including recycling, incineration, compaction, and minimisation of drilling waste generation);
- Temporary storage of waste within specially designated areas;
- Pest control through removal of waste that serves as a source of food for rodents.
- Providing containers for domestic waste with close lids; Performing washing and disinfection of domestic waste containers and collectors, as well as surfaces under these (at least every 10 days during the summer period);
- Provide waste container areas with asphalt or concrete surfaces and with fencing on three sides to the height of 1.0 to 1.2 m to prevent waste from entering the surrounding area;
- Providing special driveways and pathways to access each temporary waste storage area;
- The SDIW landfill will be in an area of relatively impermeable soil outside of water protection zones of the water bodies;
- Providing shipments of waste by specially equipped vehicles with appropriate signage complying the requirements for safe transportation of hazardous materials, and with hazardous waste data sheets available at all times;
- Not allowing third parties to oversee waste shipments, theyr are to be overseen only by authorised company personnel;
- Packing of waste prior to its shipment to prevent dust generation, spills and other losses and associated environmental pollution during transportation;
- Assignment of personal responsibility for waste management at each independent facility of the Amur GPP and timely training of the personnel assigned.

7.8.5 Residual impacts and monitoring

Environmental impacts of domestic and industrial waste during construction and operation of the Project facilities, including the SDIW landfill, will be ***minimized***, provided that all measures relating to waste accumulation, collection, transportation, utilisation, treatment and disposal specified in Project design documentation are implemented.

The OEC monitoring programme provides for monitoring of the environmental impacts of waste treatment facilities, including temporary waste storage (accumulation) areas and SDIW Landfill.

7.9 Environmental impact of emergency situations at the AGPP facilities.

7.9.1 Impacts and receptors

Review of primary activities and operations at the AGPP facilities indicates that risks of potential emergency situations are associated with operation of road building and construction machinery, storage of fuels and lubricants, and management of industrial waste.

Primary receptors and resources exposed to impact of potential emergencies will be air, water bodies, geological environment, soil, flora and fauna, Project personnel, and local communities.

Factors that will determine the scale of environmental damage resulting from emergencies at the Project facilities are:

- oil pollution of water bodies and soil and pollution of ambient air in the event of ignition;
- shockwave and thermal impact of explosions and fires.

7.9.2 Construction phase

Emergency situations which may occur during construction include:

- leaks and spills of diesel fuel, including ignition of diesel;
- scattering of construction sites and adjoining areas with domestic solid waste and construction rubbish.

The major environmental risk is associated with the presence of diesel on construction sites, e.g. at the oil/fuel and lubricant warehouses, in tanks of fuel trucks, and fuel tanks of construction machinery and equipment. The major causes of oil spill related accidents are:

- damage of oil/ fuel storage and transportation tanks;
- personnel errors;
- equipment defects; and
- extreme weather conditions.

An assessment of the probability of potential accidents was carried out considering available national statistics for accidents and safety of oil and fuel depots. The frequency of accidents occurring at fuel depots is as follows:

- storage tanks: $9.0*10^{-5}$ for leaks and $1.0*10^{-5}$ for total structural failure;
- tank cars: $1.5*10^{-4}$ for leaks.

Scenarios of emergencies considered for the oil/fuel and lubricant storage facility include oil spill resulting from instantaneous structural failure of oil storage and transfer tanks, and fire and explosion of an oil storage tank.

Since the construction contractors' temporary oil/fuel and lubricant warehouses will be installed in a sealed surface area which will be bunded and provided with storm water and snowmelt drainage to the wastewater sewer system and, subsequently to wastewater treatment facilities, environmental pollution of the surrounding area in the event of emergency at these facilities is ***unlikely***.

As diesel fuel will be brought to construction sites by fuel tank trucks carrying 5.5 m^3, accidental leaks or spills during fuel dispensing or resulting from a loss of containment at a truck tank will be relatively small.

Scenarios of potential emergencies also include diesel fuel spills in case of fuel truck rollover.

Scenario I. Fuel truck rollover resulting in a diesel spill without ignition

The level of air pollution will be determined by the weight of volatile low-molecular hydrocarbons that will evaporate from soiled ground[28]. In case of a loss of the entire contents of the tank (7,800 l), the approximate spill area will be 50 m^2 and the weight of emitted pollutants may reach 4.5 kg (at evaporation surface temperature of 5°C) and 51.05 kg (at evaporation surface temperature of 20°C).

Scenario II. Fuel truck rollover resulting in a diesel spill with ignition

The quantity of pollutants released in this case amounts to around 0.7 kg/h.

7.9.3 Operation phase

7.9.3.1 Main Production Facilities

Operational emergency hazards at Project facilities will be primarily associated with large quantities of flammable gases and combustible fluids that will be used in the production process, stored at commercial products/feedstock base, or loaded in tank cars at the loading/unloading rack. Major hazardous substances that will be present at the AGPP include combustible fluids and flammable gases of human health Hazard Class 3 and 4[29].

The possibility of incidents or accidents cannot be excluded completely due to extreme weather conditions at the Project location, possible construction errors/ defects, and the complexity of the technological process and procedures.

The most significant factors increasing the risk of accidents include:

- the presence of explosive and flammable materials within the production environment, including transport operations;
- operation and maintenance of pressurised equipment containing explosive and flammable substances;
- high concentrations of process equipment (both indoor and outdoor) ,contributing to the risk of cascading failures.

Table 7.15 describes the worst-case and the most probable scenarios of potential accidents that may occur during operation of the main AGPP facilities.

Table 7.15: Worst-case and most probable scenarios of potential accidents that may occur during operation of the AGPP facilities

Project components	Worst-case scenario	Most probable scenario	Probability and area of impact
Gas pipeline – connections	Complete pipeline rupture: • fragment dispersion, shockwave from expanding gas energy; • release of gas in two free jets; • burning of two independent high-speed jets of gas being released from both ends of the ruptured pipeline; • direct flame impact; • thermal impact.	Pipe crack, hole or leaking joint: • loss of containment of the pipeline or valves; • release of raw gas; • 'safe' dispersion in the atmosphere.	$3.5*10^{-4}$ 1/year. Area of thermal radiation impact: from 204 m to 275 m. Area of shockwave impact: from 17 m (boundary of complete destruction area) to 142 m (boundary of minimum damage area)

[28]'Methods for the assessment of environmental damage from main and field pipelines', approved by Mintopenergo of Russia on 01.11.1995
[29]Hygiene Standards GN 2.2.5.1313-03, GN 2.1.6.1339-03

Project components	Worst-case scenario	Most probable scenario	Probability and area of impact
Process area	a) Loss of containment of gas-filled equipment or pipeline: • blowout of gas into open space; • formation of explosion hazardous gas-air mixture (vapour cloud – VC); • VCE – vapour cloud explosion (deflagration) if ignition source exists; • shockwave impact on equipment and personnel. b) Large-scale catastrophic structural failure of equipment: • blowout of overheated vapours into the atmosphere; • mixing of vapours with air to concentration exceeding higher explosion limit; • ignition and subsequent burning of the external cloud surface with formation of a ball of fire; • thermal impact on personnel and equipment.		$8.5*10^{-5}$ 1/year. Area of thermal radiation impact: from 214 m to 590 m. Area of shockwave impact: from 104 m (boundary of complete destruction area) to 1380 m (boundary of minimum damage area).
Storage area (commercial product and feedstock facility)	Loss of containment of a tank: • blowout of gas into open space through the roof; • formation of explosion hazardous gas-air mixture (vapour cloud – VC); • VCE – vapour cloud explosion (deflagration) if ignition source exists; • shockwave impact on equipment and personnel.	Pipe crack, hole or leaking joint: • loss of containment of the pipeline or valves; • gas release; • evaporation of gas from the spill pool; • 'safe' dispersion in the atmosphere.	$1.5*10^{-4}$ 1/year. Area of shockwave impact: from 108 m (boundary of complete destruction area) to 510 m (boundary of minimum damage area).

