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Irkutsk Oil Company LLC

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IRKUTSK POLYMER PLANT. POLYETHYLENE PRODUCTION

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

Bright ideas. Sustainable change.

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BASIC TERMS AND CONCEPTS

Terms and Concepts	Intention	Notes (incl. variations of terms and concepts that are found in the Company documents and media publications)
Gas Programme of Irkutsk Oil Company LLC (abbreviated name – INK Gas Programme)	A long-term Gas Business Development Programme (INK Gas Programme) that INK initiated in 2010 consists of four stages and is intended to gradually enhance utilization of gaseous components of the produced hydrocarbon mixtures for production of commercial products for domestic and international markets	INK Gas Business Development Programme, INK Gas Project
Irkutsk Polymer Plant (IPP)	Gas-chemical plant for the production of polyethylene (PE) and monoethylene glycol (MEG). It includes two production complexes, the first of which is the Polymer Production Facility (PPF) with ethylene, polyethylene and alpha-olefin (butene-1) units (Stage 3 of the INK Gas Programme). The main part of the PPF offsite facilities will be shared with the second complex of IPP - MEG production (Stage 4 of the INK Gas Programme). The object of this ESIA is solely the polyethylene production and its associated activities	Formerly known as Ust-Kut Polymer Plant
Limited Liability Company "Irkutsk Oil Company" (abbreviated names – LLC "Irkutsk Oil Company", LLC «INK», INK, the Company)	The initiator of the intended activity. The Company holds the license rights to use subsoil and a tenant of land. The Company manages development of the Gas Programme through its subsidiaries	
Limited Liability Company "Irkutsk Polymer Plant" (LLC "IPP")	A wholly owned subsidiary of INK. The constructor and the operator of IPP. Direct ESIA customer.	
Ust-Kut industrial area of INK	The area is a site of compact placement of INK's Gas Programme facilities, whether existing, under construction or prospective, the largest part of which is located within the inter-settlement territories of Ust-Kut Municipal District. It consists of a number of sites connected with one another and with the existing transport and utilities infrastructure of the Ust-Kut district by utility corridors	Ust-Kut site, Ust-Kut industrial hub
Limited Liability Company "Ramboll CIS" (abbreviated names – LLC "Ramboll CIS", Ramboll, the Consultant)	Independent environmental and social consultant of the Project. ESIA developer	Formerly known as "Ramboll Environ"

ACRONYMS AND ABBREVIATIONS

AAS	Anti-Emergency System
AIDS	Acquired Immune Deficiency Syndrome
APG	Associated Petroleum Gas
BAM	Baikal-Amur Mainline
BAT	Best Available Technologies
BEDP	Basic Engineering Design Package
BOD	Biological Oxygen Demand
BREF	Best Available Techniques
CHP	Combined Heat and Power
CIA	Cumulative Impact Assessment
CITES	Convention on International Trade in Endangered Species of Wild Flora and Fauna
CJSC	Closed Joint Stock Company
COD	Chemical Oxygen Demand
CRU UEA	Hadley Centre and the East Anglia University
CWE	Combinations of Weather Events
DCA	Designated Conservation Area
DCM	Dispersion Calculation Methodology
DSG	Dry Stripped Gas
EBRD	European Bank for Reconstruction and Development
ECA	Export Credit Agency
EGP	Exogenous Geological Processes
EHS	Environmental, Health and Safety
EIA, OVOS	Environmental Impact Assessment
EMS	Environmental Management System
EPFI	Equator Principles Financial Institutions
EPM	Environmental Protection Measures
ERP	Emergency Response Plan
ESAP	Environmental and Social Action Plan
ESF	Environmental and Social Framework
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plant
ESMS	Environmental and Social Management System
ESP	Environmental and Social Policy
ESR	East-Siberian Railway
EWE	Extreme Weather Events
FAM	Fuel-Air Mixture
FCCW	Federal Classificatory Catalog of Wastes

FDP	Forest Development Project
FEED	Front End Engineering Design
FSBSI	Federal State Funded Research Institution
FSBU	Federal State Budgetary Institution
FSUE	Federal State Unitary Enterprise
FZ	Federal Law
GDS	Gas Distribution Station
GFU	Gas Fractioning Unit
GHG	Greenhouse Gases
GN	Hygienic Standards
GOST	National Standards
HDPE	High Density Polyethylene
HFL	Highly Flammable Liquids
HIF	Hazardous Industrial Facilities
HIV	Human Immunodeficiency Virus
HMMW	Highly-Mineralized Waste Water
HWL	High Water Level
IECM	Industrial Environmental Monitoring and Control
IFC	International Financial Corporation
IFI	International Financial Institutions
IGCP	Irkutsk Gas Chemical Integrated Plant
IGCP	Irkutsk Gas Chemical Integrated Plant
ILO	International Labor Organisation
IMS	Integrated Management System
INK	Irkutsk Oil Company
IP	Individual Entrepreneur
IPP	Irkutsk Polymer Plant
IRAHF	Irkutsk Region Association of Hunters and Fishermen
ITC GMGS	Irkutsk Territorial Centre for Geological Environment Monitoring
ITS	Reference Documents
IUCN	International Union for Conservation of Nature
JBIC	Japan Bank for International Cooperation
JSC	Joint Stock Company
LEB	Large Equipment Offloading Berth
LLC	Limited Liability Company
LLDPE	Linear Low-Density Polyethylene
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
MAC	Maximum Allowable Concentration

MAL	Maximum Allowable Level
MEG	Mono-Ethylene Glycol
MMS	Ministry of Municipal Services
MPC	Maximum Permissible Concentrations
NDS	Permissible Discharge Limits
NG	Natural Gas
NG&APG PP	Gas Processing Plant which processes both Natural Gas and APG
NGL	Natural Gas Liquid
OECD	Organization for Economic Cooperation and Development
OGCF	Oil Gas Condensate Field
OHSMS	Occupational Health and Safety Management System
ORP	Osetrovo River Port
OST	Industry Standards
PD	Design Documentation
PDP	Process Design Project
PE	Polyethylene
PPF	Polymer Production Facility
PR	Performance Requirements
PreESIA	Preliminary Environmental and Social Impact Assessment
PS	Performance Standards
PSAoI	Project's Social Area of Influence
RD	Guidelines
RF	Russian Federation
RZD	Russian Railways
SanPiN	Process Regulations and National Health Standards and Rules
SBE	Small Business Entities
SBZ	Sanitary Buffer Zone
SCIWC	Specific Combinatorial Index of Water Contamination
SEER	State Environmental Expert Review
SER	Stage Expert Review
SFD	Siberian Federal District
SGC	Stable Gas Concentrate
SNiP	Building Standards and Rules
SP	Codes of Practice
SPARK	Verification, Analysis and Monitoring of Companies
SPZ	Sanitary Protection Zone
SRWDS	State Register of Waste Disposal Sites
TAC	Temporary Accommodation Compound
TBI	Temporary Buildings and Installations

TBI	Temporary Buildings and Installations
TCB	Total Coliform Bacteria
UKGFU	Ust-Kut Gas Processing Plant
USSR	Union of Soviet Socialist Republics
VEC	Valued Environmental and Social Components
VOC	Volatile Organic Compound
WPZ	Water Protection Zone
WRS	Water Recycling System
WWF	World Wildlife Fund
WWTP	Wastewater Treatment Plant

1. PROJECT OVERVIEW

1.1 Introduction

Irkutsk Oil Company (INK) was established on 27 November 2000. INK is engaged in geology studies, exploration and production of hydrocarbon crude in 24 license areas in Western Siberia including Irkutsk Region and the Republic of Sakha (Yakutia). The Company shareholders are the European Bank for Reconstruction and Development (EBRD), Goldman Sachs International, and Russian entities. During its operating history the Company has produced over 34 million tons of oil and gas condensate. At present INK is among the Russia's largest independent producers of hydrocarbon crude, with projects being implemented in line with the best industry practices and requirements of EBRD.

In June 2017 Irkutsk Oil Company, LLC engaged Ramboll Environ CIS, LLC for preliminary environmental and social impact assessment (PreESIA) of construction and operation of the proposed polymer plant in Ust-Kut District. The assessment results were presented in the report with description of the economic, environmental and social benefits, identification of environmental and social risks and proposed mitigation measures to minimise potential negative impacts of the Project.

In December 2018 Irkutsk Oil Company and Ramboll CIS made an agreement for the detailed environmental and social impact assessment (ESIA) of the polymer plant construction and operation on the finally selected site, in accordance with the approved power and water supply schemes and design details.

1.2 Project Summary

1.2.1 Geographic position and administrative division of the Project area

Irkutsk Region is located in the Western Siberia and belongs to the Siberian Federal Okurg. It Region occupies the area of 774,846 km^2, and its population is 2,397,763 with density 3.11 persons per km^2. Urban population prevails in the Region (78.89%). The administrative centre is Irkutsk city. The region has boundaries with the following federal subjects:

- In the north-east – the Republic of Yakutia (Sakha);
- In the east – Zabaykalsky Krai;
- In the south-east – the Republic of Buryatia;
- in the south-west – the Republic of Tuva;
- In the west – the Republic of Khakassia;
- In the north-west: Krasnoyarsk Krai.

Figure 1.1: Irkutsk Region in the map of the Russian Federation

By the area size, Ust-Kut Municipality is the seventh largest district of Irkutsk Region. It adjoins Nizneilimsk District in the west, Zhigalovsky and Ust-Udinsky Districts in the south, Kirensky and Kazachinsko-Lensky Districts in the east, and Katangsky and Ust-Ilimsky Districts in the north. The district administrative centre is Ust-Kut city (population number 41,149 in 2019).

Figure 1.2: Ust-Kut District in the map of Irkutsk Region

Details of the environmental and social baseline situation in the Project area are provided in Sections 7 and 8.

1.2.2 Project background

“Irkutsk Oil Company”, LLC (INK) has been producing crude hydrocarbons in Irkutsk Region since 2004 and is the region’s largest producer of oil. Major part of the Company’s prospective assets (Markovsky and Yaraktinsky fields) is situated in Ust-Kut District, which is the main area of INK operations. By the composition of product yield, these deposits are classified as oil-gas condensate fields and are characterized by a large share of ethane and heavier hydrocarbons in the gas fraction.

Starting from 2010 the Company has been using the natural gas (NG) and associated petroleum gas (APG) reinjection technology for simultaneous production of gas and oil, in the situation where no gas transport and consuming infrastructure is present, while APG utilization requirements are established by Russian Government. Gas reinjection at the approximate rate of 4.5 million m^3 per day is intended to address two main objectives: reduction of impact of the field operations on atmospheric air, and increasing condensate recovery factor. However, from economic perspective, this approach results in wastage of substantial quantity of the valuable resource. Only small part of produced gas is utilized by local field power plants with the total capacity of about 100 MW.

The high blendstock content makes the gas an economically attractive subject for implementation of large-scale projects in the sphere of comprehensive gas processing. This consideration and the growing quantities of APG predetermined the need to develop INK Programme for utilization of gas resource of the Eastern Siberia (hereinafter “INK Gas Programme”). The Gas Programme provides for construction of two production facilities under a common name of the Irkutsk Polymer Plant (IPP): the Polymer Production Facility (PPF) being subject facility of this ESIA, and the Mono-ethylene Glycol Plant (MEG Plant). More details of the INK Gas Programme phases are provided in Section 5.2.

The proposed Polymer Production Facility (PPF, the Project) is intended for production of polyolefins, namely linear low-density polyethylene (LLDPE) and high-density polyethylene (HDPE) pellets. The main feedstock for production of polyolefins in Russia and Western Europe are petrochemical products, while in the US and Canada polyolefins are largely produced from ethane, which is a preferred method from environmental point of view.

Irkutsk Oil Company selected the UNIPOL™ technology by Univation Technologies, the USA, for polyethylene production at the new plant. The Plant will produce polymers of different density grades, so that INK will get access to the Russian and international markets of high density polyethylene (HDPE), as well as linear low density polyethylene (LLDPE) used in production of a variety of products. Furthermore, the Plant products range will be extended with the PRODIGY™ technology for production of bimodal HDPE with improved characteristics being the feed material for manufacturing of final products certified by the European standards (ISO), e.g. PE100 tubes, extra-strong films and vessels. Also, INK selected ACCLAIM™ technology for production of monomodal HDPE needed for manufacturing of PE80 tubes, large blown vessels, and super-strong HDPE film.

The Project will complement the gas processing structure of INK and utilize the benefits offered by the unique fraction composition of the produced gas (including associated petroleum gas) for production of marketable products. The wasteful and environmentally unfriendly practice of flaring or reinjection to formation will completely cease. Other expected economic and social benefits of the project include the following:

- significant reserves of natural gas and associated petroleum gas which are currently unclaimed, will be engaged for enhanced processing;
- production of product with a high added value;
- opportunity to develop new industrial facilities for manufacturing finished domestic and industrial products;
- Infrastructural development of Irkutsk Region’s northern areas, in particular Ust-Kut District (including enhanced electricity-generating capacities);
- Development of the regional labour market;
- Improvement of the living standard in Irkutsk Region, due to the increase in average wages and contributions to local public budgets;

- Possibility to improve reliability of heat and gas supply systems in the city of Ust-Kut.

The main production facilities of the proposed polymer plant are ethylene, polyethylene and alpha-olefin (butane-1) units. Auxiliary systems include an electric substation, water supply and wastewater disposal systems (including water intake, water and wastewater treatment and pumping), flare system (with HP subsystems for ethylene and polyethylene units and LP subsystems for the PE unit), storage facilities and PE loading platform, fuel gas system, office and laboratory facilities, process piping, tank farms with pumping stations and flash tanks, and fire suppression systems.

Proposed positions of the plant facilities under the main option considered for design are shown in schematic map in Annex A2 and discussed in more detail in Chapter 5. Irkutsk Oil Company leased an area of 430.49 ha of merchantable forest land for construction of the IPP facilities, including 109.3 ha for the main production site of the Project. The site is located at approximately 4 km north from the previously leased land plots for the gas transport system, LPG terminal, gas processing plant, access motor roads and rail roads, and temporary site structures.

1.3 INK Group Structure and Project Management Strategy

INK LLC and its affiliates are parts of the INK-Capital JSC (INK Group) being one of the Russia’s largest independent produced of hydrocarbon crude. For management and implementation of the Project the Company established a dedicated affiliate “Irkutsk Polymer Plant” LLC. Overall structure of INK Group is shown in Figure 1.3.

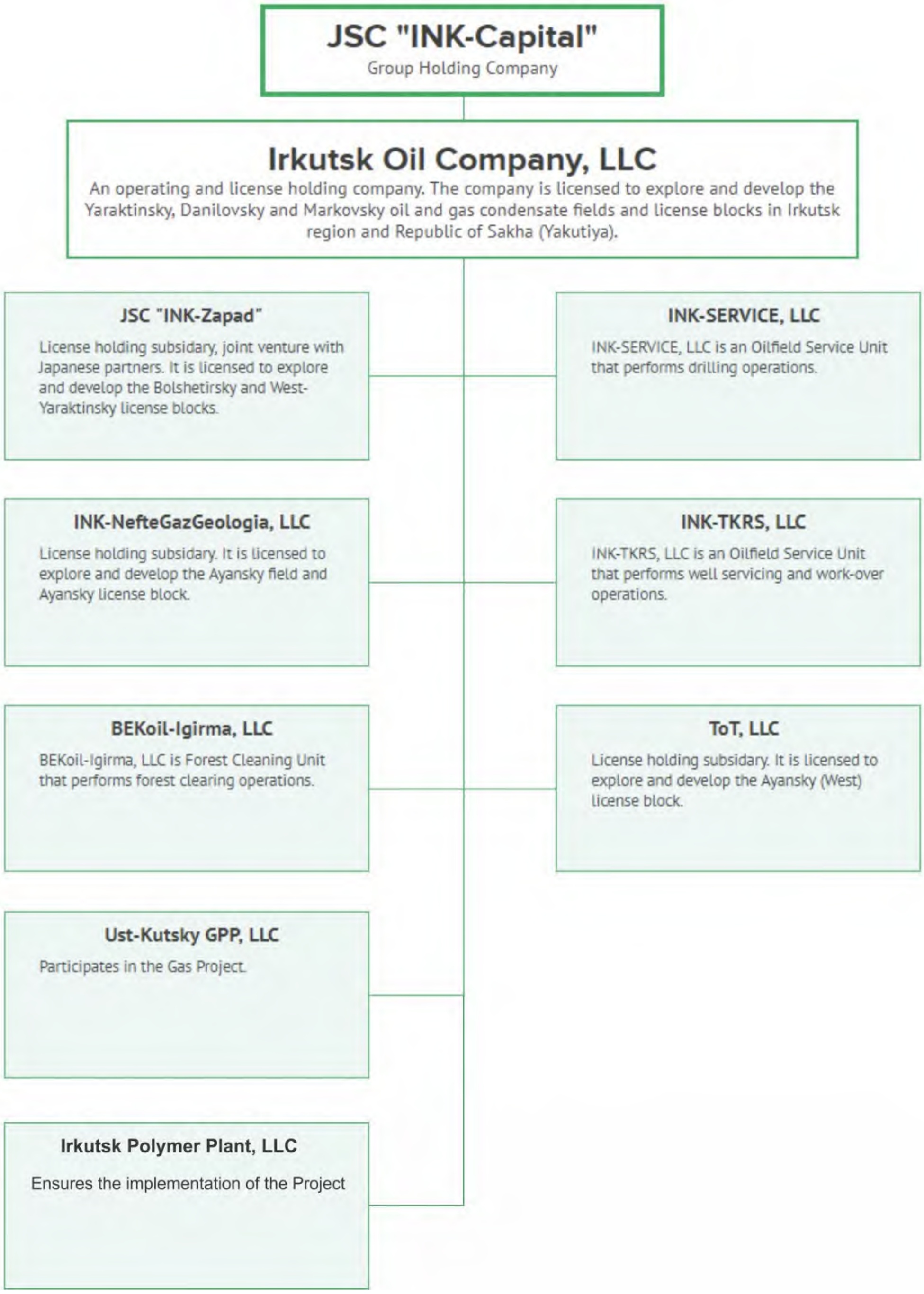

Figure 1.3: Holding structure of INK-Capital JSC

INK performs operational activities, controls subsidiary companies, holds licenses for production of hydrocarbons at the main oil-gas condensate fields – Yaraktinsky, Markovsky, Danilovsky, and in the license areas of subsoil resource in Irkutsk Region and the Republic of Sakha (Yakutia). Since the start of its existence, INK implemented a number of major projects in oil and gas industry, including projects subject to requirements of international finance institutions. For instance, the Company made and agreement with EBRD that its new projects will be implemented in compliance with the EBRD's Environmental and Social Policy. Thus, development and implementation of the Project takes into account both Russian law and the applicable international regulations, including conventions, standards of the major international lenders in environmental and social sphere, that have been ratified by the Russian Federation.

Given that the Project will be implemented by special purpose subsidiary of INK – Irkutsk Polymer Plant LLC, the environmental protection, health and safety (EHS) and social management procedures and documentation will not conflict with the respective procedures and documents of INK. However, they may be amended and refined to better correspond to specific operations of the Polymer Production Facility, the applicable requirements and Project features. More details on the Project management are provided in Chapter 14.

1.4 Project Finance and Applicable Requirements

The Company intends to use its own financial resource for the Project, as well as long-term finance from a pool of international financial institutions (MFI), primarily the Japan Bank for International Cooperation, commercial banks, and other prospective lending institutions (collectively, the "Lenders" or "INK Lenders"). In line with this financing strategy, the Project is being developed in compliance with the following environmental and social requirements (see Chapter 2 for further details):

- 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 requirements of the international finance institutions, including:
- The Equator Principles (2013);
- The World Bank/IFC Environmental, Health and Safety (EHS) Guidelines (April 2007) including without limitation 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 Environmental and Social Policy (2014) and Performance Requirements;
- Japan Bank for International Cooperation (JBIC) Guidelines for Confirmation of Environmental and Social Considerations (2012); and
- The Organization for Economic Cooperation and Development (OECD) Common Approaches (2012).

The Project performance will be assessed against the standards, including those provided within the above national and international environmental and social requirements. Details of the applicable legal requirements and Project standards are provided in Chapter 2, and specific the Project Environmental and Social Standards document is included in Appendix 2.

1.5 Objectives and development of the ESIA

This ESIA document has been prepared for the earliest identification and timely provision of information to stakeholders, for anticipatory detection of potential problems and planning of mitigation measures in good time to mitigate and manage adverse impacts to acceptable levels as defined by Russian regulatory requirements, international good practice and applicable international Lender requirements.

The ESIA incorporates and documents the following processes:

- description of the Project, its background and implementation prospects;
- characterization of a detailed environmental and social baseline;
- identification and assessment of potential environmental and social impacts and issues, both adverse and beneficial, associated with the Project;
- proposed measures to avoid, minimize or mitigate and manage adverse environmental and social impacts of the Project;
- identification of feasible opportunities for improved environmental and social performance by the Project;
- development of robust management systems that will manage environmental and social performance in an integrated manner across all Project activities and throughout the life of the Project; and

- recommendations for performance monitoring and evaluation during the Project implementation process.

The baseline situation has been assessed on the basis of survey materials and reports prepared within the scope of the INK Gas Programme, including adjoining and neighbour projects. Those include environmental engineering studies and preparation of permitting documents for various projects of INK Gas Programme in the area. ESIA further considers results of earlier stakeholder consultations which were held to identify potential problem areas throughout the whole Project life.

The Project is currently at the design documentation development stage, i.e. specific locations of the Project facilities and infrastructure have been finalized, and main design and process solutions are developed. Please refer to Chapter 5 for detailed description of the Project within the scope of the INK Gas Programme.

The ESIA process covers a full-scale assessment of environmental and social impacts, from scoping of baseline studies, identification of stakeholders and consultations, identification of the Project impacts, benefits and effects, to development of mitigations and remediation measures, and recommendations for project management, monitoring and supervision at the construction and operation phases.

In relation to the environmental and social compliance gaps identified by the ESIA process, further studies and measures to achieve compliance have been proposed. Summary of the ESIA results is provided in Chapter 15.

Stakeholder engagement is vital mean which enables stakeholders to contribute to the process of impacts identification, mitigation and monitoring, and supports smooth implementation of the Project with the maximum benefit for the community. Stakeholder engagement activities must be started at the early stages of the Project and ESIA process, in order to provide open and timely access to all relevant information. To facilitate this process as much as possible, recommendations for arrangement of such consultation activities have been prepared and presented in Chapter 4.

This ESIA document takes into account results of comprehensive assessment of the Project and corporate management processes of INK, and reflects the status of compliance with international best practice, Russian law, and requirements of international lenders.

1.6 Structure of the ESIA

In order to provide clear presentation of the ESIA procedure including its results, conclusions and recommendations, this Report is structured as follows:

Chapter 1 **Project Overview** (this chapter). The chapter introduces the Project by providing details of its location, scope, owner, objectives, proposed approach to Project finance, and applicability of international standards.

Chapter 2 **Legal Environment of the Project Implementation.** This chapter provides an overview of the regional, national and international legal framework, within which the INK Project is to be developed and implemented. Legal framework in the RF and the Irkutsk Region is considered, together with an overview of applicable international Lender requirements.

Chapter 3 **ESIA Materials Development: Key Methods and Procedures**. This chapter provides an overview of the overall process of environmental and social impact assessment and applicability of the international methodology for the ESIA procedure. The chapter further addresses: definitions of key terms; identification of potential environmental and social impacts (through consultation and scoping process); description of the criteria used to determine the significance of impacts for various environmental and social topics; and how mitigation measures are considered within the assessment process.

Chapter 4 **Stakeholder Engagement**. This chapter describes the stakeholder engagement process adopted by the Project. It describes the results of consultation activities undertaken earlier and as part of the ESIA process.

Chapter 5 **Project Description.** This chapter describes the background and phasing of the IOC Gas Business Development Programme, as well as the Project elements, including descriptions of the permanent and temporary Project facilities, infrastructure, associated facilities, as well as definition of the Project boundaries in the form of the Project influence area. The key process solutions are presented as they are seen at the current stage of planning. Tentative project implementation schedule is provided covering all phases from planning to commissioning.

Chapter 6 **Project Alternatives Review.** This chapter describes the Project development and technical solutions options considered, including the No Project Alternative, and provides a justification for the selection of the preferred Project development option.

Chapter 7 **Baseline Environmental Conditions**. The existing environmental baseline is described and characterised in this chapter.

Chapter 8 **Socio-Economic Baseline**. The existing social baseline is described and characterised in this chapter.

Chapter 9 **Environmental Impact Assessment**. This chapter presents the assessment of potential environmental impacts, including identification of mitigation measures and monitoring requirements. Impacts during each phase of the Project development are assessed on a topic-by-topic basis.

Chapter 10 **Social Impact Assessment.** This chapter presents the assessment of potential social impacts, including identification of mitigation measures and monitoring requirements. Impacts during each phase of the Project development are assessed on a topic-by-topic basis.

Chapter 11 **Decommissioning.** Potential impacts specifically associated with decommissioning, dismantling and disposal of the Project facilities and infrastructure are addressed in this chapter.

Chapter 12 **Transboundary Impacts.** This chapter considers potential long-term transboundary impacts.

Chapter 13 **Cumulative Impacts.** This chapter addresses potential cumulative impacts of the Project and other third-party anthropogenic activities in the region.

Chapter 14 **Environmental and Social Management.** This chapter describes the approaches to environmental and social management across all Project activities, and recommends the management procedures to be adopted to ensure compliance with the applicable international requirements throughout the life of the Project.

Chapter 15 **Conclusions** provides summary of the key significant impacts, mitigations and monitoring, as well as recommendations for further studies to cover the gaps and remove uncertainties.

Additional graphical and text materials are provided in the Appendices of the report.

2. LEGAL ENVIRONMENT OF THE PROJECT IMPLEMENTATION

2.1 Introduction

This chapter provides an overview of national and international environmental, social, health and safety legislation which requirements shall be taken into consideration during the Project implementation and ESIA procedure. Specific requirements applicable to the Project implementation which shape the ESIA process are described in the appropriate technical sections of the ESIA Report. Specific applicable standards are described in more detail in the Project Environmental and Social Standards Document (Project Standards) which is provided in Appendix 2.

2.2 National Regulations

The law of the Russian Federation (RF) regulates the use and protection of natural resource, environment and social, health and safety, working and recreation conditions at the national and regional level. The respective legislation is ranked in the list below (from general frameworks to more particular and specific requirements):

- Constitution of the Russian Federation
- International treaties, conventions, agreements and other international acts ratified by the Russian Federation (for details refer to Section 2.3)
- Federal laws including the RF Codes
- the RF President Decrees, the RF Government Regulations (Orders)
- Decrees issued by the federal executive authorities (ministries, agencies, services)
- Laws of the RF Constituent Entities
- Orders issued by the heads of executive bodies of the RF Constituent Entities
- Legal acts issued by local authorities
- A system of process regulations and national health standards and rules (SanPiN), hygienic standards (GN), national standards (GOST) and industry standards (OST), building standards and rules (SNiP), codes of practice (SP), guidelines (RD)
- Reference documents (ITS) on the best available technologies (BAT)

2.2.1 Federal law

2.2.1.1 General environmental and community health requirements

The main principles of Russian environmental policy are established in the RF Constitution, the Federal Law "*On environmental protection*", Federal Law "*On the sanitary and epidemiological welfare of the population*", "*Principles of the State policy in the area of environmental development of the Russian Federation for the period up to the year 2030*". The latter is strategically focused on "solving socio-economic tasks enabling environmentally-oriented economic growth, preservation of good environmental quality, biodiversity and natural resource to satisfy the needs of present and future generations, and exercise the universal right to good environment, strengthen legal enforcement in the sphere of environmental protection and provision of ecological safety".

The Constitution of the Russian Federation is the main law that lays down the human right to "favourable environment, reliable information about its state and for a restitution of damage inflicted on his health and property by ecological transgressions" (Article 42). The natural resources of Russia shall be utilized and protected in the Russian Federation as the basis of life and activity of the people living in corresponding territories (Articles 9, 58).

The Federal Law "On environmental protection" of *10.01.2002 No. 7-FZ* sets out a legal framework for the state policy in the sphere of environmental protection, regulates the relationships between the public and nature in the course of economic and other activities. It further establishes:

- basic principles of environmental protection, including the use of natural wealth for a pay and the reimbursement of a harm inflicted to the environment (Article 3);

- the right of citizens, non-governmental and other non-profit organizations to put forward proposals for a public environmental expert review and take part in the conduct thereof in the established manner; provide assistance to governmental bodies of the Russian Federation, governmental bodies of Russian regions, local government bodies in the resolution of environmental protection issues (Articles 11 and 12);
- the requirement to conduct assessment of effects on the environment in respect of a planned economic or another activity capable of exerting a direct or indirect effect on the environment (Article 32);
- general environmental provisions for location determination, design, construction, and operation of industrial facilities (Article 34);
- environmental provisions applicable to oil and gas production facilities, the facilities intended for processing, transporting, storing and selling of gas and petroleum products (Article 46);
- the duty of legal entities and natural persons, which have inflicted damage to the environment by polluting, depleting, damaging, destroying it, by irrational use of natural resources, degrading and destroying natural ecological systems, natural landscapes and other violation of the environmental protection legislation, to compensate (Article 77).

In July 2014[1] the Law was amended with the following significant changes to take effect from the 1st of January 2018 (2019):

- industrial operations will be classified in 4 categories, each subject to different state regulation measures;
- introduction of process codes for preferential treatment of BAT for operations of category I (with effect from 01.01.2019);
- 3 permits for emissions, discharges and limits for disposal of wastes will be replaced with an integrated environmental permit (for operations of category I), declaration (for operations of category II) and reporting (with effect from 01.01.2019);
- operational environmental monitoring requirements will be differentiated depending on the operations category;
- state environmental expert review will be mandatory for operations of category I (from 01.01.2019);
- legal regulation of charges for environmental impacts;
- introduction of environmental incentives for reduction of environmental pollution.

Federal Law "On the sanitary and epidemiological welfare of the population" of 30.03.1999 No.52-FZ regulates relationships in the sphere of community health protection. In particular, legal entities are obliged to ensure the safety of performed works and rendered services for human health, to exercise production control over the observance of sanitary and counter-epidemic (preventive) measures during the performance of work and the rendering of services, to inform the population, local self-government bodies, the bodies engaged in the state sanitary and epidemiological supervision in a timely manner about emergency conditions, production stoppages and breaches of technological processes endangering the sanitary and epidemiological welfare of the population (Article 11).

2.2.1.2 Assessment of impacts as a form of environmental support for operations

In accordance with the *RF Urban Development Code of 29.12.2004 No. 190-FZ*, engineering surveys (including environmental studies) in the entire area of potential influence of the Project are integral part of design development for construction or reconstruction of permanent facilities (Article 47).

The design documentation and findings of engineering survey shall be submitted to the state expert review which is aimed at evaluating their conformity to the applicable technical standards, including sanitation and epidemiology, environmental requirements, protection of cultural heritage sites, as well as fire and industrial safety-related, etc. The state expert review is provided by the FAI Glavgosekspertiza of Russia.

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[1] Law No.219-FZ of 21.07.2014

RF Government Resolution of 16.02.2008 No. 87 "On the structure of project documentation and its contents" establishes that project design package should include, inter alia, a chapter on titled "Environmental protection measures" (EPM). The chapter should contain the **findings of an environmental impact assessment (EIA or OVOS)** study and present a list of mitigation measures, and an environmental monitoring and control programme. The required approvals and information from various environmental and other authorities are attached as supporting materials. Projects can be implemented only when the above documentation is approved by the expert review authorities.

With reference to the classification established by the RF Government Resolution of 28.09.2015 No.1029 "On approval of criteria for classification of facilities producing negative environmental impacts as operations of category I, II, III and IV", operations for processing of chemicals and chemical products of the main organic chemicals including polymers are classified as category I, which means significant negative environmental impacts and applicability of the BAT requirements. Trunk pipeline transportation of gas and products of gas processing is classified as operation category II. The categories are assigned to operations causing negative environmental impacts (NEI) at the time of their state registration as NEI operations (Article 4.2 of 7-FZ).

Industries operating in the BAT application area which are not included in the "*List of operations*[2] *causing negative environmental impact of category I, contributing at least 60% to the total pollution emissions/discharges of the Russian Federation*" *(approved by the RF Ministry of Natural Resource, Order of 18.04.2018 No. 154)* are required to obtain integrated environmental permits by 1 January 2025. According to the amendments introduced by the federal law No. 496-FZ in the law No. 219-FZ, since 1 of January 2019 until 2025 I category facilities are allowed to obtain/ reissue permits and supporting documents based on previous format. Such permits are valid until receiving of IEP within the established period.

The designed polymer facility meets the NEI criteria for operations category I, therefore, application of BAT is an essential prerequisite for the permit to put the facilities into operation (refer to sub-section 2.2.1.14 for more details of sector-specific and cross-sector BAT).

The process of state environmental expert review (SEER) is regulated by the *Federal Law of 23.11.1995 No.174-FZ "On environmental review"*. In accordance with sub-clause 7.5 of Article 11 which will take effect on 01.01.2019, design documents for capital construction projects for operations of category I are subject to SEER. Environmental impact assessment materials shall be included in the documentation package submitted for SEER.

Requirements for the EIA process in Russia is established in *Regulation "On environmental impact assessment of planned economic and other operations in the Russian Federation"* approved by the RF State Committee for Environmental Protection (Goscomecologia), Order No.372 of 16.05.2000. The national EIA process includes development of EIA materials and discussion with stakeholders. In general the EIA process is comparable to international practice in this sphere, and in many respects it is compliant to the procedures recommended by the international financial institutions, including the World Bank. The main difference lay in the scope and methodology applied for the studies (Table 2.1).

Table 2.1: Comparison of international and national requirements for EIA process

International requirements	Russian requirements
- assessment of all aspects of impact focussed on the most sensitive aspects of impact - assessment of cumulative impact - assessment of transboundary impact - assessment of climate impact	- quantitative assessment - all aspects of impact are equally assessed (with focus on compliance with environmental impact standards)

[2] The List includes up to three hundred operations causing negative environmental impacts which contribute at least 60 per cent to the total pollution emissions/discharges of the Russian Federation. Such operations must apply for integrated environmental permit at Rosprirodnadzor during the period from 1 January 2019 to 31 December 2022 inclusive.

International requirements	Russian requirements
- detailed assessment of impact on biodiversity - enhanced social studies - enhanced engagement of stakeholders	
ESIA is needed to attract external loans (in case of intention to attract international investors)	**The EMP section with EIA findings is developed as part of the design documentation for subsequent approval and issuance of permit to proceed with implementation**

2.2.1.3 Air protection

Federal Law "On air protection" of 04.05.1999 No. 96-FZ establishes a legal framework in ambient air protection, including requirements concerning air protection measures to be taken by those engaged in economic activity of any kind.

To protect ambient air in residential areas, enterprises (or their groups) are required to establish sanitation protection zones (SPZ) around their sites. The size of such SPZs should be determined drawing from harmful (polluting) contaminant dispersion calculations and in line with the industry sanitation classification.

With reference to the sanitation classification of industries established by the RF Chief State Sanitary Officer, Resolution of 25.09.2007 No. 74 "On introduction of revised version of the Sanitary & Epidemiological Rules and Norms SanPiN 2.2.1/2.1.1.1200-03 "Sanitary Protection Zones and Sanitary Classification of Enterprises, Structures, and Other Facilities" (paragraph 11 - production of products and semi-products for synthetic polymers, and paragraph 13 - oil, associated petroleum gas and natural gas processing operations), the IPP is a Class I facility requiring standard SPZ of 1000 m.

The Rules for delineation of sanitary protection zones and use of land plots within the sanitary protection zones (approved by *the RF Government Resolution of 03.03.2018 No. 222)* provide for establishing of SPZ at the planning stage of a construction project.

Starting from 01.01.2019, pollution emissions to air from operations of category I will be allowed on the basis of the technological standards emission limits defined in integrated environmental permit. Procedures for development and approval of pollution emission limits is defined by the RF Government Resolution of 02.03.2000 No. 183 "On maximum permissible (pollution) emissions into and adverse physical impacts on the atmospheric air".

Pollution emission limits are calculated on the basis of the Harmful (pollution) Emissions Dispersion Analysis Methodology approved by the RF Ministry of Natural Resource, Order of 06.06.2017 No. 273.

Technological standards for production of polymers and associated products are specified in ITS documents in the form of BAT process parameters and affirmed by the RF Ministry of Natural Resources and Ecology:

- RF Ministry of Natural Resources Order of 12.04.2019 No. 231 "On approval of environmental regulation document "Process parameters of best available technologies for production of fine organic synthesis products";
- RF Ministry of Natural Resources Order of 24.04.2019 No. 271 "On approval of environmental regulation document "Process parameters of best available technologies for production of polymers, including biodegradable polymers";
- Draft Order of the RF Ministry of Natural Resources "On approval of environmental regulation document "Process parameters of best available technologies for basic organic chemicals production facilities" (drafted by the RF Ministry of Natural Resources on 08.11.2018).

Quantitative BAT process parameters applicable to production of polymers are listed in the Project Standards document (Appendix 2, Table 3.10).

Greenhouse gases (GHG). Basis for development and implementation of climate policy is provided in the Climate Doctrine approved by Decree of the President of the Russian Federation of 17.12.2009 No.861-rp.

Legal framework for reporting on GHG emissions is being developed, in order to implement the Action Plan for reduction of GHG emissions by year 2020 to a maximum level of 75% of GHG emissions in 1990, approved by the RF Government Decree of 02.04.2014 No. 504-r.

The GHG monitoring, reporting and checking system, the basic concept of which is approved by the RF Government Decree of 22.04.2015 No. 716-r, is a core element of regulation of GHG emissions which is vital for achievement of the goal set in the Decree of the President of the Russian Federation of 30.09.2013 No. 752 "On reduction of greenhouse gas emissions".

At the initial stage of implementation of the reporting system, starting from year 2019, the duty to report GHG emissions will be applicable to the largest industries and energy operators with annual direct emissions over 150 thousand tons of CO2-e.

Procedures to be followed for quantitative assessment of GHG emissions from operations in the Russian Federation for the purposes of GHG emissions monitoring, reporting and verification are adopted by the RF Ministry of Natural Resource, *Order of 30.06.2015 No.300 "On approval of "Guideline methodology and instructions for quantitative assessment of GHG emissions from entities conducting business and other operations in the Russian Federation".*

Annex 1 of the Guideline Methodology provides a list with categories of emission sources and GHGs subject to mandatory monitoring by organizations operating in Russia which includes inter alia stationary fuel combustion (monitoring of CO_2 emissions), fugitive emissions (CO_2 and CH_4) and petrochemical production (CO_2).

2.2.1.4 Protection of forests

Forest Code of the Russian Federation No. 200-FZ of 04.12.2006 outlines legal framework for relationships in forestry.

According to the Article 102 categories of protective forests are as follows:

- forests located within designated protected natural areas;
- forests located within water protection zones (WPZ);
- forests which protect natural and other facilities (including forests located within the first and the second belts of the sources of potable/sanitary water supply, anti-erosion forests, protective forests of spawning areas).

Designated protective forest plots include bank protection and soil protection forest plots located along water bodies and ravine slopes, reserved forest plots, forest plots with relict and endemic plants, habitats of rare and endangered animals.

Activities incompatible with designated purposes and useful features of protected forests and specially protected forest plots are prohibited within such forests/forest plots.