The probability of failures, especially those of catastrophic character, will be reduced due to the use of automated control systems, multifunctional systems for control of process parameters of blocks and vessels of main and auxiliary equipment, and the presence of adequately trained service personnel.

7.9.3.2 Auxiliary facilities

The primary cause of emergencies at auxillary facilities comprise leaks and spills of diesel fuel, including ignition of diesel. These emergencies are similar to those during the construction period, and are considered above (see Section 7.9.2).

7.9.3.3 SDIW landfill

Potential accidents during operation of the SDIW landfill may be associated with:

(1) *Ignition of waste as the result of spontaneous combustion or deliberate acts of third parties*

The maximum volume of waste that can be affected by spontaneous combustion will be 100 m^3, and the maximum weight will not exceed 25 tonnes[30]. Specific emission values from combustion of one tonne of solid waste and the estimated volume of emissions are presented in Table 7.16.

Table 7.16: Quantitative characteristics of emissions from combustion of waste at the landfill

Name polluting substance (PS)	Specific emission value (t per t of solid waste)	Estimated air emissions, tonnes
Sulphur dioxide	0.003	0.075
Particulate matter (PM)	0.001	0.031
Nitrogen oxide	0.005	0.125
Carbon monoxide	0.025	0.625
Carbon black (Soot)	0.001	0.016

(2) *Scattering of solid waste and construction debris resulting from rollover accidents with garbage trucks delivering waste to the landfill and garbage being scattered from refuse body*

The maximum quantity of waste lost during rollover accidents derives from truck capacities, and totals 4.7 to 12 tonnes.

(3) *Accidents during operation of high pressure gas pipeline*

These emergencies may be caused by defects of materials used for pipe manufacturing, pipeline corrosion defects, external impacts of construction machinery, and environmental factors such as soil subsidence and scouring by rainwater.

Due to the landfill being located at a significant distance from residential areas, emergency related impacts on local communities and AGPP personnel will be ***negligible***. The major adverse impact would affect landfill personnel and environmental components.

7.9.4 Emergency prevention and response measures

To reduce the risk of emergencies, increase reliability and environmental safety during operation of the AGPP facilities, the Project provides for a set of design solutions, including:

- Ensuring the strength and reliability of equipment operations within the working pressure and temperature range;
- Preventing contact of heat transfer fluid with the process environment;
- Provision of process equipment with all necessary control devices, automation and safety valves;
- use of non-combustible materials for thermal and sound insulation of pipelines and equipment;

[30]'Provisional recommendations for estimating pollutant air emissions from solid waste combustion at landfills and calculating sums of claims for ambient air pollution', approved by the Ministry of Ecology and Natural Resources on 02.11.1992

- use of appropriate security equipment to prevent unauthorised access to/entry into the facility.

Procedures and organisational measures aimed at preventing and mitigating the effects of major accidents will be place, including:

- timely commissioning and maintenance of the process safety facilities;
- systematic inspection of containment of the process equipment operated under pressure, including condition monitoring of instrumentation;
- regular testing of personnel knowledge of industrial safety standards and regulations, the rules of safe equipment operation, and occupational health and safety requirements;
- preparedness of civil defence and emergency response resources for response to natural and man-made emergencies;
- liaison and engagement with civil defence and emergency response authorities, neighbouring industrial facilities, and regular testing of reliability of emergency alarm and warning systems;
- maintaining of PPE in good condition.

The emergency response plan has been developed for AGPP facilities as required by Federal Law "On industrial safety of hazardous industrial facilities". The plan provides for emergency notification of the management and emergency response services, assessment of hazards within the emergency area, identification of sources and the scale of pollution, and decisions on the scope of work and required response resources.

Oil spill response plans for the Project facilities are to be developed in accordance with Government Decree No.240 of 15.04.2002 'On the procedure for organisation of oil spill prevention and response activities in the Russian Federation'.

7.9.5 Residual impacts

The results of the quantitative assessment of consequences of potential accidents at the proposed AGPP facilities are deemed 'acceptable', and are in compliance with national and international industrial safety standards for similar facilities in the gas industry.

Assuming the designed set of measures aimed at preventing emergency situations are implemented, the residual environmental impact in case of emergencies is assessed as ***negligible.***

8. SOCIO-ECONOMIC BASELINE

8.1 General information

The town of Svobodny is 151 km from Blagoveshchensk by road and is located on the 1,447th km of the R297 ”Amur” Highway (Chita – Khabarovsk). The highway has a dedicated approach way to Blagoveshchensk. The ‘Amur’ Highway is a segment of international transport corridor ‘Transsib’ (Central Europe – Moscow – Yekaterinburg – Krasnoyarsk – Khabarovsk – Vladivostok – Nakhodka). Svobodny and Blagoveshchensk are connected by the R468 highway. Svobodny town railway station is a part of the Trans-Siberian railway route. In addition, the town has a river port on the Zeya River, which is currently not used for passenger transportation. With access to the Zeya River that joins the Amur River, navigation of goods and passengers is possible from Svobodny to the Pacific Ocean.

Svobodnensky District is designated as a risk zone for the following natural disasters: wildfires, floods, heavy rains, heavy snowstorms and hail, windstorms, squalls, hurricanes and blizzards. Wildfires may be caused by large volumes of dry grass accumulated in abandoned farms and other undeveloped areas.

There is potential for floods in the district. In 2013, a flood affected several areas of the town of Svobodny. Up the Zeya River, the Zeya dam and hydropower plant plays a significant role in flood protection. In case of a dam failure, the total flooded area in the district may reach 1,400 km^2, with the flood wave arriving to the district’s boundary in about 48 hours.

The town of Svobodny and Svobodnensky District are two different administrative entities with separate administration, technical departments, development programs and initiatives. Nevertheless, the district and the town are inevitably interconnected at the level of infrastructure, community life and economic activities. Administratively, the district is divided into 15 rural councils (selsovets) and has 42 settlements.

The district transportation system includes “Amur” highway (48km), roads of regional significance (437.5km) and of local significance (245.5km). The road system enables transport by all types of vehicles.

Housing in Svobodnensky District for most of the population is characterized by “acceptable” living conditions. Housing is provided with amenities, including the use of heating, sewage and waste management systems.

The district is mainly agricultural in nature, and 39.6% of the land dedicated to agricultural use is farmed. Farms are mainly composed of arable land (43.8% of all farmlands). The distribution of other agricultural lands is as follows: hay lands (7.6%), pastures (11.2%) and long-fallow lands (37.3%). The district’s economy has barely any industrial output. Retail entities prevail in non-agricultural small and medium-sized enterprises,.

Agriculture is a major sector of the local economy. Over 10% of the population is engaged in the agricultural economy professionally (not including backyard farming). The official unemployment rate of the district is 2.9% of all working age and able-bodied people. In fact, nearly 40% of the working age population is either unemployed or involved in the informal economy.

The district has been selected as an area for potential creation of a Priority Areas of Socio-Economic Development.

8.1.1 Population and demographics

As of 2016, the population of Svobodnensky District is 14,584 persons. Most of the population are Russians, with Ukrainians and Byelorussians representing major ethnic minorities.

Demographic indicators demonstrate that the population in the district is growing when compared to the late 2000s. Currently, 54% of the population are of working age, 22% are of retirement age, and 25% are below working age. By 2015, an trend of working age population growth was observed.

The district does not lose its residents; on the contrary, there is a positive trend of both migration and natural increase. Over 60% of the working age population resides in relatively large settlements, with population of over 500 inhabitants.

According to Rospotrebnadzor, an elevated risk of the following diseases is reported in the Svobodnensky District:

- Kidney stone disease (for children under 14);
- Tuberculosis (exceeding average regional morbidity level by over 50%).

The Svobodnensky district is also an endemic area for tick-borne encephalitis.

8.1.2 *Population in the Project Area of Influence*

The Social Area of Influence (SAoI) of the Project includes the communities residing close to the AGPP construction sites that are likely to experience social impacts in relation to the Project. The list of the settlements in the Project SAoI is provided in Table 8.1

Table 8.1: Settlements in the Project Social Area of Influence

Settlement	Population (2016)	Administrative status
The Town of Svobodny	57,713	City
Yukhta	338	Rural settlement
Yukhta-3	127	Rural settlement
Dmitrievka	406	Rural settlement
Ust-Pera	439	Rural settlement
Chernigovka	460	Rural settlement

The demographic situation in the **town of Svobodny** is characterized by a trend of population decline. The ethnic setup of the town is mainly ethnic Russian. The demographic situation is getting worse due to low living standards, a lack of job opportunities, and low income levels (Report of the mayor of the town of Svobodny, 2015). Out-migration to other areas of the Amur Region or other regions of the RF has been observed.

The economy of the town mainly relies on traditional activities (retail and wholesale), which comprise almost half of all town's business activities (41.7%). Key industrial enterprises of the town include the following fields:

- train car repair works (*Transvagonmash* LLC);
- production of construction materials (*Stroydetali* LLC and *Kombinat Stroitelnoy Techniki* LLC);
- gold mining (*ZDP Koboldo* and *Dagmara* LLC).

The major sectors where the citizens of Svobodny are employed at are:

- healthcare - 22.9%;
- education - 18.1%;
- social insurance services, state governance, and military security - 14%;
- communications and transport - 12.6%.

As of 2016, the official number of unemployed amounted to 859 persons (2.6% of all working age population). In fact, according to the municipal administration, only 68% of working age residents of Svobodny are employed.

Secondary vocational education is the most common educational attainment in the town of Svobodny.

In its current boundaries, the **municipal entity 'Dmitrievsky rural council'** was formed in 2011 when it was combined with Ust-Pera settlement. Currently the municipal entity involves the following rural settlements:

- Yukhta (founded in 1931);

- Yukhta-3 (founded in 1931);
- Dmitrievka (founded in 1907);
- Ust-Pera (founded in 1921).

All four settlements are located along the Trans-Siberian railway, where the "Yukhta" railway station is situated. Local communities may reach the town of Svobodny by public transport. All settlements in Dmitrievsky rural council are located along the Bolshaya Pera River. Yukhta and Dmitrievka are the closest settlements to the Project site; however, they are geographically separated from the construction site by the Bolshaya Pera River.

The economic activities of local residents mainly comprise agriculture and farming, including farm animal breeding (e.g. swine, horse, sheep breeding), vegetable production, crop production (e.g. soy, wheat, and oat production) and beekeeping.

Chernigovka settlement, located in proximity to the jetty facilities on the Zeya River, is in the Zheltoyarovsky rural council. The settlement is situated close to the bank of the Zeya River, north-east of the town of Svobodny. The PAD-6 Project road will be constructed next to the settlement, and will be used by Chernigovka community to reach the Zeya River and the lakes. The settlement can be reached by public transportation.

The permanent population of Chernigovka totals 390 to 400 residents, who depend largely on agricultural activities. Like many inhabitants of rural areas in Svobodnensky District, the population of Chernigovka uses personal land plots for backyard farming activities, which provide local residents with necessary food supply and serve as additional source of income. Such activities are largely handled by female residents. The male population mainly work as shift employees at Vostochny Spaceport in the town of Tsiolkovsky.

8.1.3 Indigenous Peoples

Of all indigenous communities, only Evenks currently live in the Amur Region, and only in its northern districts. As of 2010, Amur Region was home to 1,501 Evenks. There are no indigenous people[31] communities in Svobodnensky district or the town of Svobodny.

The agricultural nature of the local economy attracted Old Believer communities that now reside in Latin American countries. These communities involve the descendants of religious activists that separated from the Russian Orthodox Church after the reforms of Patriarch Nikon in the middle of the 17th century. A special regional resettlement program was developed for these communities in 2007 to 2012, but it was never implemented due to a lack of financing.

Some Old Believer communities still live in the Svobodnensky District south of the town of Svobodny, and are engaged in traditional economic activities. These communities are located at some distance (about 30 km or more) south of the Project SAoI. According to unofficial sources, there are four families occupying 4 houses. This community is characterized by the municipal administration as closed and not keen to engage.

8.1.4 Cultural Heritage

The historical and cultural potential of Svobodnensky District is substantial. Ther are 39 historical monuments in the district, including 28 monuments listed in the state register of protected sites at the regional level. In addition, there are 114 archaeological heritage sites in the district, that are not adequately maintained and may be destroyed by economic activities. Archaeological finds have been found mostly on the banks of the Amur, Zeya and Malaya Pera Rivers.

The majority of historical and cultural heritage monuments identified above are situated outside of the Project SAoI. However, two of them are located in settlements close to the Project Area of Influence, namely in Yukhta (obelisk to the fellow villagers who sacrificed their lives for their home country during the Great Patriotic War) and Chernigovka (obelisk to the fellow villagers fallen during the Great Patriotic War).

[31]Groups referred to in Russian Legislation as 'Indigenous Small-numbered Peoples of the North, Siberia and the Far East '.