The following activities are prohibited in water protection zones:

- clearcutting;
- placement of capital construction facilities except for linear facilities and facilities associated with geological survey and hydrocarbons field development (Art. 104).

The following activities are prohibited in any designated protective forest plots other than forest reserves:

- clearcutting;
- placement of capital construction facilities except for linear facilities and hydraulic structures.

Federal Law of 19.07.2018 No. 212-FZ "On introduction of changes to the Forest Code of the Russian Federation and certain legal acts of the Russian Federation in terms of improvement of forest regeneration and cultivation" which took effect on the 1st of January 2019 introduces new forest regeneration and cultivation regulations. In accordance with the new regulations, forest users (i.e. parties using forests for geological exploration of subsoil resources, development of subsoil deposits; for construction and operation of water reservoirs, other artificial water bodies, as well as hydraulic structures, sea ports, terminal, river ports, berths; for construction, reconstruction, operation of linear facilities; for processing of timber and other forest resources) are required to regenerate and cultivate forest in an area of a size equal to the area of clearcut forest in the territory of respective Constituent Entity of the Russian Federation. The forest regeneration activities shall be completed within one year. Forest regeneration or cultivation works shall be performed one time, using adequate skills and high-quality planting material.

Since July 1, 2019, the amendments to the Forestry Code, adopted by the federal law No. 538-FZ of 27.12.2018 "On Amendments to the Forest Code of the Russian Federation and certain legislative acts of the Russian Federation to improve the legal regulation related with forest conservation on forest lands and lands of other categories". The law establishes the new criteria for assigning forest areas to the category of protective forest belts of spawning areas and defines them as forests located within the boundaries of fish protection zones or fishery protected areas established in accordance with legislation on fisheries and conservation of aquatic biological resources.

2.2.1.5 Waste management

Federal Law "On industrial and domestic waste" of 24.06.1998 No. 89-FZ regulates waste management issues. More specifically, during the construction of new facilities (Art. 10) legal entities shall:

- meet environmental, sanitation and other requirements concerning environment and health;
- be in possession of technical and process-related documentation on the use and disposal of waste generated at all stages of project implementation.

Waste management planning shall consider the waste hazard classification and waste disposal requirements.

Starting from 01.01.2019 waste generation norms and disposal limits will be developed for operations of category I and II. For category I operations, waste generation norms and disposal limits will be defined on the basis of integrated environmental permit.

2.2.1.6 Protection of subsoil, soil and land resources

Federal Law "On subsurface resources" of 21.02.1992 No. 2395-1 regulates relationships in the sphere of management and protection of subsurface resources, ground and surface water used by subsoil users for their operations and process needs.

RF Land Code of 25.10.2001 No.136-FZ regulates the relationships in the sphere of use and protection of lands as the basis of life and economy of peoples living in respective territories. Land use methods must ensure the preservation of ecosystems, and maintain the capacity of lands to be productive for agriculture and forestry, and remain the basis of economic and other activities (Article 12).

The Code establishes the responsibility of land owners, land users, landlords and tenant operators to take: land protection measures to protect their lands from chemical contamination, littering with industrial and domestic waste, and other negative (harmful) impacts that lead to land degradation; and cleanup measures for contaminated and littered land.

Land shall be used for the intended designated purpose. Procedures for reclassification of land are established in the Federal Law of 21.12.2004. No. 172-FZ "*On lands' or land plots' reclassification*".

RF Government Resolution of 10.07.2018 No.800 "On land remediation and conservation" sets the rules for land reclamation and conservation. Pursuant to the above document, reclamation shall be provided to restore land to a condition adequate for its use for designated and permitted purpose, by means of bringing land quality to compliance with the environmental quality standards and legal requirements of the Russian Federation in the sphere of community health and safety.

The Regulations paragraph 8 requires that reclamation activities are conducted on the basis of approved reclamation project design. The reclamation project shall be prepared as a separate document included in the design package for construction/reconstruction of permanent facilities which may result in land degradation or diminishing of fertility, or as an independent document in all other situations (Regulations paragraph 10).

Regulation of use-restricted areas[3] has a cross-sectoral perspective. Besides the urban development and land use regulations, this sphere is also controlled by electric power sector legislation (buffer zones of electric grid and generating facilities), industrial safety legislation (buffer zones of trunk pipelines and gas distribution networks), railway transport legislation (buffer zones of railway lines), community health and safety legislation (sanitary protection zones), nature resource legislation (water protection zones, flooding and underflooding zones, fish protection zones, designated fishery zones, forest-park zones, forest zones, etc.) and other sector-specific legislative acts of the Russian Federation. Summary of the use-restricted areas with categorization and references is provided in the Project Standards Document (see Appendix 2A).

2.2.1.7 Protection of water resources

The RF Water Code of 03.06.2006 No. 74 FZ establishes a legal framework for water resource management and protection, primary requirements in water uses, and liabilities for transgressions against water legislation.

The use of surface water bodies is managed on the basis of water use agreements for the following:

- water intake (abstraction) from water bodies (to be subsequently discharged back to water body, or without such discharge);
- use of water areas (unless otherwise stipulated in parts 3 and 4 of Article 11).
- The use of surface water bodies takes place on the basis of resolution on provision of water body for the following uses:
- discharge of wastewater;
- construction and reconstruction of bridges, underwater crossings, pipelines and other linear facilities, provided that bottom and shores of surface water body are not transformed by such operations;
- dredging, blasting, drilling and other activities resulting in transformation of bottom and shores of surface water bodies.

Water protection zones are areas adjacent to the shoreline of seas, rivers, streams, channels, lakes, water reservoirs, for which special regime of activities is set in order to prevent water pollution, littering, silting and water depletion of water bodies, and conserve the habitat for aquatic biological resources and other flora and fauna species (Article 65).

Near-shore protective belts are designated within water protection zone. Additional restrictions for activities are set for near-shore protective belts.

With effect from 01.01.2019, limits for discharge of wastewater to water bodies from category I operations will be defined in integrated environmental permits. The discharge limits are determined individually for each water user with reference to the Methods for developing permissible standards of substances' and microorganisms' discharge into water bodies for users of the water bodies (approved by the *RF Ministry of Natural Resource, Order of 17.12.2007 No. 333)* and approved pursuant to the RF Government Resolution of *23.07.2007 № 469 "On the procedure for approval* of permissible standards of substances' and microorganisms' discharge into water bodies for users of the water bodies".

2.2.1.8 Protection of animals, vegetation and habitats

Federal Law "On animals" of 24.04.1995 No. 52-FZ regulates relationships in protecting and using animals, as well as habitat protection and remediation, in order to preserve biological diversity, keep

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[3] Use-restricted areas are protective zones, sanitary protection zones, heritage zones (protection zones of historical and cultural monuments), water protection zones, flooding zones, drowning zones, protective sanitary zones of sources of drinking water and household water supply, exclusion zones, and other zones established in accordance with the Law of the Russian Federation (Art.1 of the RF Urban Development Code).

intact the wildlife gene pool, and otherwise protect animals as an integral part of the natural environment.

Pursuant to Art. 24, it is prohibited to undertake activities that may result in killing animals, reducing populations, or damaging habitats of Red Book animals. Pursuant to the Law, legal persons and citizens guilty of violating habitat protection rules, killing animals of rare or endangered species, breaking hunting or fishing rules, not meeting the requirements aimed at preventing the death of animals as a result of economic activities or transport operations, can be charged under civil, administrative, or criminal law (Article 55).

RF Government Resolution of 13.08.1996 No. 997 endorsed the "Regulations on the prevention of killing animals due to industrial processes, and due to transport link, pipeline, communications line and power transfer line operations". They regulate industries so as to prevent animal population losses as a result of: changed environmental conditions and disrupted migratory routes, getting into water intake installations, parts of industrial equipment, under moving vehicles and agricultural machines; construction of production and other sites, extraction, processing and transporting raw materials; colliding with power lines and electrocution, electromagnetic field impact, noise, vibration.

In particular, measures to be implemented to avoid pollution of water environment if there is discharge of industrial and other wastewater. It is prohibited to discharge any wastewater in areas of breeding, wintering and large gatherings of aquatic and semi-aquatic species. To minimize disturbance factors (noise, vibration, shock waves, etc.) affecting animals, it is necessary to be guided by applicable instructions and recommendations for measuring, estimating, and reducing their levels.

Federal Law "On fishery and water biological resource conservation" of 20.12.2004 No. 166-FZ regulates relations in the field of fishery and conservation of aquatic biological resources. The Law requires that measures are taken to preserve water bio-resources and their habitats during construction, reconstruction, or capital repairs of capital construction facilities (Article 50). The law also requires compensation for damages caused to water bio-resources (Article 53), either voluntarily or based on a court's decision and is calculated either on the basis of approved rates and methodologies, or based on the costs the restoration of bio-resources would take.

RF Government Resolution of 29.04.2013 No. 380 "On approval of regulation on measures of aquatic biological resources and habitats conservation" establishes the aquatic biological resources and habitats conservation measures that should be implemented along with any planned operations that cause direct or indirect harmful impact on biological resources and habitats.

The surface water quality standards shall be met in the process of effluent discharge into a water body. On the Lena River, fishery water bodies MPCs are applied as per the *Order of the RF Ministry of Agriculture of 13.12.2016 No. 552 "On approval of water quality standards for fishery water bodies, including standards for maximum permissible concentrations of harmful substances in the waters of fishery water bodies"*.

Federal Law "On designated nature conservation areas" No.33-FZ of 14.03.1995 regulates relationships in organizing, protecting and using designated conservation areas (DCA). No DCA areas are present within the Project AoI.

2.2.1.9 Heritage

The main Russian law in area of cultural heritage protection is the *Federal Law of 25.06.2002 No. 73-FZ "On cultural heritage (cultural sites) of the peoples of the Russian Federation".* The law establishes requirements for carrying out activities within the boundaries of cultural heritage sites and a special regime for the use of a land plot, a water body or a part thereof within which an archaeological heritage site is located (Article 5.1); chance finds procedures during exploration, design, excavation, construction, melioration, household and other activities (Article 36).

2.2.1.10 Indigenous Small-numbered Peoples

Indigenous people rights are regulated by the following laws:

- Federal Law "On guaranteed rights of indigenous small-numbered peoples of the Russian Federation" No. 82-FZ of 30.04.1999;
- Federal Law "On areas of traditional nature uses by indigenous small-numbered peoples of the North, Siberia, and Far East of the Russian Federation" No. 49-FZ of 07.05.2001.

2.2.1.11 Industrial safety

Federal Law of 02.07.2013 No. 116-FZ "On industrial safety of hazardous industrial sites" defines a legal, economic and social framework for hazardous production facilities to operate safely and is aimed at preventing contingencies and ensuring that organizations that operate hazardous facilities are prepared for containing and cleaning up the consequences of the said contingencies.

According to the classification established under Annex 1 to this Law, the facilities designated for hydrocarbons production, processing, handling, storage, and shipment are classified as hazardous production facilities. Technical units/devices used at hazardous production facilities in the operation process are subject to the industrial safety review in line with the established procedure (Article 13).

All hazardous facilities are divided into 4 classes: extremely high hazard (Class I), high (Class II), moderate (Class III) and low hazard (Class IV). The class of hazard is assigned at the time of registration of hazardous industrial facility in the relevant state register.

Class I hazardous facilities are subject to permanent supervision by state authorities. Operators of hazardous facilities of Class I and II are required to have safety management systems. Hazardous facilities of class I and II are subject to mandatory declaration.

In accordance with the *Federal Law "On mandatory insurance of civil liability of a hazardous facility's owner for damage caused as a result of emergency at hazardous industrial facility" of 27.07.2010 No. 225-FZ*, owner of hazardous facility is required to procure insurance of property interests related to the duty to compensate damage caused to affected parties as a result of emergency, by making an insurance agreement with an insurance company for the whole period of operation of the hazardous industrial facility.

Federal Law of 21.12.1994 No. 68-FZ "On the protection of the public and areas against natural and man-caused emergencies" sets out organizational and legal arrangements for protecting communities, land, water and air within the Russian Federation, industrial and social facilities, and the environment from natural and man-caused emergencies. The Law requires that organizations:

- create, train and maintain in the state of readiness a task force and equipment to prevent and eliminate emergencies, train personnel to protect themselves and act in an emergency;
- organize and carry out rescue and other emergency operations at their industrial and social facilities and in adjacent areas in accordance with emergency prevention and response plans;
- create financial and material reserves for emergency response action, etc. (Article 14).

Citizens of the RF have the right to the protection of their life, health, and belongings in an emergency, and to the reinstitution of damage done to their health and property (Article 18).

Federal law of 22.07.2008 No. 123-FZ "Technical Regulation of fire safety" is applied to protect life, health, property of persons and legal entities, state and municipal property against fire; it defines the main provisions of technical regulation in the area of fire safety and establishes general fire safety requirements for the assets (products) to be protected, including buildings and structures, industrial facilities, fire-fighting products and general purpose products.

Federal Law "On the building and structure safety technical standards" No. 384-FZ of 30.12.2009 sets out minimum requirements to buildings and structures, as well as to building and structure construction-related processes of design (including survey activities), construction, installation, commissioning, operation and disposal (demolition). Buildings and structures shall be designed to avoid risks of an adverse environmental impacts in the course of their construction and operation.

RF Government Resolution of 21.08.2000 No. 613 *"On emergency measures in oil spill contingency and response"* defines the principles for development of oil spill prevention and response plan in relation to emergencies of site, local, territorial, regional, and federal importance, as well as for organization of interaction of forces and resources appointed for elimination of the same.

- Order of the RF Ministry of Civil Defence, Emergencies and Disaster Relief of 28.12.2004 No. 621 "On approval of guidelines for development and approval of oil spill prevention and response plans in the Russian Federation" establishes general requirements for the planning of measures to prevent and eliminate spills of oil and oil products and emergency situations caused by the spills of oil and oil products (ES (Oil)), and also defines the procedure for agreement and approving of the oil spill prevention and response plan, including for organizations engaged in field exploration, oil extraction, and processing, transportation, storage, and use of oil and oil products. Organizations develop Plans corresponding to the level of possible emergency: site, local, territorial, regional, and federal, and in the water areas - local (facility), regional and federal.

2.2.1.12 Occupational health and safety

Labour relations and occupational safety are regulated by the *Labour Code of the Russian Federation No. 197-FZ of 30.12.2001.* The Code contains provisions intended to comply with state guarantees in relation to labour rights and freedom, ensure good working environment, and protect rights and interests of employees and employers. The Labour Code covers all the key regulations such as:

- collective bargaining;
- conclusion, modification and termination of labour agreements;
- breaks, leave and wages;
- guarantees and compensations;
- labour discipline;
- employee rights to labour protection, etc.

The Federal Law "On compulsory social insurance against industrial accidents and occupational diseases" of 24.07.1998 No. 125-FZ establishes the legal, economic and organizational basis for compulsory social insurance against industrial accidents and professional diseases, as well as determines the procedure of compensation for harm caused to life and health of an employee in the course of his duties under an employment contract and in other cases established by law.

2.2.1.13 Design and operation of polymer production facilities[4]

Sanitary regulations for production of synthetic polymers and synthetic polymers processing enterprises (approved on 12.12.1988 No. 4783-88) are applicable to the production of synthetic polymers-polyacrylates, polyvinyl chloride, phenol-formaldehyde and epoxy resins and polymers derived from them, low and high pressure ***polyethylene***, polypropylene, polyvinyl alcohol and its derivatives, polymers and copolymers of styrene, polyurethane foams, and as well as to the enterprises for their processing. They include requirements for the allocation of industrial enterprises, buildings, structures, and maintenance of the territory; for the production buildings and structures; operations and equipment, including requirements for limitation of noise and vibration levels; for the main workplaces, workflow, and work and rest schedules; for the sanitary protection of the environment.

In particular, when allocating production within the territory of enterprises and industrial hub, the total level of concentration of unidirectional action hazardous substances in the air of industrial sites (in emissions from both designed and existing production facilities) shall not exceed 30% of the maximum permissible concentration of these substances established for occupational air of production premises, and at the borders of SPZ - maximum permissible concentration established for atmospheric air in populated areas.

[4] A brief description of the Russian BAT branch reference documents is presented in subsection 2.4.7 BAT reference documents.

2.2.1.14 Application of the Best Available Technologies

The designed Plant meets the NEI criteria for operations category I, therefore, application of BAT is an essential prerequisite for the permit to put the facilities into operation.

The following basic criteria are adopted for BAT in the sphere of basic chemicals production:

- minimisation of adverse impact on the environment (assessed by the values of specific pollution emissions/discharges per unit of end product);
- application of resource and energy saving methods and high resource efficiency (in particular energy efficiency) of production process, assessed by specific energy consumption per unit of end product);
- full-scale implementation of equipment, other technical devices, methods at two or more sites;
- period of implementation (possibility of consistent improvement of resource efficiency and environmental performance through gradual improvement of technical facilities and procedures within the scope of energy management and environmental management systems).
- The following BAT reference documents are directly applicable to the Project:
- ITS 18-2016. Production of basic organic chemicals (including ethylene);
- ITS 31-2017. Production of fine organic synthesis products (ɑ-olefins production - butene-1);
- ITS 32-2017. Production of polymers, including biodegradable polymers (production of polyethylene).

For the purpose of the Plant benchmarking in the context of BAT, it is advisable to refer to environmentally significant parameters of three reference technologies:

- Production of ethylene by pyrolysis of LPG and ethane fraction;
- Production of butene-1 (ɑ-olefins);
- Production of polyethylene using gas phase technology.

BAT reference and BAT process performance data for the above technologies are included in the Project Standards Document (Appendix 2, tables 3.10 – 3.13).

Besides the requirements listed in sector-specific ITS documents, certain requirements of cross-sectoral BAT reference documents are also applicable to the Project. These relate to emissions and discharges treatment, waste management processes, design and operation of waste neutralization and disposal facilities, process cooling systems, environmental management and energy management systems:

- ITS 8-2015 Wastewater treatment in manufacture of products (goods), performance of works and provision of services at large enterprises;
- ITS 47-2017 Waste water and waste gas treatment/management systems in the chemical sector;
- ITS 22-2016 Purification of harmful (polluting) emissions to air from manufacturing of products (goods), works and services at large enterprises;
- ITS 22.1-2016 General principles of industrial environmental monitoring and its metrological support;
- ITS 46−2019 Reduction of pollution emissions and discharges from storage of products (goods);
- ITS 9-2015 Thermal waste treatment (waste incineration);
- ITS 48-2017 Increase of energy efficiency.

Most cross-sectoral reference documents provide high-level guidance and duplicate the requirements of the RF environmental law which are already addressed in the Company's commitments, policies, corporate standards and other corporate regulations. However, certain specific BAT requirements shall be considered during selection of process technologies and subsequent design development for the Project.

2.2.2 Regional and municipal regulatory framework

Laws and other regulations at the regional level applicable to the Project are listed below.

Environmental protection in general

The framework for environment protection and use of natural resources and social development in Irkutsk Region is set out in the *Charter of Irkutsk Region of 17.04.2009 No. 1*.

Irkutsk Region Law "On certain aspects of environmental protection in Irkutsk Region" of 11.06.2008 No.23-oz regulates responsibilities of economic entities for environmental protection activities and operational environmental monitoring.

- *Irkutsk Region Law "On urban development in Irkutsk Region" of 23.07.2008 No. 59-oz* regulates certain aspects of relations in the urban development at the regional level.

Irkutsk Region Government Resolution of 30.12.2014 No. 712-pp establishes regional standards for urban design at the regional level.

Irkutsk Region Government Resolution of 02.11.2012 № 607-pp approves territorial planning scheme of the region.

Air protection

Irkutsk Region Government Resolution "On approval of the Regulation for pollution (harmful) emissions control in adverse weather conditions within the territory of Irkutsk Region" of 15.04.2009 No. 110-pp establishes, that once receiving forecast information on adverse weather conditions, entities with sources of emissions of harmful (polluting) substances are obliged to initiate mitigation measures to minimize harmful (polluting) emissions without delay.

Waste management

Order of the Ministry of Natural Resources and Environment of Irkutsk Region "On Procedure for development and approval of standards for waste generation and waste disposal limits with regard to the economic and (or) other activities of legal entities and individual entrepreneurs (with the exception of small and medium-sized businesses), implementation of which entails generation of wastes at the facilities subject to the regional state environmental supervision" of 14.01.2016 No. 1-mpr establishes requirements for development, submission of documentation and approval of standards for waste generation and waste disposal limits with regard to the economic activities, which entail generation of wastes at the facilities subject to the regional state environmental supervision.

Irkutsk Region Government Resolution of 12.12.2016 № 780-pp approves procedure for collection of solid municipal wastes (including segregate waste collection) in Irkutsk Region.

Protection of subsoil, soil and land resources

Irkutsk Region Law "On certain aspects of use and protection of land in Irkutsk Region" of 21.12.*2006 No. 99-oz* regulates the use and protection of land in Irkutsk Region and defines the content of the application for the transfer of lands and the scope of supporting documents.

Irkutsk Region Law "On regulation of certain relations with regard to subsoil use in Irkutsk Region" of 07.10.2008 №No.75-oz" regulates certain relations concerning subsoil use in Irkutsk Region, including the procedure for provision of subsoil plots of local significance for geological exploration for the purposes of groundwater prospecting, assessment and extraction.

Protection of water resources

Order of the Ministry of Natural Resources and Environment of Irkutsk Region of 30.11.2017 No.36-mpr "On demarcation of shoreline, water protection zones and near-shore protective belts on the Lena River and Kuta River within the boundaries of Verkhnemarkovo, Podymakhino, Ust-Kut settlements of Ust-Kut District".

Irkutsk Region Government Resolution "On approval of the Regulation on the procedure for establishment of the size, boundaries, and regime of sanitary protection zones for drinking and household water supply sources" of 06.07.2015 No. 335-pp specifies the procedure for establishment of the size, boundaries, and regime of sanitary protection zones for potable water supply sources located within the territory of Irkutsk Region.

Irkutsk Region Government Resolution of 04.08.2011 No. 222-pp "On approval of Regulation on water bodies' use in Irkutsk Region for the purpose of protecting traditional habitats and lifestyles of the indigenous small-numbered peoples of Siberia".

Protection of forest resources

Order of the Forest Resource Ministry of Irkutsk Region of 11.10.2018 No.78-mpr "On approval of Forest Management Regulations for Forestry Departments in Irkutsk Region" approves the Forest Management Regulation for Ust-Kut Forestry Department of Irkutsk Region.

The Forest Management Regulation sets out the standards and parameters for integrated forest exploitation in terms of use, protection and reproduction of forest resources in the territory controlled by Ust-Kut Forestry Department.

Protection of wildlife and habitats

Irkutsk Region Law "On the Red Book of Irkutsk Region" of 24.06.2008 № 30-oz regulates the issues with regard to the Red Book, the procedure for listing into the Book rare and endangered species of animals and plants.

Irkutsk Region Government Resolution of 13.05.2015 № 235-pp approves the list of rare and endangered species of plants, animals and other living organisms within the territory of Irkutsk Region included into the Red Book of Irkutsk Region.

Irkutsk Region Law of 10.10.2008 "On Administrative Liability for the destruction of rare and endangered species of plants, animals and other living organisms listed into Red Data Book of Irkutsk Region" No. 87-oz provides for administrative liability for wrongdoings.

Occupational health and safety

Irkutsk Region Law "On fire safety in Irkutsk Region" of 07.10.2008 № 78-oz regulates social relations with regard to the fire safety in Irkutsk Region.

Irkutsk Region Law "On occupational safety in Irkutsk Region" of 23.07.2008 No. 58-oz defines authorities/powers and forms of engagement for government bodies of Irkutsk Region, local self-governing authorities, employers, professional associations, and other bodies representing the employees in respect of occupational safety. It guarantees employees' rights to occupational safety and labour protection. In particular, if a decision is made by competent authority to close a workplace due to violation of occupational safety requirements, the affected employee is entitled to a new workplace and professional retraining at the expense of the employer, including compensation during the period of training based on average salary for the previous work year.

Decree of Irkutsk Region Administration of 22.12.2006 No.700-ra "On compliance with the occupational, environmental, and fire safety requirements, and protection of Irkutsk Region population and natural environment in the use of oil, gas and refined products" contains recommendations for economic entities engaged with shipment, storage and sales of petroleum products, natural and liquefied hydrocarbon gases in Irkutsk Region, as follows:

- to develop Safety Data Sheets for hazardous facilities in compliance with the requirements of the Order of RF Ministry of Civil Defence, Emergencies and Disaster Relief "On approval of standard safety data sheet for hazardous facilities" of 04.11.2004 No. 506;
- develop and ensure concordance of Oil Spill Prevention and Response Plans according to the level of potential emergency;
- make provisions for organization of appropriately certified internal response teams (subdivisions) for containment and cleanup of oil spills. Before these teams (subdivisions) are in place, the appropriate agreements with professional emergency response teams (services) should be signed in accordance with the established procedure.

Irkutsk Region Law of 08.06.2009 No. 34-oz regulates certain aspects of protection of communities and areas from man-caused and natural emergencies at inter-municipal and regional levels in Irkutsk Region.

Socio-economic development / territorial planning

- Irkutsk Region Socio-economic Development Concept for the period till 2020 (Irkutsk Region Governor Decree of 04.06.2010 No.34-r);
- Irkutsk Region Investment Strategy for the period till 2025 (Irkutsk Region Government Decree of 28.08.2014 No.701-rp);
- Irkutsk Region Fuel and Power Sector Development Strategy for the period 2015-2020 and until year 2030 (Irkutsk Region Government Decree of 12.10.2012 No.491-rp);
- Draft Irkutsk Region Socio-economic Development Strategy till 2030;
- Irkutsk Region Forest Plan (approved by Irkutsk Region Governor Decree of 26.11.2014 No.445-ug);
- Irkutsk Region Territorial Planning Scheme (approved by Irkutsk Region Government Resolution of 02.11.2012 No.607-pp, rev. of 06.03.2019);
- Ust-Kut Municipality Territorial Planning Scheme (approved by Ust-Kut Municipal Duma Resolution of 30.04.2013 No.145) (rev. of 28.11.2017);
- Ust-Kut Municipality Socio-economic Development Strategy for the period till 2030 (approved by Ust-Kut Municipal Duma Resolution of 20.12.2018 No.181);
- Ust-Kut Urban Settlement Master Plan.

2.3 International Treaties and Conventions

The Russian Federation has ratified a number of international conventions concerned with environmental and social protection, requirements of which need complied with throughout the development of the Project.

Environmental Impact Assessment

- Convention on Environmental Impact Assessment in a Transboundary Context, 1991 (amended in 2004) (Espoo Convention)[5].

Biodiversity

- Convention on Biological Diversity, 1992;
- Convention on the Protection of Migratory Species, 1979 (Bonn Convention)[6];
- Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention)[7], 1979;
- Convention on Wetlands of International Importance Especially on Wildfowl Habitat, 1971 (the Ramsar Convention);
- Convention on International Trade in Endangered Species of Wild Flora and Fauna, 1973 (CITES).

Air quality and climate change

- United Nations Framework Convention on Climate Change, 1992;
- Kyoto Protocol, 1997;
- Paris Climate Agreement, 2015[8];
- Vienna Convention for the Protection of the Ozone Layer, 1988;
- Montreal Protocol on Substances that Deplete the Ozone Layer, 1989;

[5] The Espoo Convention has not yet been ratified by the Russian Federation; however, this document is listed here as the Russian Federation contemplates its ratification. Based on the results of ESIA, it should be noted that the Espoo Convention requirements are not applicable, as it is not expected that impacts of the Project will extend beyond the boundaries of the Russian Federation.

[6]Russian Federation is not a party to the Convention. IFC Performance Standard 6 is guided by and promotes the observance of the applicable international laws and conventions.

[7] Russia has been a party to the conventions of the Council of Europe since 1995, but Russia is not a party to Bern Convention. The representative of the Ministry of Natural Resources of the Russian Federation takes part in the activities as an observer. IFC Performance Standard 6 is guided by and promotes the observance of the applicable international laws and conventions.

[8] By the time of reporting, the Russian Federation has not ratified the Paris Climate Agreement.

- Sofia Protocol on the Control of Emissions of Nitrogen Oxides or their Transboundary Fluxes, 1988.

Waste and management of hazardous substances

- Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, 1989 (Basel Convention).
- Minamata Convention on Mercury, 2013[9].

Stakeholder engagement

- Convention on Access to Information, Public Participation in decision making and Access to Justice in Environmental Matters, 1998 (Aarhus Convention)[10].

Cultural heritage

- Convention Concerning the Protection of the World Cultural and Natural Heritage, 1972;
- Convention for the Safeguarding of the Intangible Cultural Heritage[11], 2003.

Community and workforce

- International Labor Organisation (ILO)[12] conventions including the core conventions protecting workers' rights:
  - ILO Convention 87 on Freedom of Association and Protection of the Right to Organize;
  - ILO Convention 98 on the Right to Organize and Collective Bargaining;
  - ILO Convention 29 on Forced Labour;
  - ILO Convention 105 on the Abolition of Forced Labour;
  - ILO Convention 138 on Minimum Age (of Employment);
  - ILO Convention 182 on the Worst Forms of Child Labour;
  - ILO Convention 100 on Equal Remuneration;
  - ILO Convention 111 on Discrimination (Employment and Occupation);
- UN Convention on the Rights of the Child, 1989;
  - International Convention on the Protection of the Rights of all Migrant Workers and Members of their Families, 1990.[13]

Human rights

- The International Bill of Human Rights, 1948.

Industrial safety

- Convention on the Transboundary Effects of Industrial Accidents, 1992.

2.4 Policies and Standards of International Financial Institutions

The Project is being developed in accordance with the following International Financial Institutions (IFIs) standards:

- Equator Principles (2013)[14];
- The IFC Performance Standards (2012)[15];

[9] By the time of reporting, the Convention is signed but not ratified by Russia.

[10] At the time of writing this report, the Aarhus Convention has not been ratified by the RF.

[11] Russian Federation is not a party to the Convention at the moment.

[12]The RF has been ratified 69 ILO conventions so far including all core conventions.

[13]Russian Federation is not a party to the Convention. IFC Standard 2 refers to the requirements of this Convention.

[14] https://equator-principles.com/

[15] https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/policies-standards/performance-standards

- The World Bank/IFC EHS Guidelines (2007) including the General EHS guidelines and applicable Industry Sector Guidelines[16];
- Japan Bank for International Cooperation (JBIC) Guidelines for Confirmation of Environmental and Social Considerations[17];
- The OECD Common Approaches (2016)[18].

The EBRD is a minatory shareholder of the IOC, therefore the Project shall be designed and implemented in compliance with the EBRD Environmental and Social Policy and Performance Requirements (2014)[19].

2.4.1 Equator Principles

Equator Principles are the ten voluntary environmental and social standards to be adhered to in case of project financing by the Equator Principles Financial Institutions (EPFI). The Equator Principles were first established in 2003 and were subsequently amended in 2006 and 2013.

The Equator Principles are focused on the project environmental and social standards including responsibility for compliance. Particular attention is paid to protection of indigenous peoples, labour standards, and the need for consultations with affected communities.

The Equator Principles include:

- Principle 1: Review and categorization
- Principle 2: Environmental and Social Assessment
- Principle 3: Applicable Environmental and Social Standards
- Principle 4: Environmental and social management system and Action Plan
- Principle 5: Stakeholder engagement
- Principle 6: Grievance mechanism
- Principle 7: Independent Review
- Principle 8: Covenants
- Principle 9: Independent Monitoring and Reporting
- Principle 10: Reporting and Transparency

Principles 1 to 6 are most applicable to the ESIA Stage of the Project.

Principle 1 applies where total Project capital costs are US$10 million or more and includes the steps to be taken by the EPFIs to determine the project category in relation to its potential impacts. The procedure is based on IFC environmental and social categorisation process.

The categories are:

Category A – Projects with potential significant adverse environmental and social risks and/or impacts that are diverse, irreversible or unprecedented

Category B – Projects with potential limited adverse environmental and social risks and/or impacts that are few in number, generally site-specific, largely reversible and readily addressed through mitigation measures; and

Category C – Projects with minimal or no adverse environmental and social risks and/or impacts.

Principle 2 highlights the need to conduct a Social and Environmental Assessment (e.g. a full-scale ESIA process, a limited or focused audit, or a straight-forward assessment on site with immediate application of pollution standards, design criteria, or construction standards depending on the categorisation and significance of impacts) to address relevant social and environmental impacts and risks associated with

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[16] https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/policies-standards/ehs-guidelines

[17] https://www.jbic.go.jp/en/business-areas/environment.html

[18] http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=TAD/ECG%282016%293&doclanguage=en

[19] http://www.ebrd.com/who-we-are/our-values/environmental-and-social-policy/performance-requirements.html%20

the Project implementation. The assessment should also propose mitigation and management measures relevant and appropriate to the nature and scale of the Project.

For all Projects, in all locations, when combined Scope 1[20] and Scope 2[21] Emissions are expected to be more than 100,000 tonnes of CO2 equivalent annually, an alternatives analysis will be conducted to evaluate less Greenhouse Gas (GHG) intensive alternatives. Requirements for analysis of alternative scenarios and quantitative assessment of GHG emissions are set in Annex A to the Equator Principles (Annex 2: Climate Change: Alternatives Analysis, Quantification and Reporting of Greenhouse Gas Emissions).

Principle 3 sets out responsibility of an ESIA Report to establish the Project's overall compliance with (or justified deviation from) the relevant host country laws, respective IFC PS, and EHS Guidelines.

Principle 4 defines the need for Category A (and B) projects to maintain or establish an environmental and social management system (ESMS), which addresses the management of impacts, risks, and corrective actions required to comply with applicable host country social and environmental laws and regulations, and requirements of the applicable IFC PS and EHS Guidelines. Where the applicable standards are not met to the EPFI’s satisfaction, the client and the EPFI will agree an EP Action Plan (AP).

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

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

2.4.2 IFC Performance Standards

The Environmental and Social Sustainability Policy of IFC 2012 requires that projects are screened to identify their category and thus define the applicable scope and type of environmental assessment. The resulting category also specifies IFC’s institutional requirements for disclosure in accordance with IFC’s Access to Information Policy. Projects can be placed into one of four categories, depending on the type, location, sensitivity, and scale of the Project, as well as the nature and magnitude of its potential environmental impacts. The different categories are listed in Table 2.2.

Table 2.2: IFC Project Categorisation

Category	Description
Category A	Business activities with potential significant adverse environmental or social risks and/or impacts that are diverse, irreversible, or unprecedented.
Category B	Business activities with potential limited adverse environmental or social risks and/or impacts that are few in number, generally site-specific, largely reversible, and readily addressed through mitigation measures.
Category C	Business activities with minimal or no adverse environmental or social risks and/or impacts.
Category FI	Business activities involving investments in FIs or through delivery mechanisms involving financial intermediation. This category is not applicable to the Project being considered here.

[20] Scope 1 Emissions are direct GHG emissions from the facilities owned or controlled within the physical Project boundary.

[21] Scope 2 Emissions are indirect GHG emissions associated with the off-site production of energy used by the Project.

The Project can potentially cause significant negative impacts on the communities and environment. In this regard, it is classified as Category A. However, most of the Project impacts can be limited and managed with the use of appropriate environmental and social management procedures and implementation of monitoring to be defined in the Environmental and Social Management Plan and other related plans developed under the ESIA.

The IFC is a member of the World Bank Group and is recognized as an international leader in environmental and social sustainability policy. As a part of the 'positive development outcomes' outlined in the IFC's Policy on Social and Environmental Sustainability, the corporation applies a comprehensive set of social and environmental Performance Standards (PS) in its project review process. In April 2012, the IFC updated its Policy and PSs on Social and Environmental Sustainability.

PS 1: Assessment and management of environmental and social risks and impacts

PS 2: Labour and working conditions

PS 3: Resource Efficiency and Pollution Prevention

PS 4: Community health, safety, and security

PS 5: Land acquisition and involuntary resettlement

PS 6: Biodiversity conservation and sustainable management of living natural resources

PS 7: Indigenous peoples

PS 8: Cultural heritage

PS 1 applies to all projects that have environmental and social risks and impacts. PS 1 defines seven minimum requirements or system elements that must be addressed in the project ESMS, which are summarized as follows:

- establishment of a policy framework for achieving and maintaining compliance with host nation laws and regulations, as well as achieving the environmental and social objectives of the project;
- establishment of processes for the identification of risks and impacts, with ongoing iterations to address the effect of project changes, over the project life cycle;
- establishment of management programs or procedures to address specific risks and impacts, and the means for adjusting those programs to accommodate project changes;
- provisions for maintaining organizational capacity and competency;
- establishment of appropriate emergency preparedness and response mechanisms;
- establishment of processes for ongoing stakeholder engagement/ communication; and
- establishment of processes for monitoring and reviewing environmental and social performance as the basis for continual improvement.

The requirements of **PS 2** are guided in part by a number of international conventions negotiated through the ILO and the UN. The specific objectives of this PS are:

- to establish, maintain and improve the worker- management relationship;
- to promote the fair treatment, non-discrimination and equal opportunity of workers and compliance with national labour and employment laws;
- to protect the workforce by addressing child labour and forced labour;
- to promote safe and healthy working conditions; and
- to protect and promote the health of workers.

The specific objectives of **PS 3** are:

- to avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities;
- to promote more sustainable use of resources, including energy and water; and
- to reduce project-related GHG emissions.

PS 4 addresses the client's responsibility to avoid or minimize the risks and impacts to community health, safety, and security that may arise from project related-activities, with particular attention to vulnerable groups. The specific objectives of this PS are therefore:

- to the extent possible, anticipate and avoid adverse impacts on the health and safety of the affected communities during project life, from both routine and non-routine circumstances; and
- to ensure that the safeguarding of personnel and property is carried out in accordance with relevant human rights principles and in a manner that avoids or minimizes risks to the Affected Communities.

The specific objectives of **PS 5** are:

- to avoid, and when avoidance is not possible, minimize to avoid forced evictions;
- to anticipate and avoid, or where avoidance is not possible, minimize adverse social and economic impacts from land acquisition or restrictions on land use by (i) providing compensation for loss of assets at replacement cost and (ii) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected;
- to improve, or restore the livelihoods and standards of living of displaced persons; and
- to improve living conditions among physically displaced persons through the provision of adequate housing with security of tenure at resettlement sites.

PS 6 is developed with due consideration of the Convention on Biological Diversity and recognizes that protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources are fundamental to sustainable development.

The specific objectives of this PS are therefore:

- to protect and conserve biodiversity;
- to maintain the benefits from ecosystem services, which are defined as the various functions and valued benefits an ecosystem provides for other resources and for human beings; and
- to promote the sustainable management of living natural resources through the adoption of practices that integrate conservation needs and development priorities.

To achieve the goals of this Standard, habitats are identified and divided into modified, natural and critical ones.

The specific objectives of **PS 7** are:

- to ensure that the development process fosters full respect for the human rights, dignity, aspirations, culture, and natural resource-based livelihoods of indigenous peoples;
- to forecast and prevent adverse impacts of projects on indigenous peoples communities or, when this can not be avoided, minimize and/or compensate damage and loss caused by the impact;
- to offer a way to enjoy the benefits and opportunities of sustainable development in a manner that is acceptable within a given culture;
- to establish and maintain an ongoing relationship based on Informed Consultation and Participation with the indigenous peoples affected by a project throughout the project's life-cycle;
- to ensure the Free, Prior, and Informed Consent of the affected communities of indigenous peoples when the circumstances described in this PS are present; and
- to respect and preserve the culture, knowledge, and practices of indigenous peoples.