Four archaeological heritage sites have been discovered within the AGPP Early Works Facilities construction area by the additional survey performed by the Center for Conservation of Historical and Cultural Heritage of Amur Region in 2014-2015. These are as follows:

- Yukhta, ancient settlement – 1 (TBI site of AGPP);
- Yukhta, ancient settlement – 2 (GAZ9 site of AGPP);
- Ust-Pera, ancient settlement – 5 (GPP – VZ2 (water abstraction) Water Main site);
- Ust-Pera, settlement – 1 (PZD Zavodskaya site).

Body sherds, flakes, chips, cores and stone tools (e.g. a knife) of various ages including early Middle Ages (Mokhe culture, 6th to 9th century A.D.) and Neolithic Age (14 to 8 thousand years ago) have been found within the above archaeological sites.

8.1.5 Recreation, fishing, hunting and gathering

The district has various resort areas offering opportunities for nature-based recreation. However, these areas are not well-developed. On the other hand, the local tourism economy, while hindered by lack of infrastructure and distance, has the following benefits:

- High level of recreational hunting potential;
- Popularity of country-side recreation centers;
- Popularity of children's recreation centers.

The recreation areas closest to the Project site are located near Nizhniye Buzily and Razlivnaya settlements (approximately 8 and 15 km to the north from the Project site).

Backyard farming is important for local residents, and there are over 500 backyard farms in Dmitrievsky rural council occupying nearly 145.6 ha. The residents of Dmitrievsky rural council are also engaged in gathering activities. Berries (e.g. blueberries and wild strawberry) and mushrooms (e.g. milk mushroom) are most popular among local residents, and are mainly collected from wetland and lake areas.

Hunting, fishing and gathering serve as supplementary nutrition supply for local communities. For fishing activities, the surroundings of the Zeya River are exploited. Two hunters' societies are active near the Chernigovka settlement – "Hunting establishment of the city of Svobodny" (related to hunters with military background) and "Svobodnenskoye hunting establishment".

8.2 Assessment of Socio-Economic Impact

8.2.1 Influence Area of Social Impacts

In accordance with IFC PS 1, social impacts shall be assessed in the Project's area of social influence (SAoI). Based on the Project overview and information on potential impacts of its components, the following areas and communities have been included in the PSAoI:

- Svobodnensky District Municipalities:
  - Dmitrievsky rural council - the SAoI includes the settlements of Dmitrievka, Ust-Pera, Yukhta and Yukhta-3;
  - Zheltoyarovsky rural council - the Project's area of social influence includes Chernigovka settlement;
  - Nizhnebuzulinsky rural council with land plots of local residents exposed to the Project impacts;
- Svobodny city.

8.2.2 Impacts Overview

The Project has the potential to produce both positive and adverse social impacts.

Positive impacts refer to the economic benefits of Project implementation for the communities within the PSAoI, which are currently affected by economic depression and low development. Project construction and operation will create new employment opportunities for young people and other groups. Local businesses will get a chance to sell their products and services through the Project procurement system. Support to local residents employed for Project operation will be guaranteed through Corporate Social Responsibility schemes. The Project will yield significant and sustainable benefits for local communities.

A description of potential ***adverse social impacts*** associated with the Project is provided below.

Occupational health and industrial safety risks

Experiences of projects similar to AGPP in Russia and elsewhere indicates the existence of risks to the Company and its personnel if occupational health and industrial safety issues are not adequately addressed in compliance with Russian law and principles of IFC PS 2, including:

- Workplace injuries resulting from failure to comply with safety requirements for working at height, handling of heavy loads and working in confined space;
- Occupational diseases caused by personnel exposure to impacts of chemicals;
- Transport risks at the Project sites and transport routes.

Handling of gases is the main source of hazards at the construction stage.

The impact level is assessed ad ***low or medium***.

Community safety and separation risks

Project-related operations will be conducted at the Project site, and only some activities will affect other territories (e.g. road rehabilitation and construction of the river port). Project operations and construction sites will be fenced and provided with permanently guarded checkpoints, thus the risk of unauthorized access is assessed as very low.

As most of the loading/unloading operations during Project implementation will be conducted outside the construction site (e.g. at the railway stations, river port), a lot of traffic is anticipated between such facilities and the main Project site. In addition, it may be necessary to provide bus transportation of some personnel between the Project site and external accommodation facilities.

During the operation stage, Project traffic will be limited to bus transportation of workforce from the residential area in Svobodny. Public roads in the Project area of influence are generally well maintained and provide safe conditions for road users. Importantly, there exists a bypass road which can be used by Project transport to avoid the busiest streets of the city on the way from Blagoveschensk. Similar schemes (i.e. without need to drive through residential areas) are provided on the routes between the port/railway station and the Project site.

Temporary separation of communities and temporary traffic disruptions may be possible if local traffic and communities are affected by closure of some roads for repair.

Unmitigated traffic impacts during Project construction (and to a lesser extent, operation) is assessed as ***moderate or low***.

Land use and natural resource

The areas exposed to direct impacts of the Project are unpopulated, and impacts on land use are assessed as ***moderate***. Project implementation will not result in "physical displacement" of local communities due to loss of dwellings. However, some land plots were used by local communities for crop farming and cattle grazing, therefore the Project may cause "economic displacement" due to loss of economic activities and sources of livelihood (in the context of IFC PS 5).

Land plots with a total area of 528 ha have been purchased from 50 local land owners for Project implementation. The land was previously used for crop farming (mainly soybeans, wheat and barley). Most of the land plots were purchased through amicable settlements between "willing sellers and a willing

buyer", with adequate compensation in accordance with local standards. A further 113 land plots with a total area of 1,084 ha have been acquired from the national and municipal property.

The Amur Region branch of the All-Russia Association of Public Unions of Hunters and Fishers (ROSOKHOTRYBOLOVSOYUZ), an NGO officially registered in the Russian Federation, provides annual monitoring of fauna in certain transects and reports the results to the public supervision authorities.

The Association has the following concerns about the Project:

- Forest felling in the Project area will affect local fauna (disturbance of habitats, migration of species);
- Noise and light impacts will cause nuisance to local animals;
- Inflow of workforce to the Project area and the city of Svobodny will increase the load on natural areas, as there will be some hunters and fishers among the labour migrants who will create additional load on terrestrial and aquatic fauna.

Immigration

Immigration of the Project workforce from other parts of the region or from other regions of Russia may affect the economic and social situation in Svobodnensky district and Svobodny city for the following reasons:

- The capacity of existing social infrastructure may be too small to serve the needs of the increased population, especially if workers arrive with their families;
- Inflation supported by the higher purchasing power of Project personnel may affect vital resources (e.g. housing, food and transport services); the leisure and shopping infrastructure are currently being developed at the temporary workers' accommodation camps;
- The difficult crime situation in Svobodny may be further aggravated if local residents to see the immigrants as "wealthy" marks for robbery, and also due to an increase of alcohol and drug abuse supported by the higher purchasing power of personnel, especially during rest periods between shifts;
- Potential conflicts between local residents and labour migrants about unequal economic conditions, which may provoke outbursts of violence against certain ethnic groups, or for "revenge.