PS 8 reflects an important role of cultural heritage of present and future generations. Consistent with the Convention Concerning the Protection of the World Cultural and Natural Heritage, this Performance Standard aims to ensure that clients protect cultural heritage in the course of their project activities.

The specific objectives of this PS are therefore:

- to protect cultural heritage from the adverse impacts of project activities and support its preservation; and
- promote the equitable sharing of benefits from the use of cultural heritage.

The eight Performance Standards are supported by IFC EHS Guidelines.

2.4.3 Applicable General EHS Guidelines of IFC

IFC Environmental, Health and Safety (EHS) Guidelines applicable to the Project are:

- General EHS Guidelines (April 2007);
- EHS Guidelines for Large Volume Petroleum-based Organic Chemicals Manufacturing (includes gaseous hydrocarbons as raw materials; April 2007);
- EHS Guidelines for Petroleum-based Polymers Manufacturing (partially applicable; April 2007);
- EHS Guidelines for Thermal Power Plants (December 2008);
- EHS Guidelines for Onshore Oil and Gas Development (applicable to the Project auxiliary facilities, April 2007);
- EHS Guidelines for Natural Gas Processing (applicable to the Project auxiliary facilities). (April 2007);
- EHS guidelines for ports, harbours, and terminals (with regard to onshore facilities; February 2017);
- EHS Guidelines for Water and Sanitation (December 2007);
- EHS Guidelines for Waste Management Facilities (December 2007).

2.4.4 Japan Bank for International Cooperation (JBIC) Guidelines for Confirmation of Environmental and Social Considerations

In 2015, the JBIC reviewed its Guidelines for Confirmation of Environmental and Social Considerations, which were adopted on April 1, 2012.

The Guidelines' objective is to ensure consideration of the environmental and social aspects in all projects subject to lending or other financial operations by JBIC.

In the process of confirmation of environmental and social considerations, JBIC places importance on dialogue with the host country (including local governments), borrowers, and project proponents ("borrowers and related parties") regarding environmental and social considerations, while respecting the sovereignty of the host country. JBIC also takes note of the importance of transparent and accountable processes, as well as the participation in those processes of stakeholders in the project concerned, including local residents and local NGOs affected by the project ("stakeholders").

For confirmation of environmental and social considerations, JBIC undertakes:

- (a) classification of the project into one of four categories: A, B, C, and FI ("screening");
- (b) reviews on environmental and social considerations when making a decision on funding, to confirm that the requirements are duly satisfied; and
- (c) provides monitoring and follow-up after the decision on funding is made.

A proposed project is classified as Category A if it is likely to have a significant adverse impact on the environment. A project with complicated impact or impact, which is difficult to assess due to lack of precedence, is also classified as Category A. The impact of Category A projects may affect an area broader than the sites or facilities subject to physical construction. Category A, in principle, includes projects in sensitive sectors or with sensitive characteristics and projects located in or near sensitive areas. An illustrative list of sensitive sectors, characteristics, and areas is provided in Section 3 of Part 2 of the Guidelines.

The Project is going under category A due to several reasons, such as:

- Oil and natural gas development, pipelines, petrochemicals, roads and railways, thermal power are regarded as sensitive sectors;
- large-scale land reclamation, land development and land-clearing being environmentally significant processes.

For Category A projects, JBIC checks the extent of stakeholder participation and information disclosure being undertaken for the project, in accordance with the environmental impact assessment systems of the host country.

JBIC ascertains whether a project complies with environmental laws and standards of the host nation and local governments concerned, as well as whether it conforms to their environmental policies and plans.

JBIC also ascertains, whether the project meets the applicable EHS standards of the World Bank Safeguard Policies or IFC PSs. JBIC also refers to standards established by other IFI, other internationally recognized standards, and/or standards or good practices established by developed countries such as Japan as benchmarks.

For category A projects, JBIC examines the potential negative and positive environmental impact of projects. JBIC evaluates measures necessary to prevent, minimize, mitigate, or compensate for potential negative impact, and measures to improve the environment if such measures are available. In relation to Category A projects, borrowers, and related parties must submit ESIA reports and environmental permit certificates issued by the host governments or other appropriate authority.

When third parties specifically point out that environmental and social considerations are not being fully addressed, JBIC passes such claims to the borrowers and, if necessary, encourages them to request the project proponents to take appropriate action.

If JBIC concludes that there is a need for improvement with respect to environmental and social considerations, it may ask the project proponent to take appropriate actions through the borrower and in accordance with the loan agreement. If the response of the project proponent is inadequate, JBIC may consider taking its own actions in accordance with the loan agreement, including the suspension of disbursements.

<u>Environmental and social considerations required for funded projects</u>

- Underlying principles:
  - Environmental impact which may be caused by a project must be assessed and examined from the earliest planning stage possible. Alternative proposals or mitigation measures to prevent or minimize adverse impact must be examined, and the findings of such examinations shall be incorporated into the project plan. Such examination must include analysis of environmental costs and benefits in as quantitative terms as possible and be conducted in close harmony with economic, financial, institutional, social, and technical analysis of the project;
  - For projects that have particularly significant adverse impact or are highly contentious, a committee of experts may be formed to seek their opinions as appropriate, in order to increase accountability.
  - Examination of mitigation measures:
  - Multiple alternative proposals must be examined to prevent or minimize adverse impact. In examination of measures, priority is to be given to the prevention of environmental impact, and when this is not possible, minimizing and mitigating impact must be considered next;
  - Compensation measures must be examined only when impact cannot be prevented by any of the aforementioned measures; and
  - Appropriate follow-up plans and systems, such as monitoring plans and environmental management plans, must be prepared; and costs of implementing such plans and systems, and financial methods to fund such costs, must be determined. Plans for projects with particularly large potential adverse impact must be accompanied by detailed environmental management plans.

Scope of impact to be examined

- Environmental impacts to be investigated and examined include impact on human health and safety, as well as the natural environment through air, water, soil, waste, accidents, water usage, ecosystem and biota; social concerns including respect for human rights, such as involuntary resettlement, indigenous people, cultural heritage, landscape, gender, children’s rights,

communicable diseases, working conditions; and impact that may lead to trans-boundary and global environmental problems; and
- In addition to the direct and immediate impact of projects, derivative, secondary, and cumulative impact are also to be examined and investigated to a reasonable extent.

Compliance with laws, standards and plans

- Projects must comply with laws and regulations, and standards relating to environmental and social considerations established by the governments governing the project site; and
- Projects must, in principle, be undertaken outside protected areas that are specifically designated by laws or regulations of the government for the conservation of nature or cultural heritage. Projects shall not impose significant adverse impact on designated conservation areas.

Social acceptability and social impacts

- For projects with a potentially large environmental impact, sufficient consultations with stakeholders, such as local residents, must be conducted via disclosure of information from an early stage where alternative proposals for the project plans may be examined. The outcome of such consultations must be incorporated into the contents of the project plan; and
- Appropriate consideration must be given to vulnerable social groups, such as women, children, the elderly, the poor, and ethnic minorities.

Ecosystem and biota

- Projects must not involve significant conversion or significant degradation of critical natural habitats including critical forests areas;
- In case the project involves the significant conversion or degradation of natural habitats including natural forests, priority is to be given to the prevention of environmental impact. When this is not possible, appropriate mitigation measures must be established. Evaluation of the impact on natural habitats by the project and consideration for the offset measures should be based on expert opinion;
- Illegal logging of forests must be avoided.
- Involuntary resettlement
- Involuntary resettlement and loss of means of livelihood are to be avoided where feasible.

The following conditions are met in principle while developing ESIA Reports for Category A Projects:

- When assessment procedures already exist in host countries, and projects are subject to such procedures, borrowers and related parties must officially complete those procedures and obtain the approval of the government of the host country.

2.4.5 The OECD Common Approaches

Export Credit Agencies (ECAs) from member states of the Organisation for Economic Cooperation and Development apply the "Recommendation of the Council on Common Approaches for Officially Supported Export Credits and Environmental and Social Due Diligence (The "Common Approaches"), which were most recently updated in April 2016.

The Common Approaches provide guidance to ECAs for screening, classifying, environmental and social reviewing, evaluating, making a decision and monitoring projects under consideration by ECAs. Project should, in all cases, comply with host country standards. Members benchmark projects against the relevant aspects of the following international standards:

- All ten World Bank Safeguard Policies; or
- All eight International Financial Corporation (IFC) Performance Standards;
- Relevant aspects of the standards of Regional Development Banks (such as European Bank for Reconstruction and Development (EBRD);
- Relevant internationally recognised standards such as those of the EU.

In addition, Members may also benchmark projects against the relevant aspects of any internationally recognised sector specific or issue specific standards that are not addressed by the World Bank Group.

2.4.6 *New Environmental and Social Framework (ESF) of the World Bank*

In August 4, 2016 the World Bank approved a new Environmental and Social Framework (ESF), that is expected to go into effect in early 2018.

The framework brings the World Bank's environmental and social protections into closer harmony with those of other development institutions, and makes important advances in areas such as transparency, non-discrimination, social inclusion, public participation, and accountability – including expanded roles for grievance redress mechanisms.

The approved Environmental and Social Framework introduces comprehensive labour and working condition protection; an over-arching non-discrimination principle; community health and safety measures that address road safety, emergency response and disaster mitigation; and a responsibility to include stakeholder engagement throughout the project cycle.

ESF includes the concept of the World Bank's sustainable development, protections and ten Environmental and Social Standards (ESS). They include the World Bank's mandatory requirements that apply to Borrowers with regard to the projects they support by Investment Project Financing (IPF).

Environmental and Social Standards:

- Standard 1: Assessment and management of social and environmental risks and impacts
- Standard 2: Labor and Working Conditions
- Standard 3: Resource Efficiency and Pollution Prevention
- Standard 4: Community Health, Safety, and Security
- Standard 5: Land acquisition, restrictions on land use and involuntary resettlement;
- Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources
- Standard 7: Indigenous peoples/sub-Saharan African historically underserved traditional local communities;
- Standard 8: Cultural Heritage
- Standard 9: Financial Intermediaries
- Standard 10: Stakeholder engagement and information disclosure.

2.4.7 *EBRD Environmental and Social Policy and Performance Requirements*

In April 2019 EBRD adopted a new Environmental and Social Policy (ESP)[22] which will be applied to projects initiated after 1 January 2020. At present the ESP version of May 2014 is applied. The key changes in ESP are intended to clarify the performance standards and their applicability; specify the scope for preliminary screening of projects; reinforce the approach and requirements to the supply chain management; introduce more stringent requirements for identification of vulnerable communities, and evaluation and mitigation of disproportionate impact on them; reinforcement of gender focus at all stages of project cycle.

Under the ESP categorises projects as either A / B / C / FI based on environmental and social criteria to: (i) reflect the level of potential environmental and social impacts and issues associated with the proposed Project; and (ii) determine the nature and level of environmental and social investigations, information disclosure and stakeholder engagement required for each project, taking into account the nature, location, sensitivity and scale of the Project, and the nature and magnitude of its possible environmental and social impacts and issues.

According to the EBRD ESP, the project is classified as Category A when it 'could result in potentially significant and diverse adverse environmental or social impacts and issues which, at the time of categorisation, cannot readily be identified or assessed and which require a formalised and participatory assessment process..

[22] https://www.ebrd.com/news/publications/policies/environmental-and-social-policy-esp.html

It is anticipated that it would be categorised as 'A' due to the diversity and complexity of potentially significant impacts and therefore would require third party assessment. The project is also assigned the category "A", if it is included in the Indicative List of Category "A" projects given in Annex 2 of the ESP. Therefore, the Project can be classified as "A" category based on at least two criteria: 5. Integrated chemical installations, and 7. Pipelines, terminals and associated facilities for the large-scale transport of gas, oil and chemicals. The category can be specified with the Project development.

According to the ESP Projects are expected to be designed and operated in compliance with good international practices relating to sustainable development. The EBRD Performance Requirements (PRs) comprise:

- PR 1: Assessment and Management of Environmental and Social Impacts and Issues;
- PR 2: Labour and Working Conditions;
- PR 3: Resource Efficiency and Pollution Prevention and Control;
- PR 4: Health and Safety;
- PR 5: Land Acquisition, Involuntary Resettlement and Economic Displacement;
- PR 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources;
- PR 7: Indigenous Peoples;
- PR 8: Cultural Heritage;
- PR 9: Financial Intermediaries (not applicable to the Project);
- PR 10: Information Disclosure and Stakeholder Engagement.

Other guidance documents of EBRD[23] include:

- Guidance on EBRD's methodology for assessing greenhouse emissions, July 2010;
- Good Practices for the Collection of Biodiversity Baseline Data, July 2015;
- Good Practices for Biodiversity Inclusive Impact Assessment and Management Planning, July 2015;
- Workers' Accommodation: Workers' Accommodation: Processes and Standards (A guidance note by the IFC and the EBRD, 2009);
- Retrenchment and restructuring –labour and community issues, a brief guide, 2010.
- Labour and working conditions - range of guidance documents designed to help clients manage labour issues, including:
- Labour Policy: guidance for clients;
- Grievance Management guidance note;
- Employment documentation: guidance for clients;
- Forced labour: guidance for clients;
- Children, young people and work: guidance for clients;
- Non-discrimination and equal opportunity: guidance for clients.

The EBRD, as a signatory to the European Principles for the Environment, is committed to promoting the adoption of EU environmental principles, practices and substantive standards. As stated in the ESP, substantive environmental standards of the European Union are contained in EU secondary legislation, for example, regulations, directives and decisions.

EU Directives applicable to the project include:

- Directive on the assessment of the effects of certain public and private projects on the environment (2011/92/EU);
- Public Participation in Decision Making Directive (2003/35/EC);
- Directive on environmental liability with regard to the prevention and remedying of environmental damage (2004/35/CE);

[23] http://www.ebrd.com/who-we-are/our-values/environmental-and-social-policy/implementation.html%20

- Ambient Air Quality Directive (2008/50/EC);
- Regulation on substances depleting the ozone layer (2037/2000);
- Directive on industrial emissions (integrated pollution prevention and control) (2010/75/EC);
- Directive relating to the assessment and management of environmental noise (2002/49/EEC);
- Water Framework Directive (2000/60/EC);
- Directive on environmental quality standards in the field of water policy (2008/105/EC);
- Groundwater Directive (2006/118/EC);
- Directive on the quality of fresh waters needing protection or improvement in order to support fish life (78/659/EEC);
- Waste Framework Directive (2008/98/EC);
- Habitats Directive (92/43/EEC);
- Birds Directive (2009/147/EC);
- Drinking Water Directive (98/83/EC).
- The following EU BREFs[24] can be applied to the Project:
- Production of Polymers, August 2007;
- Common Waste Water and Waste Gas Treatment/Management Systems in the Chemical Sector, 2016;
- Large Volume Organic Chemical Industry, February 2003;
- Large Combustion Plants, July 2006;
- Refining of Mineral Oil and Gas, 2015;
- Emissions from Storage, 2006;
- Waste Incineration, August 2006;
- Energy Efficiency, February 2009.

2.4.8 Categorization of ESIA Object Based on International Requirements

The procedure for identification and assessment of environmental and social risks and impacts of the planned activities in accordance with IFI requirements requires that each project seeking funding is screened to identify its category and thus the applicable scope and type of environmental assessment and disclosure is defined. Categories are assigned depending on the type of activity, its location, nature and scale of potential environmental impact, and sensitivity of the project receptors, using the criteria described in sections 2.4.1-2.4.7.

The ESIA concerns the Polymer Production Facility and associated infrastructure. The Project fits the category A description as per the requirements of JBIC, IFC, EBRD, and the Equator Principles, due to the existing spatial and technological solutions and based on the following criteria:

- The Project may cause significant negative environmental and social impact; certain impacts may be complex and are hardly predictable at this stage, however, the Project area of influence extends beyond immediate Project sites;
- A wide range of specially designed measures is needed to prevent / mitigate the environmental and social impacts and minimise the Project risks;
- The planned activity is included in the JBIC list of sensitive sectors[25] (oil and gas chemical industry);
- The planned activity is also listed as a category A project by EBRD[26] (5. Integrated chemical installations, i.e. those installations for the manufacture on an industrial scale of substances using chemical conversion processes, in which several units are juxtaposed and are functionally linked

[24] http://eippcb.jrc.ec.europa.eu/reference/

[25] Japan Bank for International Cooperation Guidelines for Confirmation of Environmental and Social Considerations (2015)

[26] Appendix 2 to the Environmental and Social Policy of the EBRD (2014)

to one another and which are for the production of: basic organic chemicals <…> and 7. Pipelines, terminals and associated facilities for the large-scale transport of gas, oil and chemicals;

- The Project infrastructure and certain facilities will be constructed in environmentally vulnerable areas - the spawning protection forests.

Also, it should be noted that the LPG Terminal, Ust-Kut Gas Processing Plant, Polymer Production Facility and MEG Plant are elements of the Ust-Kut industrial area, and assessment of impacts and risks of individual projects should always take into account the cumulative effects. The Project will increase the existing environmental and social impacts in the concerned area. In accordance with IFC Guidance for Environmental and Social Review Procedures (2016)[27], in case of extension of the planned activity within the framework of the main Project, the original project category will not change, and given the scale of the INK's Gas Programme, the full range of planned development projects also matches category A.

The Project categorization may be subject to further examination, if the Project facilities location and/or technology is changed, and considering the existing infrastructure in the Project area.

- Most impacts of the planned activity will be spatially limited and managed within the framework of the existing environmental and social management and monitoring system of INK. The required measures will be identified in the ESIA and subsequently in the Environmental and Social Management Plans for the Project construction and operation.

2.5 Corporate Policy and Standards

In 2013 INK Group implemented an integrated management system (IMS) according to international standards ISO 14001 and OHSAS 18001. The re-certification audit of the corporate IMS took place in August 2018. Strategic direction of the Company development in area of EHS is defined by Health, Safety, and Environment Policy (approved by INK Order of 07.06.2018 No. 0582/00-p). The IMS standards and procedures are described in Section 14.1.

[27] IFC Guidance for Environmental and Social Review Procedures, IFC, 2016. – The document is available at https://www.ifc.org/

3. ESIA MATERIALS DEVELOPMENT: KEY METHODS AND PROCEDURES

3.1 ESIA Approach

The Project ESIA is intended to provide an accurate and comprehensive assessment of adverse impacts, benefits and potential risks of the planned operations, and develop corrective measures that will be implemented to manage these impacts, so that adverse impacts can be avoided or reduced to an acceptable level and beneficial impacts can be enhanced, as well as the approaches to monitor and control them.

The methodology used for the ESIA has been developed and successfully applied by Ramboll for assessment of impacts of major complex projects seeking loan finance from International Financial Institutions and Export Credit Agencies. The methodology is based on the provisions of the EU Directive 2011/92/EU "On the assessment of the effects of certain public and private projects on the environment"[28] and Performance Standard 1 of the International Finance Corporation (IFC) of the World Bank Group[29]. These two documents describe environmental and social impacts as any change to an environmental or social receptor (including community, workers, etc.), whether potential or actual, resulting from the business activity to be financed.

This chapter provides a structured description of the ESIA methodology including:

- Main Stages of ESIA Process (Section 3.2);
- ESIA scoping (Section 3.3);
- Baseline studies (Section 3.4);
- Impact identification and evaluation of significance (Section 3.5);
- Mitigation measures (Section 3.6);
- Presentation of ESIA results (Section 3.7); and
- Assessment of cumulative impacts (Section 3.8).

The preliminary assessment of impact of the Irkutsk Polymer Plant that was prepared in 2017 based on the initial project development concept, was meant to provide initial identification of impacts, to give stakeholders an early notice of the proposed operations, and to develop appropriate mitigation measures. The current ESIA studies are conducted at the stage of elaboration of the IPP project design documentation and use the information available at the time of the ESIA Report. Technical solutions approved as part of the final project design may be slightly different from those considered herein, however, the project concepts have been finalized by the time of ESIA studies.

The Project ESIA studies are informed by the relevant survey reports, environmental impact assessments, design and other documentation which have been prepared so far for the Project components and associated activities, as well as scientific publications, statutory reports, etc. listed in more detail in Appendix 1 to this report. Potential inaccuracies of the environmental and socio-economic forecasts due to the gaps and uncertainties in the baseline data and applied models, are addressed in Sections 7-10.

Specific recommendations are prepared as part of the ESIA process for implementation of management, mitigation and remediation measures, additional studies, as well as approaches to monitoring and control, in order to make sure that Project activities are fully compliant with the applicable requirements (refer to Section 2).

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[28] Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the Assessment of the Effects of Certain Public and Private Projects on the Environment (amended by Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014)

[29] Performance Standard 1. Assessment and management of environmental and social risks and impacts / Performance Standards on Environmental and Social Sustainability. - IFC, 2012. Can be accessed at https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/policies-standards/performance-standards

3.2 ESIA Process

To ensure a robust and comprehensive impact assessment, the ESIA process is structured around a series of progressive and iterative stages (Figure 3.1). Stakeholders, entities and individuals responsible for development/implementation of the Project design, the ESIA team provide inputs to these stages. Public engagement is maintained at all stages of the ESIA process.

This ESIA shall cover all required stages: from scoping, stakeholder identification and consultations, review of alternatives, identification and assessment of benefits and adverse impacts of the Project, to development of mitigation and remediation measures, and proposals for the control and monitoring to be undertaken.

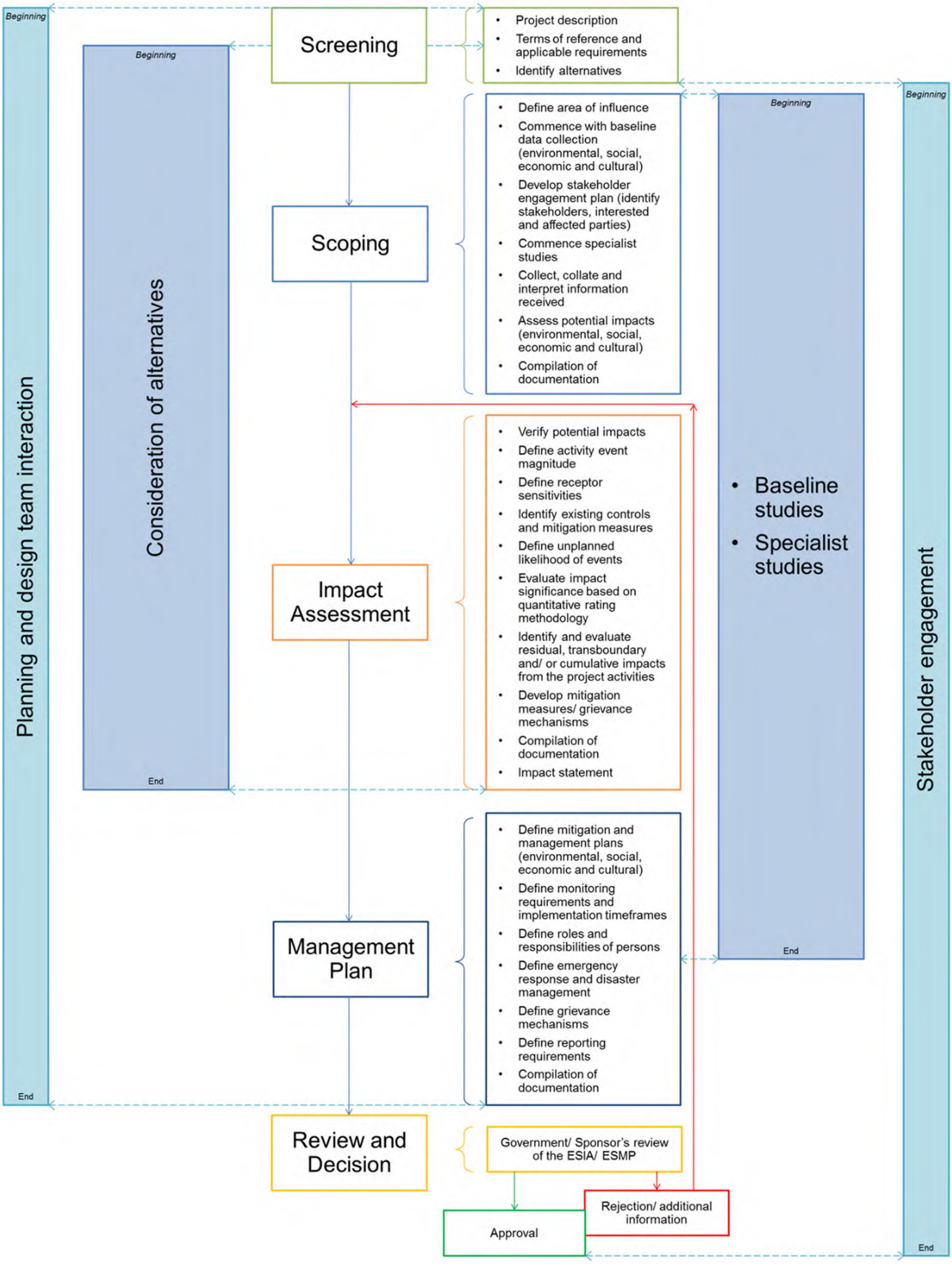

Figure 3.1: ESIA Process

3.3 ESIA Scoping

Scoping of studies to be conducted for assessment of the Project impacts is a vital element of ESIA preparation. Scoping is the process of determining the content and extent of the matters that should be covered in the ESIA and associated documentation as well as identifies methods for assessment of impacts. The scoping process is intended to identify the types of the environmental and social impacts to be examined and documented by the ESIA, considering the most significant potential aspects and risks.

The main objectives at the scoping stage are:

- Preliminary review (screening) of documents provided by the Client regarding proposed operations and potential alternatives;
- Collection and high-level analysis of the available information of the environmental and social conditions at the Project site and wider area, and identification of the most sensitive (vulnerable) receptors;
- Identification of the applicable local and international requirements and standards, international Lenders' requirements;
- Identification of similar projects for benchmarking of the proposed operations;
- Preliminary identification of stakeholders and initial consultations with them; and
- Initial identification of the Project impacts.

This stage also includes project categorisation and identification of its area of influence using the criteria established by the EBRD (ESP 2014) and IFC (PS1). In accordance with the above criteria, the assessment shall cover the areas which are likely to be affected by: a) direct or indirect impacts (in case of indirect impacts special focus is made on those which affect biodiversity and ecosystem services upon which affected communities' livelihoods are dependent); b) impacts from unplanned but predictable developments caused by the project that may occur later or at a different location; c) impacts of associated facilities; d) cumulative impacts of the Project and other existing, planned or reasonably defined projects (at the time of the ESIA process).

In relation to the proposed Project, this stage was completed as part of the preliminary ESIA studies in 2017. The findings of this stage have been updated in this ESIA Report.

3.4 Baseline Studies

Baseline studies are primarily undertaken at two key stages, i.e. scoping and impact assessment. However, as shown in Figure 3.1, they are an ongoing activity throughout the ESIA Process. During scoping work, relatively 'high-level' environmental baseline data are required to assist identification of likely gaps and key impacts to be considered in more detail at later stages. Where gaps are identified at the scoping stage between available baseline data and data required for the ESIA, then additional surveys or studies are undertaken to collect the required data. The work included desk-based studies and the site visit conducted by the Consultant's environmental and social team.

It is important to make sure that receptors are identified and analysed, and their sensitivity is determined at the stage of scoping and baseline studies. Receptors are environmental and social components that may be affected, adversely or beneficially, by the planned activities. Three high-level categories of receptors can be identified:

- Environmental (such as air quality, water bodies, landscapes, terrestrial soils, marine sediments, etc.);
- Biodiversity and biological resources (such as habitats, species and ecosystem services, for example, flood protection provided by nearby wetlands); and
- Social (such as residents of local communities, businesses, land and other resource users, cultural heritage resources).

Details of receptor categorization and the approach to assessment of their sensitivity to identified impacts are provided in Section 3.5.6.

3.5 Impact Identification and Evaluation of Significance

3.5.1 Identification of Impacts

The following approach supports identification of environmental, social and cumulative impacts:

- Review of previous studies, surveys, impact assessments, environmental monitoring data in the proposed location area of the Plant and associated facilities within the scope of the Project;
- Review of the design documentation, including potential alternatives, as well as characteristics of the proposed operations (separately for construction, operation, decommissioning) and associated activities which may cause environmental, social and human health impacts;
- Consideration of the local area development plans and strategic development programmes for the region;
- Review of applicable national and international requirements and standards, and requirements of the International Financial Institutions;
- Stakeholder consultation, including their input to identification, mitigation and control of Project impacts. Stakeholder engagement should be initiated early in the Project, to ensure open access to all relevant information;
- "Source - Path - Receptor" Analysis. Potentially significant social and environmental impacts are also identified by structured analysis of potential sources of impacts, ways they can impact the environment and human health (e.g. direct impact or transport of pollution emissions/discharges in the environment), and sensitivity of potentially affected receptors.

Potential impacts on individual components of the environment are identified for all phases of the planed operations, and their magnitude is assessed.

3.5.2 Project Implementation Phases

A phase of any project is a period of time when certain activities are implemented that collectively shape a stage in the Project life cycle. The following phases are considered by the ESIA Report:

- Construction;
- Commissioning;
- Operation; and
- Decommissioning (including demolition/dismantling and reclamation).

The above Project phases may be combined (integrated) for assessment, or they may be separated for a more detailed review, as appropriate.

3.5.3 General Approach to Impact Assessment

An **impact** is any change to an environmental or social (including community health and safety) receptor, whether direct or indirect, expected to result from the construction, operation and decommissioning of a proposed Project[30]. Impacts on individual receptors may be negative (adverse) or positive (beneficial).

The actions undertaken to determine and evaluate the significance of potential Project impacts are illustrated in Figure 3.2 and involve four key steps:

- **Prediction**: What will happen to the status of specific receptors as a consequence of this Project (direction, extent, duration, reversibility);
- **Evaluation of significance:** How significant is the impact? What is its relative significance when compared to other impacts;
- **Mitigation:** If there are impacts of concern (adverse), can anything be done to avoid, minimise, or offset the impacts? Or to enhance potential beneficial impacts; and
- **Residual impact assessment**: After mitigation, are the impacts still of concern.

[30] This definition reflects the wording provided in the internationally recognized standard ISO 14001:2015: "Any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's environmental aspects. Environmental aspect - element of an organization's activities or products or services that can interact with the environment".

If yes, the process needs to be repeated at least once before the 'final' determination of residual impact significance occurs. A ***residual impact*** is the impact that remains following the application of mitigation measures.

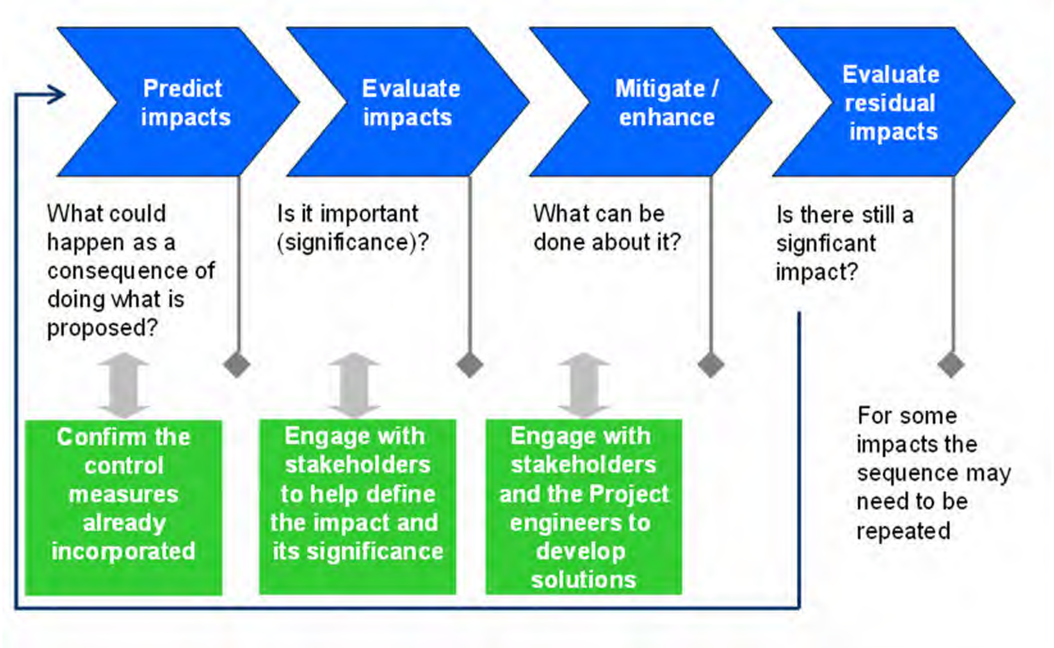

Figure 3.2: Impact Evaluation Process

3.5.4 *Prediction*

Impact prediction involves determining the magnitude or extent of a change or changes in the status of a receptor or linked receptors resulting from the planned operations, through application of forecast models, analysis of experience of similar operations, or environmental science. Impact prediction provides valuable information to determine the broader characteristics of impacts.

3.5.5 *Impact Types*

Impacts can be divided into types and, also exhibit a number of characteristics. Table 3.1 provides definitions of key impact types. The degree to which an impact may be managed or modified by the mitigation measures is dependent upon its characteristics.

All of impact types exhibit certain characteristics in terms of:

- Reversibility;
- Extent;
- Duration; and
- Frequency.

Table 3.1: Classification of Project Impacts

Classification of Impacts	Definition	Characteristics
By overall effect	Beneficial	Impacts expected to result in positive changes at the identified receptors
	Adverse	Impacts expected to result in negative changes at the identified receptors
By origin	Direct	An impact that results from a direct interaction between a planned activity and the receiving environment (receptors)
	Indirect	An impact that follows on from the primary interactions between the Project and its environment (e.g. increased demand for resource as a result of workforce drift to the area of planned activities from other regions, or feedback effects in ecosystems affected by direct impacts)

Classification of Impacts	Definition	Characteristics
By the nature of secondary effects	Cumulative	Project impacts which may be amplified if combined with impacts caused by third party operations (projects) on the same resources and/or receptors

Cumulative impacts are those that result from the incremental impact of the Project when added to other existing, planned or reasonably defined projects (in the studied area), and activities which are not directly related to the Project and associated facilities. The approach to assessment of cumulative impacts is provided in Section 3.7.

3.5.6 Evaluation of Significance: Planned Events[31]

Impacts significance is assessed in this Report using the qualitative, and where possible quantitative methods applicable for major project ESIAs. The quantitative methods provide an outlook of the measurable changes induced by the Project, based on available design documentation or experience of similar facilities. Quantitative assessment of the impacts on receptors can be also provided using the official Russian methodologies for estimation of potential damage associated with specific impacts.

The qualitative methods are based on expert estimations, experience of other projects of similar nature and scale, and follow a structured format to produce consistent and logical projections. It should be noted that environmental impacts are sometimes difficult to evaluate in quantitative terms, due to their intangible nature (e.g. emotional impacts or sensitivity), or due to interrelation of the change and specific local situation (e.g. scale of migrant inflow compared to the baseline population).

The impacts are assessed in a structured and coordinated manner throughout the ESIA process. The approach adopted enables attribution of potential impacts to specific environmental and social aspects. For adverse impacts, significance is assigned based on determining impact magnitude and receptor sensitivity, after which mitigation is identified depending on impact characteristics.

Beneficial impacts are identified, assessed and evaluated, making use of impact magnitude (as per the guidance below), but not receptor sensitivity. Instead, beneficial impacts are described and evaluated based on available data, alignment with government policies/targets, stakeholder inputs and professional expert judgement. Measures to enhance them will be identified to try to maximise the expected benefits.

The magnitude of an impact is a measure of the scale of a change from baseline conditions for a receptor. This measure of change can be described by considering the following factors in combination:

- **Reversibility:** Restoration of the pre-impact status of a receptor.
- **Extent:** Spatial extent (e.g. pollution dispersion or habitat impacted) or population / community extent; and
- **Duration:** Period of time over which an impact will interact with a receptor. This factor may also cover the frequency and regularity criteria.

The magnitude of each impact is assessed using the above parameters and the characteristics provided in Table 3.2.

Table 3.2: Description of impact criteria

Criterion	Description	Definition
Reversibility	Irreversible	Impacts that cause a permanent change in the affected receptor
	Reversible	Restoration of the pre-impact status of a receptor due to mitigation/reinstatement measures and/or natural recovery. Duration of the impact and duration of subsequent recovery period should be considered

[31] - *Planned events* (ESIA Methodology – Ramboll, 2017)

Criterion	Description	Definition
Extent (spatial)	Site	Within the boundaries of land and water area allocated for the Project and associated use-restricted zones (sanitary protection, security, etc.)
	Local	Within the boundaries of local municipality
	Regional	Within the boundaries of a region, territory, republic
	National	Impacts that affect more than one regions or constituent entities of the Russian Federation, water flows/bodies of the national significance
	Transboundary	Impacts that affect receptors, beyond the boundaries of the country in which the project is located and producing transboundary/global effects (e.g. impacts of greenhouse gas emissions).
Duration	Short-term irregular or occasional	Impact caused by short-term single or recurrent events
	Mid-term regular or associated with a phase of activities	Impacts with duration equal or nearly equal to that of certain activity or a phase of the planned operations
	Long-term	Impacts with duration equal or comparable to the Project lifetime. Impacts of this category may cease after completion of Project activities

Assessment of duration of an impact also considers its frequency (e.g single, rare, periodic, constant) for a more detailed characterization of duration of time when impact is felt. All characteristics listed above are factored into the assessment of impact magnitude.

Table 3.3 provides generic criteria to be used to determine the impact magnitude. Taking the results derived from the previous step a decision can be made on impact magnitude (negligible, low, moderate, high). Discipline specific criteria have been devised and these are presented Chapters 9 and 10, respectively.

Table 3.3: Impact Magnitude

Impact	Criteria
Negligible	No persistent discernible impact. The change is essentially indistinguishable from natural background variation.
Minor	Limited impacts that can be identified by the available means of monitoring, with no effect on functions of ecosystems and communities **Extent**: site-specific / local **Duration:** short / medium term **Reversibility**: reversible
Moderate	Noticeable impacts which may result in quantitative changes in ecosystems, however without their quality transformation, and without loss (partial or complete) of their natural functions. **Extent**: local / regional **Duration:** medium / long term **Reversibility**: reversible / irreversible
Major	Prominent impacts that may result in temporary or permanent transformation of ecosystems, with loss of their functions, and transformation of communities' life style and quality. **Extent:** regional / national / transboundary **Duration:** medium / long term **Reversibility**: reversible / irreversible

Once the respective magnitudes of each impact have been allocated the next step is to determine receptor sensitivity. Receptor sensitivity is based on two components: the degree to which a receptor is resilient to a change and the value attributed to the receptor by stakeholders or applicable regulations/policies.

Receptor resilience takes into consideration not only activity - receptor- impact pathways, but also the characteristics of a receptor that might make it more or less resilient to change. As such, a receptor can be considered as existing within a spectrum of 'vulnerable' to 'resilient'.

Receptor value considers importance represented by conservation status, socio-cultural importance and/or economic value. Certain receptors are deemed to be of greater importance than other receptors.

The final step is to combine the impact magnitude and receptor sensitivity results to determine impact significance in relation to its receptors. For known (planned) impacts, significance is determined by their intensity, based on the impact magnitude and sensitivity of the receptor. For example, an impact of low magnitude affecting a receptor of moderate sensitivity is an impact of low/moderate significance (the actual significance determination - low or moderate - in this case can be made by the ESIA team) or an impact of high magnitude affecting a receptor of moderate sensitivity results in an impact of high significance.