The level of such impacts is assessed as ***high.*** Activities on prevention of any disturbances are taken by the Project.

Cultural Heritage

As cultural sites are present at the Project site and in SAoI indicates the possibility of chance finds during excavation works in the construction phase. A chance find procedure is developed and implemented for all types of earthaworks, in order to ensure adequate protection of archaeological values or other objects of cultural value.

The level of this impact is assessed as ***moderate.***

8.2.3 Mitigation Measures

Description of proposed measures to mitigate social impacts of the Project is provided below.

1. Development and implementation of the Local Employment Policy, stimulating employment of local job seekers. The Policy will establish the applicable recruitment procedures. A local workforce database shall be prepared beforehand using the information available at the employment authority. Ensuring compliance with the labour law of the Russian Federation as a specific provision in the contract agreements. Monitoring of Project (sub)contractors' compliance with the above requirements through a grievance mechanism (in accordance with IFC PS 2) and regular OHS monitoring. Application of the labour relation requirements to all contractors through specific clauses in construction and supply agreements.

2. Implementation of occupational health and industrial safety measures including:
    - Development of action plans for improvement of working conditions for various stages and parts of operations;
    - Analysis of occupational hazard levels for risk identification;
    - Implementation of all recommendations given by OHS inspections by competent authorities of the Russian Federation;
    - Provision of workers accommodation in compliance with applicable H&S standards of the Russian Federation and international best practice (in particular IFC and EBRD Guidance "Workers' Accommodation: Processes and Standards" and associated health standards);
    - Health monitoring of Project personnel for tuberculosis at the time of employment and further on an annual basis, as a minimum;
    - Monitoring of key performance indicators of occupational health and industrial safety on a regular basis in accordance with the procedures established by the Company's management system (including CMP and ESMP), as well as the applicable standards of Russian oil and gas industry.
3. Implementation of the following traffic safety measures:
    - All works on public roads or causing diversions or other disruptions to public traffic will be properly signposted, with traffic lights and/or flagmen to regulate traffic if necessary;
    - Wherever disruption to local traffic or works will exceed one day duration, GPPB or the relevant contractor will notify relevant local authorities (District road department and selsovet) of the exact location, nature and duration of the works on public local roads and will publish notices in local mass media (see SEP for identification of relevant mass media).
    - Relevant contractor shall ensure safe traffic conditions by installing warning signs, traffic lights (if necessary), use of traffic controllers and / or escorting heavy-tonnage cargoes with special signals (flashing lights) on public roads (if necessary) and haul roads of Amur GPP construction site. In particular, traffic guards will be used when accompanied by large-tonnage cargo on the route "Amur GPP Jetty – Amur GPP construction site"; responsible persons are recommended to conduct careful road safety examination for the intersection of the Project roads with the regional road R-468;
    - GPPB and contractors conduct regular refreshment courses for drivers. It is recommended to monitor drivers' driving safety behaviour on a permanent basis and to consider providing incentives to the safest drivers in the form of a 'Driver of the Month' programme or similar.
    - GPPB and contractors to monitor compliance with speed limits on public roads and on Project site for light vehicles, busses, and Project machinery. GPPB and relevant contractor should provide vehicles with portable radars to verify abidance of traffic regulations by all Project drivers, including contractors' drivers.
    - GPPB and contractors shall enforce a zero-tolerance policy on alcohol (and other substances) during working hours, with immediate terminations if needed subject to the relevant provisions of the RF Labour Code.
    - GPPB shall ensure that its contractors and sub-contractors doing road works abide by these provisions (with relevant provisions clearly spelled out in construction and transportation contracts) and shall supervise compliance in the field.

- For haulage of heavy pieces of equipment, Contractors shall prepare Traffic Management Plans as warranted, defining designated itineraries and time schedules, and addressing compliance with relevant traffic safety regulations of the RF for heavy loads.

6. Provision of comfortable accommodation for the construction workforce; development of rotational shift camp management plan aiming to minimize potential conflicts with local communities.
7. Implementation of a workforce accommodation strategy for the operation phase, by providing a residential area for the Project personnel in the northern part of Svobodny. This will help to avoid additional loading of the existing social infrastructure.
8. Development and implementation of a chance finds procedure aiming to ensure protection and preservation of any cultural or archaeological objects which might be found during excavation activities (the procedure was implemented in 2016).

8.2.4 Residual Impacts

Implementation of the proposed measures will help to minimize anticipated social impacts, so the residual impact is assessed as ***low***.

9. TRANSBOUNDARY IMPACTS

The Project will be implemented in the territory of the Russian Federation (transportation of LPG/helium by sea is not covered by the ESIA as being outside the Project's influence area).

Sulphur content in the natural gas processed by AGPP is extremely low. This means that SO_2 emissions from operation of the Plant and power generation facilities will be of local significance, without any notable transboundary effect.

No significant impacts associated with nitrogen content are anticipated beyond the national boundaries either.

Thus, the Project is not expected to produce any significant transboundary impacts through pollution. One exception here is associated with emissions of greenhouse gas throughout the Project life cycle.

Disposal of wastes will be in the Project area, at the local landfill for processing and burial of solid municipal and industrial wastes. Certain types of wastes will be handed over for treatment and disposal by specialist contractors in the Russian Federation.

Therefore, the potential influence area of the Project does not extend beyond the national boundaries.

10. DECOMMISSIONING AND LIQUIDATION

Following phased commissioning of the Project facilities over the period 2021 to 2025, the AGPP will operate for 30 years. The auxiliary AGPP facilities are designed for a similar period, e.g. water intake facilities (25 years) and solid waste landfill (25 years). Other facilities (e.g. access motor roads, railway spurs) may remain operational for a longer period, provided that they are adequately maintained, repaired and reconstructed as required.

The life cycle of Project facilities will be shaped by a complex combination of external and internal factors, including industrial and associated development in the AGPP area, economic environment, socio-economic and environmental situation. Prediction of specific times for decommissioning of various parts of AGPP is impossible at this stage.

Russian law does not require preparation of demolition (dismantling) design for capital projects at the time of design development for their construction. Such future activities will include preparation of special design documents preceded by design studies and state expert review.

One source of information for the environmental design studies will be operational monitoring data collected during the entire period of operation of the Project facilities.

As the AGPP facilities will be implemented using a phased approach and have different life-cycle durations, their decommissioning and dismantling will be also extended in time.

Design documents for this phase of the Project shall consider the following:

- Development of the applicable legal framework and changes in the legal baseline by the time of the plant decommissioning;
- Environmental changes in the Project's AoI by the time of winding-up;
- Development of new demolition technologies and methods by the time of decommissioning of the designed facilities, including experience of similar projects.

At present, AGPP decommissioning procedures can be described and arranged in the form of a high-level plan based on the Russian law and the most effective and safe international industry practice (IFC PS).

The Regulation on the Scope of Design Documents and Requirements to their Content (approved by the RF Government Resolution of 16.02.2008 No.87) establishes the general standard requirements for design of demolition (dismantling) of capital projects other than linear facilities (p.24).

In general terms, the Project decommissioning and process will include the following activities:

- Phased safe shutting down of the production/technological processes;
- Removal of liquid and solid products/wastes to treatment and recycling/disposal, and further washing and cleaning to remove residual petroleum products and other process liquids and wastes from the pipelines, tanks and process vessels;
- Assessment of feasibility of further use of the emptied and cleaned structures, facilities and equipment to identify the best solution from socio-economic perspective, in compliance with contemporary international industry practice;
- Dismantling and removal of decommissioned above-ground and underground vessels and piping;
- Further environmental surveys for assessment of pollution caused by the Project activities, and development of a restoration plan.

The highest uncertainty about the future decommissioning of the AGPP is related to the waste management schemes. The design service life of the Project landfill for solid municipal and operational wastes is equal to the life of AGPP or less. Demolition of the plant buildings and structures will produce large quantities of wastes which will require transportation to disposal facilities elsewhere.Assessment of potential environmental and social impacts of the Project decommissioning and liquidation is impossible at this stage. The Project of decommissioning will be developed prior to the liqudation stage in

accordance with the Russian legislation. Also, the Progect of land remediation will be developed in line with the regulatory requirements and agreed with the authorities.

11. CUMULATIVE IMPACTS

11.1 Definition and Applicable Guidelines

Cumulative Impacts Assessment (CIA), both environmental and social, is one of the requirements set for a comprehensive ESIA. The relevant IFC Performance Standards include the following definition:

Cumulative impacts are the impacts that result from the incremental impact, on areas or resources used or directly impacted by the project, from other existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted.

Recommendations related to CIA are also provided in the EU commissioned document entitled 'Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions' (1999) applied extensively by European companies in the ESIA process as a primary source of practical guidance. It advocates an approach that is consistent with more recent IFC guidance (Performance Standards on Environmental and Social Sustainability), including the following:

- Gathering of project information,
- A scoping phase (temporal and spatial scope),
- Scoping, to identify important issues for further assessment,
- Collection of baseline data, potentially over a wider geographic area than for the Project alone,
- Assessment of cumulative impacts (outlining a range of assessment tools and techniques) with consideration given to the carrying capacity of the receiving environment.

11.2 CIA Methodology

The first stage of the CIA is aimed at identifying ***potential Valued Environmental Components (VECs)*** and defining the spatial and temporal boundaries. VECs are those receptors that are important when assessing the risks posed from cumulative impacts. VECs have been identified throughout the pre-ESIA process, including through consultations undertaken with stakeholders and reviews and assessments undertaken as part of the pre-ESIA.

Only those environmental and social receptors on which the Project itself is assessed to have potentially significant effects are included in the CIA.

The Project AoI includes:

- Project Area (areas directly affected by the Project include those affected by direct physical impacts from the AGPP or associated and auxiliary facilities located within the Project boundaries),
- Areas adjacent to the Project Area where the Project facilities will have indirect impacts.

The CIA also considers a larger spatial area outside of the Project AoI. The precise ***spatial boundaries*** are defined based on the geographic range of specific VECs as well as the spatial distribution of other third-party activities or influences that might impact the VECs.

Consistent with the EU guidance, consideration is normally given to existing projects or those expected to be initiated within a period of five years from the data of the CIA completion, with an exception of development projects that may be initiated after five years, but for which reliable information and certainty is available. The ***temporal boundary*** is therefore defined based on the availability and quality of information about existing and reasonably foreseeable projects or projects with a conceptual plan.

After definition of the assessment boundaries, the following VECs were identified for further CIA assessment:

- Atmospheric air;
- Geological environment and soil;
- Ground water;

- Surface water;
- Aquatic life;
- Terrestrial flora and fauna (natural habitats);
- Landscapes;
- Community health and safety;
- Local infrastructure;
- Local employment and economy.

The CIA defined the past and current operations, as well as planned and clearly described projects located close by the Project area. Their interaction has potential to generate cumulative impacts in time and space.

11.2.1 Past and Current Operations

The Project sites are fallow lands which are now overgrown with shrubs and young trees, or areas disturbed by past operations. The footprint area of the Project facilities comprises arable land. Flat territories are occupied with soybean fields (tilled area on the eastern side of the GPP site extending 560 m towards the site centre). The natural habitats are partially degraded by past agricultural operations (e.g. tillage, dairy cattle breeding and sheep farming) and other anthropogenic impacts, wildfires and poaching.

The distance from the AGPP Project site to the nearest industrial and municipal service operations in the city of Svobodny is 10 to 15 km.

11.2.2 Planned Industrial Operations

According to the strategic development documents for the Russian Far East and Baikal Region, development of Amur region will focus on three main areas:

- Natural-resource-based area along the Baikal-Amur Mainline;
- Amur River Basin industrial and logistics area, Svobodny space-launch area;
- Advanced development territories (ADT): ADT Belogorsk (agriculture) and ADT Svobodny (gas-chemical industry).

The advanced development territory of Svobodny is located in the restricted administrative territorial unit (RATU) Uglegorsk and in the adjacent areas of Svobodnensky district. Its development will rely on construction industry, high tech and knowledge-intensive instrument and machinery engineering to serve the needs of construction and operation of the Vostochny cosmodrome.

In 2015 the RF Government issued a Resolution on establishing ADT Svobodny intended to support development of major gas processing industries in Svobodnensky district.

Other than major projects in the fuel-and-energy and aerospace sector, many other projects are planned for implementation in the Svobodny town and district in various sectors including industrial production, agriculture, municipal services, transport and communications, recreation and tourism, and also in social sphere.

11.3 Discussion

Existing impacts and planned projects (construction programme, distance to the Project area, size of occupied territory) have been reviewed to assess potential contribution of the Project to the cumulative impacts. As a result, the following projects which can produce significant cumulative impacts with the Project have been identified for CIA:

- Vostochny Cosmodrome and auxiliary facilities in RATU Uglegorsk,
- Construction and operation of the Power of Siberia (“Sila Sibiri”) gas pipeline within the boundaries of Svobodnensky district (gas pipelines, PS-72 Zejskaya),

- Construction and operation of the Combined Heat Plant (CHP) "Sila Sibiri" and associated transmission lines and transformer substations,
- Construction and operation of the Amur Gas Chemical Complex,
- Trains and motor freight vehicles for transportation of AGPP products.

Other projects are not considered by the assessment as their temporal and/or spatial interaction with the Project will not cause any adverse cumulative impacts, or due to lack of the necessary details for adequate assessment because of early stage of such projects' development.

11.4 Assessment, Significance and Management of Cumulative Impacts

Table 11.1 provides the summary of the assessment of cumulative impacts on important social and environmental components, including specification of the types of the planned operations which were considered by CIA.