Table 3.4 provides an account of the key features (definitions) of each of the impact significance classifications (from Not Significant to High).

Table 3.4: Impact Significance Matrix

		Receptor Sensitivity			
		Negligible	**Low**	**Moderate**	**High**
Impact Magnitude	**Negligible**	Not Significant	Not Significant	Not Significant	Not Significant / Low[32]
	Minor	Not Significant	Low	Low / Moderate	Moderate
	Moderate	Not Significant	Low / Moderate	Moderate	High
	Major	Low	Moderate	High	High

Definitions of the above significance ranks adopted in international ESIA practice are provided in Table 3.5.

Table 3.5: Project impacts ranking by significance

Impact significance	Description
Negligible	Impacts are expected to be indistinguishable from the baseline or within the natural level of variation. These impacts do not require mitigation and are not a concern of the decision-making process.
Low	Impacts with a "Low" significance are expected to be noticeable changes to baseline conditions, beyond natural variation, however well below the applicable standards (e.g. environmental quality standards, and are not expected to cause hardship, degradation, or impair the function and value of receptor. These impacts warrant the attention of decision-makers, and should be avoided or mitigated where practicable.
Moderate	Impacts with a "Moderate" significance are likely to be noticeable and result in lasting changes to baseline conditions, which may cause hardship to or degradation of a receptor, although the overall function and value of a receptor is not disrupted. These impacts must be mitigated to avoid or reduce the impact.
High	Impacts with a "High" significance are likely to disrupt the function and value of a receptor, and may have broader systemic consequences (e.g. ecosystem or social well-being). They may also result in a failure to maintain adverse effects within the permissible regulatory levels. These impacts are a priority for mandatory mitigation to avoid or reduce the significance of the impact.

This method is applied at least twice: to both pre- and post-mitigation scenarios for all impacts identified. In general, residual impacts classed as "Not Significant" or "Low Significance" are not considered to be of

[32] Allows technical discipline author to decide which significance level is applicable in the given situation

concern for the assessment[33]. For adverse impacts of "Moderate" and "High" significance, an iterative process is undertaken to further investigate opportunities for mitigation, according to the hierarchy above. Where the significance cannot be further reduced, an explanation is provided of why further reduction is not practicable. Monitoring may be required to confirm the measures used to mitigate adverse impacts are working properly and that the impact is not worse than predicted. Monitoring requirements are presented in Chapters 8 and 9.

3.5.7 Risks and Unplanned Events[34]

Where there is uncertainty about occurrence of an event (e.g. intrinsically occasional event during normal operation and/or where impacts are caused by unplanned/emergency situations), the magnitude of ***risk*** associated with such event is determined as a function of its ***occurrence probability*** and ***intensity*** of potential impact. Probability criteria applicable to this ESIA are described below (Table 3.6). They are set for the whole ESIA process and are equally applicable to all types of impact.

Table 3.6: Risk occurrence criteria

Likelihood	Qualitative assessment of impact / event probability
High	Impacts/events which are observed in the sector (studied operations or region) all the time and reoccur more than once a week
Moderate	Impacts/events regularly observed in the sector and region, including seasonal cycling, which can be considered as very likely for the design lifetime of the planned operations
Low	Impacts/events which are rarely observed in the sector and region, or regularly observed in other sectors. These would generally occur 1 to 2 times per year
Not Significant	Impacts/events that have never been observed in a wider range of sectors or in the region. Impact/event which can be considered as unlikely for the design lifetime of the planned activities

The criteria of general risk / impact (change) occurrence risk are shown in Table 3.7.

Table 3.7: General risk / event occurrence risk criteria

Impact probability	Impact intensity			
	Not Significant	Low	Moderate	High
High	Insignificant	Medium / Minor	Medium / High	Critical
Moderate	Insignificant	Minor	Medium	High
Low	Insignificant	Minor	Medium / Minor	Medium / High
Not Significant	Insignificant	Insignificant	Minor	Medium

Unplanned events will often result in a *high* impact significance, even with mitigation/remedial measures in place e.g. major oil spills. In such cases, not only the specific measures must be in place to manage an unplanned event, but the probability have to be minimised to levels seen to represent good industry practice. In this table, unplanned events with *high* residual impact significance would need to be minimized to extremely unlikely ("Improbable") events. Sometimes, if such events can be assessed quantitatively, a special analysis of risks is required to define numeric value of the event probability. In this case the probability value should be less than $1x10^{-6}$.

3.6 Impact Mitigation

Mitigation measures are developed as necessary or appropriate to minimise the risk intensity and/or impact probability, and therefore make the impact or risk less significant. Significance of potential

[33] A more stringent approach may apply for the assessment of ecological receptors of high sensitivity, such as critical habitat, or species classified as having vulnerable or above conservation status. In this case, residual impact significance of Low and above is very likely to be a concern to the further development of the Project.

[34] Unplanned events (ESIA Methodology – Ramboll, 2017)

impact/risk has been assessed during the ESIA process based on potential and residual impacts, using the criteria mentioned in Section 3.5.6.

As part of the ESIA process, when adverse impacts are identified, measures for mitigation, minimization and control of risks, and monitoring of residual impacts are developed (as necessary or appropriate). A ***residual impact*** is the impact that remains following the application of mitigation measures.

The process of identifying design controls and mitigation measures must follow the sequence of the mitigation hierarchy (Figure 3.3), as specified in IFC's Performance Standard No. 1, which is widely regarded as the best practice approach to managing impacts.

First, efforts are made to avoid or prevent, then minimise or reduce adverse impacts. If the impact cannot be fully avoided by application of design controls, they are supplemented by further engineering measures for minimization and mitigation of the adverse impacts. These measures are supported by additional mitigation measures to be applied through the effective management of project-related activities during construction, operation and decommissioning. Any remaining residual impacts are then addressed via mitigation measures such as restoration and remediation (e.g. at the end of construction) and/or offsetting and compensation. The measures are developed and implemented in the same order as they are listed above.

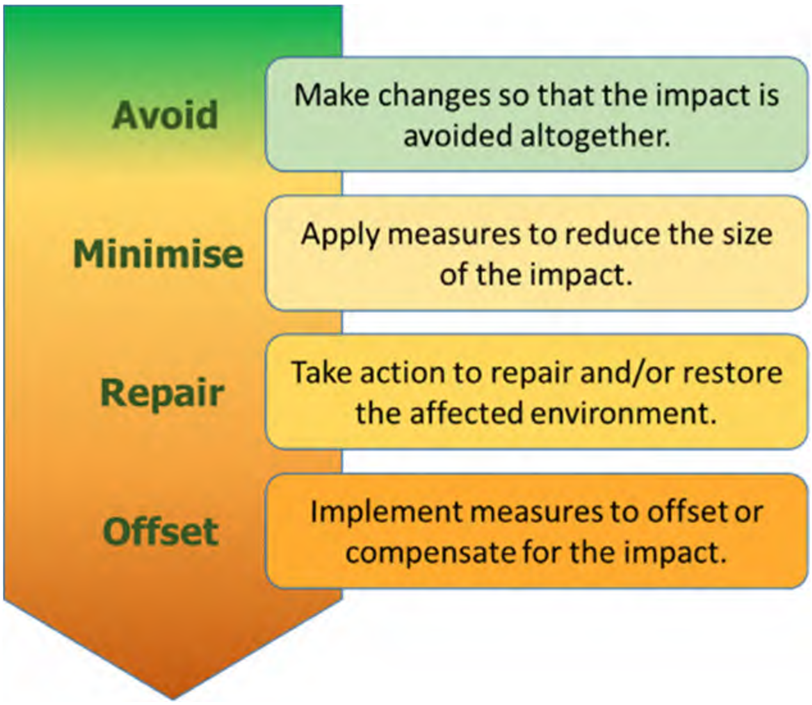

Figure 3.3: Mitigation Hierarchy

Development of mitigation measures will be primarily focused on minimization of the impacts of "High" significance. However, where possible and appropriate, mitigations are also proposed for the impacts of "Moderate" and "Low" significance, in order to reduce environmental and social effects / risks to the lowest level.

3.7 Cumulative Impacts

3.7.1 Definition and Applicable Guidelines

Cumulative impact assessment (CIA) is one of the requirements set for a comprehensive ESIA. Performance Standard 1 defines the Area of Influence (AoI) to encompass "cumulative impacts that result from the incremental impact, on areas or resources used or directly impacted by the project, from other existing, planned, or reasonably defined developments at the time the risks and impact identification process is conducted." Performance Standard 1 offers some context to limit the cumulative impacts to be addressed to "those impacts generally recognized as important on the basis of scientific concerns and/or concerns from Affected Communities".

The CIA methodology is mainly based on the six steps approach outlined in the *Good Practice Handbook on Cumulative Impact Assessment and Management Guidance for the Private Sector in Emerging Markets (2013).* This document is a supplement to the IFC Performance Standards and Guidance Notes and provides recommendations relating to practical assessment of cumulative impacts recognizing some of the uncertainties and constraints faced by private sector proponents. It also introduces the concept of valued environmental and social components (VEC) in the assessment of cumulative impacts.

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 EIA process as a primary source of practical guidance. Although a relatively old document, it advocates an approach that is consistent with more recent IFC guidance described above.

3.7.2 CIA Objective

The CIA analysis has two objectives:

- To determine if the combined impacts of: the project, other projects and activities, and natural environmental drivers will result in VEC condition that may put the sustainability of a VEC at risk (i.e., exceed a threshold for VEC condition which is an unacceptable outcome); and
- To determine what management measures could be implemented to prevent unacceptable VEC condition, this may include additional mitigation of the project being assessed, additional mitigation of other existing or predictable future projects, or other regional management strategies that could maintain VEC condition within acceptable limits.

3.7.3 CIA Methodology

A six-step process described in the IFC's Good Practice Handbook that should be used in conducting a CIA for the project includes the following steps:

- Scoping phase I – VECs, spatial and temporal boundaries
- Scoping phase II – Other activities and environmental drivers
- Establish information on baseline status of VECs
- Assess cumulative impacts on VECs
- Assess significance of predicted cumulative impacts
- Management of cumulative impacts – design and implementation

Step 1. Scoping phase I – VECs, Spatial and Temporal Boundaries

The first stage of the CIA is aimed at identifying potential VECs and defining the spatial and temporal boundaries.

VECs

VECs are those receptors that are considered to be important when assessing the risks posed from cumulative impacts. VECs have been identified throughout the ESIA process, including consultations undertaken with stakeholders and reviews and assessments undertaken as part of the ESIA.

Consistent with the above-mentioned guidance, the assessment is limited to impacts generally recognized as important on the basis of scientific / expert concerns and concerns from Affected Communities and excludes any potential impacts that would occur without the Project or independently of the Project. In addition, only those environmental and social receptors on which the Project itself is assessed to have potentially significant effects are included in the CIA. In practical terms, this means that:

- If the impact of the Project on a receptor has been assessed *negligible* then it is not considered as a VEC in the CIA (i.e. scoped out in all cases);
- Receptors on which the assessed Project impact is low are considered on a case-by-case basis for inclusion as a VEC in the CIA.

Spatial Boundaries

The CIA considers a larger spatial area outside of the Project AoI. The precise spatial boundaries are defined on the basis of the geographic range of specific VECs as well as the spatial distribution of other third-party activities or influences that might impact the VECs.

Temporal Boundaries

Consistent with established EU guidance[35], consideration is normally given to existing projects or those expected to be initiated within a period of 5 years from the data of the CIA completion, with an exception of development projects that may be initiated after 5 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.

The overall Phase I scoping is undertaken through consideration of the VECs, spatial and temporal boundaries and also the Phase II scoping, in a systematic manner, taking the assessed Project impacts to each social and environmental receptors identified in the course of ESIA (Chapters 8 and 9), and taking into account the following aspects:

1. All the different types of Project impacts on those receptors and the assessed significance of the residual Project impact;
2. Spatial extent of a receptor in this particular region;
3. Consideration of how the spatial extent of the receptor may overlap with the influence of other industrial activities identified through the Phase II Scoping process;
4. Consideration of the relative temporal boundaries of the different stressors (e.g. whether or not such stressors are concurrent, consecutive etc.) and the duration of such impacts;
5. Other non-industrial influences that may affect a receptor (within the determined spatial and temporal boundaries).

The above aspects are determined, and the potentially affected receptors identified in the CIA process are taken into consideration for the above factors, which are then considered as VECs.

Step 2. Scoping phase II – Other Activities and Environmental Drivers

This part of the scoping exercise identifies historical, existing and planned activities and the presence of natural influences and stressors that have the potential to affect the VECs identified in Step 1 that will require further assessment within the CIA.

Natural influences and stressors that are unrelated to the Project activities are also considered, for example, the potential impact of climate change in terms of the climatic extremes and impacts on permafrost, migratory and predatory animals. Given the inherent uncertainty and variability associated with climate change projections, these factors are only considered in terms of a high-level and qualitative assessment.

Step 3. Baseline Conditions

Baseline data for the Project AoI is based on detailed studies and survey works undertaken by the Project and as described in baseline chapters of ESIA (Chapters 5 and 6). These Project-specific studies are supplemented by readily available information at the regional scale beyond the Project AoI.

Step 4. Assessment of Cumulative Impacts

The Project CIA has adopted a VEC centric approach, i.e. VECs and their resilience have been identified / determined then the impacts from various activities on these VECs were assessed.

In the "'Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions" (1999), it is indicated that normally most of project proposals are associated with too many uncertainties outside of a period of 5 years. *It is recommended, therefore, to assume a time limit of maximum 5 years.*

The assessment presented in this Chapter considers only the residual impacts associated with the Project, i.e. the impacts that will persist after implementation of the planned mitigation measures. The VECs, potentially affected according to the assessment to an insignificant degree, should not necessarily be included in the cumulative impact assessment (Table 3.8).

Table 3.8: Criteria for including valued environmental and social components

Residual impact			
Insignificant	Low	Moderate	High
Not included in CIA	Considered for assessing the potential cumulative impact	Included in CIA	Included in CIA

Predicted future conditions for VECs are analyzed taking into consideration all impact factors, including the contribution of this Project to the overall cumulative impacts.

Due to the inherent uncertainties in the nature of cumulative impacts, the CIA has by necessity been performed in a qualitative manner, but nevertheless provides useful context for determining the significance of the Project's contribution to the overall impacts.

Step 5. Significance of Cumulative impacts

The methodology described in Section 3.4 was developed primarily for assessing Project-specific impacts, although can be broadly applied to cumulative impacts.

Step 6. Management of Cumulative Impacts

Many of the mitigation measures defined during the assessment of Project impacts will also be applicable to the mitigation of cumulative impacts. However, it is also recognized that the cumulative impact assessment may generate additional mitigation measures and strategic or long-term actions, for example, the need to share findings of assessments and cooperate with third parties such as future developers and regional authorities or local government bodies.

Consistent with the approach taken elsewhere in the ESIA and described in Section 3.5, the mitigation hierarchy, which broadly requires that consideration be given to avoidance, minimization, mitigation and offsetting in that order of preference, has been applied.

3.8 Presentation of ESIA Results

The table below contains a form of a summary table which is designed to provide a visual presentation of the environmental and social impact assessment (refer to Chapters 8 and 9), including types of activities, impacts and their receptors, description of mitigations and assessment of the residual impact. A key to the alphabetical symbols of stages of the Plant Project, receptors sensitivity, impact significance and risk category is provided under the summary table form. The table can be adjusted or extended to accommodate for specific features of some types of impacts and provide an appropriate presentation of the results of assessment.

Table 3.9: Evaluation of impact significance: a form of a summary table

Impact	Sign	Receptor	Receptor Sensitivity	Stage	Impact significance	Risk	Mitigation measures	Residual impact

Parameter / Параметр	Abbreviation / Сокращение	Расшифровка / Description	Parameter / Параметр	Abbreviation / Сокращение	Расшифровка / Description
Stage / Этап	C	Construction / Строительство	Risk / Риск	Cr	Critical / Критический
	O	Operation / Эксплуатация		H	High / Высокий
	Cm	Commissioning / Ввод в эксплуатацию		M	Medium / Средний
	DCm	Decommissioning / Вывод из эксплуатации и последующий период		Mr	Minor / Малый
Recipient Sensitivity / Чувствительность реципиента	H	High / Высокая		I	Insignificant / Незначительный
	M	Moderate / Средняя	Impact significance / Значимость воздействия	H	High / Высокая
	L	Low / Низкая		M	Moderate / Умеренная
	N	Negligible / Незначительная		L	Low / Низкая
Sign / Направленность	P	Positive / Положительное (благоприятное)		N	Not significant / Пренебрежимо малая
	N	Negative / Отрицательное (неблагоприятное)			

4. STAKEHOLDER ENGAGEMENT

4.1 Background

This Chapter provides information on the Project stakeholder engagement activities and practices.

The majority of potential Project stakeholders (e.g. local communities and authorities) most probably reside (on a permanent or temporary basis) in the following areas, city areas and administrative units:

- Ust-Kut city (in general);
- Mostootryad neighbourhood (Ust-Kut city);
- Yakurim neighbourhood (Ust-Kut city);
- YGU neighbourhood (Ust-Kut city);
- Novaya REB and Staraya REB neighbourhoods (Ust-Kut city);
- 2nd Lesnaya Street area within the Mostootryad area;
- Kedr-2 Gardening Association;
- former Polovinka settlement (integrated into Ust-Kut city).

Also, the residents of Podymakhino village (Ust-Kut district) may be interested in receiving information regarding the Project.

Engagement of stakeholders is necessary in order to identify and address potential negative impacts of the Project and make sure that the Project will generate positive effects and benefits for the parties engaged at the local and regional level. Stakeholder engagement process initiated at an early stage of Project development, alongside with adoption of appropriate communication mechanisms:

- facilitates timely access of general public to all relevant information and
- enables stakeholders to contribute to Project development, identification and assessment of its impacts, as well as development of mitigation and/or enhancement measures (for positive effects).

This Chapter covers the following key issues:

- identification of key stakeholders;
- overview of the Company's approach to stakeholder engagement activities;
- summary of stakeholder engagement activities taken by the Company to date;
- brief description of recommended future stakeholder engagement activities;
- current stakeholder engagement roles and responsibilities;
- structure of the grievance mechanism adopted by the Company;
- review of the Project monitoring and reporting on stakeholder engagement.

A Stakeholder Engagement Plan (SEP) has been developed by Ramboll within the ESIA package to reflect the relevant Project activities. The SEP addresses in more details the topics that are discussed in this Chapter as a high-level overview.

4.2 Key Stakeholders

Identification of key stakeholders is an integral part of the ESIA process which is required to determine the groups that are or will be affected as a result of the Project implementation. General list of stakeholders is provided below, and a more detailed description of the stakeholder groups is included in the SEP.

For effective and meaningful interaction, the following stakeholder categories have been identified:

4.2.1 Affected parties

This category includes individuals, groups and entities in the Project area of influence which are subject to impacts (actual or potential) and may be the most sensitive to the changes induced by the Project.

This group includes the following parties:

- land users within the Kedr-2 Gardening Association;
- residents of Mostootryad and Yakurim neighbourhoods;
- residents of YGU neighbourhood / residents of the Novaya REB and Staraya REB neighbourhoods (depending on the final location of the Company's residential quarters);
- other potentially affected residents of Ust-Kut city (exposed to transport, employment and other impacts);
- local hunters in the areas adjoining or crossing the Project construction site, as well as local fishermen and pickers of wild plants (berries, mushrooms, etc.);
- Project workforce including (sub)contractors' personnel.

4.2.2 Other stakeholders

This category includes individuals/groups/entities which, even not being directly affected by the Project impacts, still believe that their interests may be in some manner affected by the Project, and are capable of influencing the Project implementation process.