Table 11.1: Activities / projects covered by CIA for each VEC

VEC	Amur Gas Chemical Complex	Gas Pipeline "Sila Sibiri" (including PS-7a Zejskaya)	Vostochny Cosmodrome in RATU Uglegorsk	"Amurskaya" TPP	Trains and freight vehicles used for products transportation
Atmospheric air	v	v		v	v
Geology	v	v		v	v
Ground water	v	v		v	v
Surface water	v			v	
Aquatic life	v				
Terrestrial flora and fauna	v	v	v	v	v
Landscapes	v	v		v	
Community health and safety	v		v	v	v
Local infrastructure	v		v	v	v
Local employment and economy	v	v	v	v	v

V – activities / projects included in the assessment

11.4.1 Impacts on air quality

Chapter 7.2 (Section 7.2 Air Quality) reports that the residual air quality impacts are all predicted to be insignificant during construction, and low during the operation phase. Major sources of emissions and resulting air pollution during operation will be gas compressor units, direct-fired/ combustion heaters of gas, boiler plants and gas treatment units.

The main potential sources of impacts on air quality within the Project AoI are the planned projects located close to the AGPP SPZ boundaries: the Sibur plant, the "Power of Siberia" gas pipeline, the "Amurskaya" TPP and lorries (for transportation of the finished products – helium). Their simultaneous operations may result in adverse cumulative effects on air quality (especially regarding nitrogen dioxide and carbon monoxide). Considering the distance of the closest residential areas (the garden/vegetable allotments of the Yukhta settlement are 1.7 km west, and Yukhta settlement is 2.3 km south-west) from

potential sources of impacts and predominate west and north-west wind direction, the cumulative impact is likely to be no more than ***moderate*.**

11.4.2 Impact on the Geological Environment and Groundwater

It has been shown in NTS Section 7.3 and 7.5 that several types of residual impacts on the geological environment have been assessed as "moderate" to "high".

Construction of two major industrial facilities (the Sibur plant and the "Power of Siberia" gas pipeline) as well as the "Amurskaya" TPP is planned in the immediate vicinity of the Project area and approximately within the same time frame; their impact on the geological environment will likely be aggravated by Project construction activities. Horizontal and vertical transformation of the ground stratum due to excavations and associated operations, loads imposed on the ground and development of hazardous exogenous geological processes and phenomena caused by vegetation removal, destruction and disturbance of the soil cover, re-distribution of huge amounts of soil and changes in the surface runoff and underground discharge within a very large area can be assessed as ***long-term and of moderate magnitude***.

11.4.3 Impact on groundwater

Residual impacts on the upper aquifers is expected to be from moderate to high, mainly during the construction phase due to high concentration of construction machinery, transport vehicles, mobile buildings and structures, industrial and domestic wastes against the background of considerable volumes of works associated with destruction or disturbance of the soil cover and low degree of underground water protection. Similar impacts are also expected during construction of the Sibur plant, the "Power of Siberia" gas pipeline and the "Amurskaya" TPP. Taking into consideration the high permeability of the ground (self-purification ability), no significant cumulative impact is expected and the impact on the upper aquifers is assessed as **temporary and low**.

As far as the operational aquifer is concerned, it appears likelythat it will be depleted due to deterioration of the recharge conditions and changes in the surface runoff and underground discharge from the industrial sites and adjacent areas (i.e. the recharge zone of the aquifer). Cumulative impacts are probable, but it is not possible to assess the magnitude of this impact at the current time due to the lack of monitoring data for this aquifer.

11.4.4 Impact on surface water quality

In the Section 7 of the NTS, it was demonstrated that residual impacts on surface water quality are predicted to be ***low***.

The Sibur plant and the "Amurskaya" TPP projects are located within the Project AoI, and the impact of these projects appears likely to be on the same watershed (Zeya river with its tributaries: Rakusha and Bolshaya Pera). Impacts will be associated with wastewater discharge and discharge of upper aquifers and stormwater runoff from industrial sites and their adjacent areas (predominantly during the construction phase).

Provided that appropriate mitigation measures are taken at each of these projects, the cumulative impact on the Zeya River is assessed as ***temporary and of low magnitude***.

11.4.5 Impact on aquatic resources

Residual impacts on aquatic resources have been assessed from ***low*** to ***moderate***. Moderate impacts on aquatic habitats are expected only during dredging and other underwater engineering operations during construction of the temporary jetty on the Zeya River and the railway bridge across the Bolshaya Pera River. This adverse impact is limited to a short duration. It is unlikely that impacts of this type from other projects (e.g. the Sibur plant) will take place at the same time and cause any significant cumulative impacts. Due to this, cumulative impacts is assessed as ***short-term*** and of ***low magnitude***.

11.4.6 Impact on terrestrial flora and fauna

As discussed in Section 7.7 of the NTS, residual impacts on terrestrial flora and fauna have been assessed as ***low*** to ***moderate***. The main impact of the Project implementation on natural habitats will be

long-term physical loss due to land acquisition for construction of Project facilities and infrastructure, clearing of forests and other vegetation, and partial loss and fragmentation of habitats within the boundaries of the Project area. Elevated noise levels caused by vehicles (disturbance factor) and landscape modification (e.g. construction of motor roads and other linear facilities) is also expected. The parameters of the disturbance zone are limited to a range of 2 to 3 km from the boundary of an impact source.

Implementation of industrial projects (e.g. the "Power of Siberia" gas pipeline, the Sibur plant, and the "Amurskaya" TPP) at adjacent areas can cause similar impacts on the same habitats (e.g. on habitats of large mammal species within an area of over 10 km^2), both due to an increase in disturbed habitats and the influx of construction and service personnel. All this can be aggravated by illegal hunting (poaching), which will result in an adverse impact on game animal resources.

The cumulative impact on wildlife and vegetation due to destruction and deterioration of habitats can be assessed as ***long-term*** and of **moderate magnitude**.

11.4.7 Impact on landscapes

Expected changes in the landscape structure of the right bank of the Zeya River in the interfluvial area of the Bolshaya Pera and Gashchenka Rivers are not limited to the construction of the AGPP and its associated facilities. Adjacent areas will be used for numerous facilities associated with the "Power of Siberia" gas pipeline and the Sibur chemical plant. Some of these facilities will be located within the direct visibility of the residential settlements of Svobodnensky District (Yukhta, Chernigovka, Gashchenka, Ust-Pera) and of the town of Svobodny (AGPP residential camp). The overall decrease in forested area against a background of significant fragmentation of slightly and moderately transformed natural landscapes with areas of anthropogenic features will result in the loss of the characteristic forest-meadow landscape and initiation of mechanisms causing gradual transformation under the abruptly changed conditions. The cumulative impact is assessed as ***long-term***, ***irreversible*** and of ***high magnitude***.

11.4.8 Impact on health, safety and security of local communities

As has been discussed in Chapter 8, Project implementation can have negative impact on the health and safety of the local communities due to the following factors (the residual impact level of the Project is low):

- Risks for safety of the local residents associated with the traffic of heavy machinery for shipment of equipment and passenger transport on local public roads, and an increase in the road traffic intensity will result in higher risks of traffic accidents;
- Tensions and conflicts associated with a significant influx of workers from other regions.

Mutual interference of the transport streams associated with the Vostochny spaceport project will be insignificant as contrary to the Amur GPP Project, most transportation will be by railway, rather than by motor vehicles. However, during construction of the Sibur chemical plant, it is possible that the cumulative impact of the transport traffic (heavy machinery and trucks) on public roads will increase to moderate. It will inevitably decrease during the operation phase, when risks will be limited to transport of personnel from the AGPP and Sibur plant.

As to potential tensions and conflicts associated with immigrating workforce, cumulative impacts are deemed very likely, as growing tensions caused by the influx of the workforce to the Uglegorsk area have been already reported in the area. A temporary increase in tensions will also be caused by the additional influx of workforce of the Sibur chemical plant construction project. At the same time, considering the generally favorable attitude of the local communities to implementation of major projects in their region, the cumulative impact relating to this aspect is assessed as moderate.

In general, the cumulative impact on the health and safety of the local communities, considering also other existing and planned major projects in the subject region, can be assessed as ***moderate***.

11.4.9 Impact on local infrastructure

The influx of workforce for implementation of various projects to the subject region will potentially increase pressure on existing public healthcare, education and transport infrastructure and services. Nevertheless, the residual impact of the AGPP Project on local infrastructure has been assessed as low.

In-migration of personnel and applicants for jobs for the Sibur chemical plant project will increase the overall impact on the social infrastructure in the town of Svobodny, and in case of no mitigation measures it can reach a high level especially during construction and initial period of operation of the Project. The load on the social infrastructure in Svobodny will be intensified as certain elements are already overloaded. The impacts of Vostochny spaceport on the social infrastructure will be less noticeable, because the spaceport personnel will use t infrastructure located in Uglegorsk. Considering that implementation of the above projects will cause significant increases in the population of the region, a certain increase of the overall load on infrastructure facilities of regional significance (e.g. regional specialized medical institutions, occupational and higher educational institutions, cultural institutions in the city of Blagoveshchensk) is also to be expected.

Construction of the Sibur plant, the "Power of Siberia" gas pipeline, and the "Amurskaya" TPP will increase the traffic intensity on public roads in Svobodnensky District and in the town of Svobodny, which may lead to deterioration of local roads and to subsequent needs for better financing of road maintenance and repair at the expense of local budgets. There will also be an increase in the intensity of traffic related to transport of local residents using both private cars and public transport. The intensity of heavy machinery traffic will decrease during the operation phase.

Assuming no adequate mitigation measures are implemented on individual projects, the overall level of cumulative impacts on local infrastructure is assessed as ***moderate to high***.

11.4.10 Impacts on employment opportunities for local residents and local economy

Implementation of major industrial and innovative development projects in Svobodnensky district will provide benefits to the local and regional economy due to the following factors:

- Direct and indirect employment opportunities for local residents and associated benefits for the economy;
- Increase in tax proceeds to the local and regional budgets;
- Purchase of local goods and services and associated effects relating to motivation and development of businesses.

Creation of new jobs due to implementation of this and other projects will have a significant effect on local employment opportunities and provide a prominent input into regional economy. Potential opportunities for socioeconomic development of the region are discussed in detail in Section 8. Overall, cumulative impacts on socioeconomic development are assessed as ***high*** and ***beneficial***.

Adverse cumulative impacts can be associated with potential inflation at the local level caused by the influx of workforce and applicants for jobs increasing due to mplementation of the Sibur project. An increase in the demand for goods and services can cause local rises in prices and economic losses to local households. The intensity of such cumulative impacts on the economy and wellbeing of local communities due to implementation of major projects in Svobodnensky District is assessed as ***moderate***.

11.4.11 Management of Cumulative Impacts

Management of cumulative impacts requires implementation of appropriate mitigation measures at source at each stage of the Project.

The Company is committed to take a proactive approach for management of such impacts through implementation of the mitigation measures, and sustainable engagement and consultations with the local communities which is reflected in the Stakeholder Engagement Plan.

The CIA conducted did not reveal any additional significant environmental and social cumulative impacts requiring special mitigation measures or control, except for those already developed for the Project (see

Sections 7 and 8). However, several recommendations should be taken into account for coordination of impact mitigation strategies with companies that lead projects within the Project AoI:

- Performance of air pollution dispersion modelling in liaison with the nearest projects (the "Power of Siberia" gas pipeline, the Sibur plant, and the "Amurskaya" TPP). Should significant impacts identified, impact mitigation measures and coordinated plans for management of machinery and motor vehicle traffic during the construction and operation phasess should be developed;
- Coordination of strategies aimed at mitigation of the adverse environmental impacts with the "Power of Siberia" gas pipeline, the Sibur plant and the "Amurskaya" TPP projects. This will ensure compliance with the global best practices for execution of works, and compliance with requirements aimed at improving biodiversity management systems both within and outside of the Project area.
- Liaison with the "Power of Siberia" gas pipeline, the Sibur plant and the "Amurskaya" TPP projects and relevant environmental agencies during development of environmental monitoring programs and implementation of environment protection measures.
- Engagement with the "Power of Siberia" gas pipeline and Sibur plant projects during peparation of plans for social infrastructure development, and implementation of other measures aimed at mitigating cumulative impacts on the health and safety of local communities.
- Engagement of local communities in the consultation process during development of all new projects which might be initiated in the Project area and within its area of influence.

12. ENVIRONMENTAL AND SOCIAL MANAGEMENT

GPPB will develop and implement management programs that describe mitigation and performance improvement measures and actions that address the potential environmental and social risks and impacts identified through the ESIA process. These programs will include procedures, practices and plans to ensure that all environmental and social aspects of the Project are managed in a comprehensive and systematic way. The programs will be applied to the full scope of Project operations carried out by both GPPB and their direct contractors.

In particular, GPPB will develop the following document packages:

1. Environmental and Social Management Plan (ESMP)

An ESMP comprising a set of individual environmental and social management plans (ESMPs) will define environmental and social requirements to the Project, as well as procedures and methods to ensure compliance with these requirements throughout Project implementation. Thus, the ESMPs will describe:

- The organisational approach to environmental and social management, including definition of roles and responsibilities.
- The environmental and social standards to be applied.
- Specific measures aimed at management, mitigation and monitoring of all potentially significant environmental and social impacts. These will include measures identified for each type of impact and which have been used to determine the residual environmental and social impacts in this ESIA.

Recognizing the dynamic nature of the Project, the ESMPs will be responsive to changes in circumstances, unforeseen events, and the results of monitoring and review of designed activities. The ESMP for the construction phase and associated Construction Management Plans (CMPs) will be specifically developed alongside those for the operation phase, which are to be developed prior to the Project facilities being commissioned.

2. Environmental and Social Action Plan (ESAP)

ESAP will be prepared at a later stage and based on recommendations of RINA's report and will describe and prioritise any additional actions needed to enable the development and implementation of further relevant mitigation measures, corrective actions and/or monitoring measures necessary to manage the environmental and social impacts and risks identified in the ESIA. Additional actions captured in the ESAP are typically those that require additional time for their full development after the finalisation of the ESIA.

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