This category of stakeholders includes the following organisations:

- other residents of Ust-Kut district;
- various federal ministries, national and regional authorities;
- district and local administrations;
- private companies (e.g. Ind Timber LLC operating the facilities near the planned Project sites);
- civil society organizations (e.g. the Veteran Council);
- mass media;
- education institutions at the district and regional level.

4.2.3 Vulnerable groups

This category includes persons who may be affected by disproportionate impacts of the Project, or who may be put in more adverse situation than other community groups, due to their vulnerable status[36]. It can take additional efforts to ensure their equal representation and engagement in the Project interaction and decision making process. The following vulnerable groups have been identified by the ESIA:

- disabled and senior persons, children;
- persons living with HIV/AIDS;
- low-income groups.

The following groups have been excluded from the preliminary list of vulnerable groups prepared at the PreESIA stage:

- residents of Mostootryad and Yakurim neighbourhoods (Ust-Kut city);
- former court prisoners residing in gardening associations near the proposed Project site.

The grounds for removing the above groups from the list of vulnerable groups are described in Chapter 7.

4.3 Current Stakeholder Engagement Activities

4.3.1 INK engagement and disclosure approach

<u>INK Policy and Standards</u>

In 2013 INK adopted a procedure for "Internal and external communication within the Integrated Management System". The document defines the procedure for disclosing environmental, social, health and safety information, as well as other information within the scope of IMS to external and internal stakeholders. The procedure is applicable to activities of INK and its affiliates.

[36] The vulnerable status may result from: race, skin colour, gender identity, language, religion, political or other attitudes, nationality or social status, property status, origin or other status. Other aspects including age, ethnic and cultural identity, literacy, physical or mental capability, poverty or other adverse economic situation, and dependence on specific natural environment and natural resource.

The procedure provides classification of the main stakeholders, defines the process of internal and external information exchange, and for information provision to contractors.

The Company's interaction with external stakeholders on environmental and social matters is structured and regulated by the following internal regulations of INK:

- Stakeholder Engagement Plan (at the corporate level) with description of the main principles of engagement and the necessary related activities;
- Instruction "On the procedure for informing media, Russian and international community about operations of INK LLC";
- PR 4.4.3-01-2016 "Internal and external communication within the Integrated Management System";
- Instruction "On the public grievance procedure of INK LLC";
- Stakeholder Grievance Log;
- Corporate newsletter "Vestnik INK";
- Company's corporate website www.irkutskoil.ru.

The Company's interaction with external stakeholders is based on the following documents:

- Employment contract;
- PR 4.4.3-01-2016 "Internal and external communication within the Integrated Management System";
- ST.05.10 "Management and interaction with contractors on health and safety issues";
- Security services contract with Obereg Security Company, LLC.

In general, INK activities for interaction with external stakeholders are focused on the following directions:

- liaison with public authorities and non-governmental organizations in the areas of the Company's operations;
- interaction with communities of indigenous small-numbered peoples of the North at the development sites;
- disclosure of information on socio-economic cooperation and environmental activities;
- public hearings, processing of written and verbal public grievances and queries;
- participation in socio-economic development of Ust-Kut District and Irkutsk Region through the corporate social responsibility programmes.

4.3.2 Information disclosure formats

Within the Project INK uses the following information disclosure formats:

- disclosure of information and documents through the corporate website www.irkutskoil.ru, community liaison offices and the Company's offices;
- provision of relevant Project information at the public hearings;
- information summaries are disclosed in the form of brochures/leaflets and disclosed via the community liaison offices and the Company's offices;
- direct communication with stakeholders in the form of feedback to grievances and queries;
- the Project information is disclosed during face-to-face meetings and interviews with representatives of local stakeholders (particularly as part of the ESIA process);
- face-to-face meetings with representatives of local land users (primarily with the chairman of the Ust'-Kut Society of Hunters and Fishermen);
- publication of relevant information in mass media.

The Company gives a prior notice of the planned public hearings, ESIA consultations and other activities to all stakeholders via mass media, personal communications, publications at the corporate website and display of announcements on information boards in public places.

4.3.3 *Stakeholder engagement roles and responsibilities*

The Public Relations Unit bears the main responsibility for stakeholder engagement process. The Unit is part of the Department for Regional Policy and Authorities Liaison supervised by the Deputy General Director for Legal and Environmental Issues and Regional Policy. In particular, the Unit performs the following functions:

- handling of grievances and queries;
- arrangement and coordination of external stakeholder engagement activities on the Project-related matters;
- preparation and holding of public hearings;
- communications with external stakeholders.

4.3.4 *Project stakeholder activities taken to date*

The Company performs regular stakeholder engagement activities within the scope of its Gas Business Development Programme (the Gas Programme). In 2016 alone the Company held 5 public discussions on assessment of environmental impacts of the proposed development projects and 3 unscheduled discussions in response to public grievances.

Description of other stakeholder engagement activities implemented by INK as part of the Gas Programme is provided below.

<u>Public hearing on project materials for construction of LPG Facilities (July 2013)</u>

The hearing was held in Ust-Kut in July 2013. The event had been announced in advance, and was attended by representatives of the Company, Ust-Kut District, local community, non-governmental organizations and supervising authorities. The topics discussed included potential collisions with third parties' infrastructure, employment of local residents, waste disposal, logistics and provision of treatment plant.

<u>Public hearing on the EIA (OVOS) of construction of pipeline system for transportation of processed natural and associated petroleum gas from Yaraktinsky and Markovsky fields (May 2014)</u>

The hearing was held at the premises of Ust-Kut District Administration (Ust-Kut city) and Verkhnemarkovo Village Administration on 20 and 21 May 2014. The topics discussed included pipeline construction technologies, materials used, socio-economic cooperation, impacts on the environment and fish resource, access to hunting areas, employment of indigenous population.

<u>Public hearing on EIA (OVOS) of construction of industrial and domestic solid waste landfill at Yaraktinsky OGCF (June 2015)</u>

The hearing was held on 16 June 2015 at the premises of Ust-Kut District Administration (Ust-Kut city). The project designers presented to the participants the proposed materials and technologies for construction of the landfill. Environmental impacts and potential aid that the Company can provide to social institutions were discussed.

<u>Public hearing on EIA (OVOS) of exploration well No.602 at Markovsky field (October 2016)</u>

It is notable that within the scope of the Gas Programme INK also engages community representatives from neighbour municipalities of Ust-Kut District. Thus, on 18 October 2016 the hearing was held at the premises of Kirensky District Administration. The event was attended by 55 persons, and the discussions covered the impacts of the well drilling project on fish resource of the nearby rivers, employment, and support for the municipal social institutions.

<u>Public hearing on the plan of further development of the Gas Programme of Irkutsk Oil Company LLC at Yaraktinsky and Markovsky Oil and Gas Condensate Fields (OGCF) (March 2017)</u>

The hearing was held at the premises of Ust-Kut District Administration (Ust-Kut city) on 9 March 2017. Representatives of the Company and the design company informed the participants about the equipment and technologies to be used in the proposed facilities, and parameters of the anticipated environmental impacts. Representatives of the local community expressed their concerns, including regarding potential impact of the project on air, aid for social institutions in Verkhnemarkovo village, employment opportunities at the new facilities for local residents.

Meetings held by Ramboll CIS during the PreESIA process (May 2017)

In May 2017 Ramboll CIS held a series of meetings with Project stakeholders including the following persons and representatives of various entities:

- Head of Ust-Kut City Administration of Irkutsk Region;
- First Deputy Mayor of Ust-Kut Municipality of Irkutsk Region;
- Manager of the Economic Analysis and Forecasting Unit (Ust-Kut District);
- Deputy Chairman of the Committee for Economy, Socio-Employment Relations and Prices (Ust-Kut District);
- Manager of the Environmental Protection Unit (Ust-Kut District);
- Head of the Architecture Department;
- Department for Youth Policy;
- Head of the Natural Resource Department;
- Consultant on Civil Defense and Emergency Response (Ust-Kut District);
- Director of the Municipal Public Institution "Unified Operations Control Service";
- Chairman of the Property Committee (Ust-Kut District);
- Deputy Medical Director of the Regional State Funded Healthcare Facility "Ust-Kut District Hospital";
- General Director of TRK Ust-Kut Dialog;
- Chairman of the Board of Ust-Kut city branch of Irkutsk Region Association of Hunters and Fishermen;
- Senior Public Inspector of the Irkutsk Region Wildlife Management Service;
- Head of the Ust-Kut Department of the Russian Ministry of Interior, lieutenant-colonel of police;
- Deputy Medical Director of the branch of Federal State Funded Healthcare Facility "Centre of hygiene and epidemiology in Irkutsk Region" for Ust-Kut city, and Ust-Kut, Kazachinsko-Lensky and Kirensky districts;
- Chairman of the Veteran Council, primary organization in the Lena residential area;
- Director of Ust-Kut Historical Museum, Ust-Kut District.

Public discussion (hearing) on the ESIA for the project of Ust-Kut GPP, LLC "Ust-Kut gas fractioning unit" (December 2017)

The public hearing was held at the premises of Ust-Kut District Administration (Ust-Kut city) on 12 December 2017. Representatives of the Company and the designer presented the results of assessment of environmental impact of the Ust-Kut gas fractioning unit. Participants asked the Company and designer questions about potential noise impacts and fire safety of the unit. Other questions concerned required level of education for working at the GFU and preferred education profile for teenagers interested in future employment with the Company. After the presentation and discussion, participants endorsed the assessment report. The project of Ust-Kut GPP, LLC "Ust-Kut gas fractioning unit" was recommended for implementation with the following voting returns: "Yes" - 21, "Abstrain" - 2, "No" - 0.

Meetings held by Ramboll CIS during the ESIA process (May 2019)

In May 2019, Ramboll CIS held a series of meetings with Project stakeholders for preparation of a full ESIA, including the following persons and representatives of various entities:

- Representatives of Ust-Kut Municipality (Ust-Kut District);
- Representatives of Ust-Kut city administration;
- Medical Director of the Regional State Funded Healthcare Facility "Ust-Kut District Hospital";
- Representative of TRK Ust-Kut Dialog;
- Chairman of the Board of Ust-Kut city branch of Irkutsk Region Association of Hunters and Fishermen;

- Senior Public Inspector of the Irkutsk Region Wildlife Management Service;
- Representatives of the Irkutsk Region Forestry Agency Division for Ust-Kut Forestry;
- Head of the Ust-Kut Department of the Russian Ministry of Interior, lieutenant-colonel of police;
- Chairman of the Veteran Council, primary organization in the Lena residential area;
- Director of "Ust-Kut Historical Museum", Ust-Kut District.

At the meetings Ramboll CIS held discussions and collected information on the following topics: socio-economic situation in the areas surrounding the Project site; administrative identity and socio-economic profile of Polovinka village; economic situation and main economic activities in Ust-Kut district; environmental protection (including management of municipal solid waste); housing and municipal services and housing policy; transport and road network; demographic situation in Ust-Kut district, trends over the past 5 years; existing socio-economic development strategies, plans and programmes; education and state of education institutions in Ust-Kut district; crime rate in the region; facilities available in healthcare institutions and community morbidity rates, etc.

<u>Meeting of INK representatives with Ust-Kut City Duma deputies and representatives of Ust-Kut Administration (April 2019)</u>

The meeting was held on 17 April 2019 for discussion of the Company's activities in Verkhnemarkovo village. The meeting was attended by INK, the Deputies of Verkhnemarkovo village in the Duma, representatives of the Administration, and the village community (about 40 persons). The Head of Verkhnemarkovo village Administration posed a number of questions to INK and requested information about identity of the company that will be in charge of construction and operation of the gas pipeline in the village. Other topics of discussion included approval of the territorial planning scheme, certification of the village boiler house, etc. The villagers asked questions about safety and security systems used at the Markovsky OGCF and reasons of using significant areas for drilling operations. The village Administration, Duma and residents also made a number of requests and proposed ideas to enhance the level of comfort in the village and surrounding areas.

<u>Discussion of the progress of the expert review of the design and cost estimation documents package (the design documentation, DD) for construction of gas pipeline to the boiler house in Verkhnemarkovo village (May 2019)</u>

The progress of DD expert review for gas pipeline construction to the boiler house in Verkhnemarkovo village was discussed at the premises of Ust-Kut District Administration (Ust-Kut city) on 13 May 2019. The meeting was attended by representatives of Ust-Kut District Administration and INK. The discussion was focused on identification of funding sources for updating the DD in relation to the expert examination process, and for construction of the gas pipeline. Potential involvement of INK in operation of the future gas pipeline and the existing boiler house was discussed at the same meeting.

The meeting attendees recommended INK to explore the issues of procurement of services for updating the DD for the purposes of approval by the state expert review, and to consider the possibility of construction of gas pipeline to Verkhnemarkovo village at the expense of INK.

In the second part of the discussion, representatives of Ust-Kut District and Verkhnemarkovo village Administrations invited INK to participate in operation of the new gas pipeline and of the existing boiler house under mutually agreed terms, as the current operator of the boiler house and pipeline is incapable of providing personnel with adequate skills for operation of the planned gas pipeline. INK explained that the Company does not have the required competences for operation of municipal gas pipelines and gas boiler house. No final conclusion was reached on this matter.

4.3.5 Summary of requests and grievances received by INK during the period from 01.01.2017 to 27.05.2019

162 grievances and requests were received in 2017 from individuals, municipalities and civil society organisations. The share of grievances was insignificant. 104 out of the total of 162 grievances and requests were reconciled, and the rest were either re-directed to responsible third parties or rejected. Most requests related to financial aid. The requests were received from administrations, ministries, schools, sports and culture organisations, etc. Typical subjects of the requests were procurement of

medical equipment, financial support for festive events, allocation of land, invitation to participate in sports competitions, cooperation projects, make presentation at a conference, etc.

In 2018, 226 grievances and requests were processed, mostly from various municipal institutions, civil society organisations and individuals seeking charity (sponsor) aid. 176 requests were satisfied. 4 grievances were received and processed in 2018 on the matters not related to the INK Project. All grievances were processed and measures were taken for their adequate reconciliation. No repeated grievances were received from stakeholders.

In 2019 (as of June 2019), 136 requests were received and processed. 106 requests were accepted for further action, and 30 were rejected. No grievances were received in 2019. Subjects of the requests included financial support from administrations, ministries, schools, hospitals, sports and culture organisations, etc. Apart from financial aid, the requests concerned provision of exhibits for museums, supply of gas condensate, participation in charity events, etc.

INK responds to all received grievances and complaints in a timely manner. Grievances received from external stakeholders are registered with assignment of divisions and personnel responsible for feedback within the Company.

4.4 Future Engagement Activities and Information Disclosure

4.4.1 Principles of engagement

The Company will use various engagement and information disclosure methods at all stages of the Project lifecycle in compliance with good international practice (e.g. Environmental and Social Policy of the EBRD) in order to make sure that interests of various groups are fully incorporated, and all stakeholders are involved in the decision making process within the scope of the ESIA. The principles of stakeholder engagement include the following:

- Communication with stakeholders will be maintained by means of providing to the communities directly affected by the Project and other relevant stakeholders the access to timely, relevant, meaningful and understandable information in a culturally acceptable form, without manipulations, interference, coercion or intimidation;
- Stakeholder engagement will involve the following elements: identification and analysis of stakeholders, planning of engagement activities, disclosure, consultations and participation, grievance mechanism, as well as regular reporting to the relevant stakeholders;
- The stakeholder engagement process will comply with all applicable requirements of the Russian law in the sphere of information disclosure and consultations.

4.4.2 Engagement Methods

The following engagement methods may be used at various stages of the Project lifecycle, and also for consultation within the ESIA process:

- public meetings;
- focus groups;
- face to face meetings;
- engagement with media;
- information centre and reading room;
- forums, conferences, exhibitions;
- Project brochure and newsletter;
- guided tours to Company's sites.

In addition, multiple cultural and sports events are held with support of and on the initiative of INK and M.V.Sedykh Charity Foundation. 16 events are planned for year 2019, including 9 cultural and 7 sports events. All events are evenly distributed throughout the year and include education programmes, displays of paintings and photographs, guest theatre performances, New Year celebrations and other community support activities to be conducted throughout the Project life cycle.

More details of the engagement activities are provided in the SEP.

4.4.3 ESIA Consultations and Disclosure Activities

4.4.3.1 Methods of disclosure

The following methods can be used by the Project for information disclosure:

- distribution of the Project presentation brochure (on a quarterly or biannual basis) to the affected communities and other stakeholders;
- disclosure of the Project ESIA report prepared by Ramboll CIS;
- disclosure of the Project SEP;
- disclosure of the Project Non-technical Summary based on ESIA.

More details of the stakeholder engagement and disclosure format in relation to the international ESIA process are provided in the Project Stakeholder Engagement Plan.

4.4.3.2 ESIA Consultations and Disclosure

Stakeholder consultations within the international ESIA process will be conducted in three stages starting in 2020 Q1:

a. **Stage 1:** Disclosure of the ESIA Report, SEP and Non-technical Summary (NTS) at the INK office in Ust-Kut, the community liaison office established in Ust-Kut (at the premises of the Ust-Kut Historical Museum), INK office in Irkutsk, and via the official website of INK. Comments and queries in relation on the disclosed documents will be collected during 30 days.
b. **Stage 2:** Face to face discussion of the international ESIA package with stakeholders in Ust-Kut. Special attention will be given to local hunters and fishermen who can attend the general meetings to be organized for the local communities, but will also be invited in a discussion focused on their specific concerns associated with Project impacts and mitigations proposed by Ramboll. Venues for the meetings will be identified by the Company in liaison with Ust-Kut City and District Administrations and other stakeholders.
c. **Stage 3:** Disclosure of the final and updated versions of the ESIA Report, SEP and NTS with incorporated comments at the INK office in Ust-Kut, the community liaison office established in Ust-Kut (e.g. at the premises of the Ust-Kut Historical Museum), INK office in Irkutsk, and via the official website of INK.

The Stakeholder Engagement Plan also developed by Ramboll represents further detail for the process of public disclosure and consultations relating to the ESIA report.

4.5 Grievance Mechanism

As mentioned in Section 4.3.1, the Company adopted Instruction "On the public grievance procedure of INK LLC" which is approved by the Company Order of 31.07.2008. The Instruction has been developed in line with Russian law and defines the terms and procedures for handling grievances and queries from individuals and entities on the matters relating to operations of affiliates and structural units of INK LLC.

More details on the grievance mechanism are provided in SEP.

5. PROJECT DESCRIPTION

5.1 Project Background and Outlook

Irkutsk Oil Company (INK) has been producing crude hydrocarbons in Irkutsk Region since 2004 and is the region's largest producer of oil. Major part of the Company's prospective assets (Markovsky and Yaraktinsky fields) is situated in Ust-Kut District, which is the main area of INK operations. By the composition of product yield, these deposits are classified as oil-gas condensate fields and are characterized by a large share of ethane and heavier hydrocarbons in the gas fraction (see Table 5.1).

Table 5.1: Comparison of blendstock content in gas from the West Siberian fields (%)

Blendstock content, %				
Field	**Methane**	**Ethane**	**C3–C4**	**C3–C6**
Yaraktinsky OGCF	82.55	**7.71**	**4.56**	**5.59**
Markovsky OGCF	89.11	**6.14**	**1.82**	**1.88**
Kovyktinsky GCF	91.39	4.91	1.31	1.78
Chayandinsky OGCF	85.48	4.57	1.97	2.58

Source: INK

INK is implementing a large-scale gas project to take advantage of the vast gas resources in its fields and license blocks. At the first stage, the Company has been using the natural gas (NG) and associated petroleum gas (APG) reinjection technology for simultaneous production of gas and oil, in the situation where no gas transport and consuming infrastructure is present, while APG utilization requirements are established by the Russian Government. Gas reinjection at the approximate rate of 4.5 million m^3 per day is intended to address two main objectives: reduction of impact of the field operations on atmospheric air, and increasing condensate recovery factor. However, from economic perspective, this approach results in wastage of substantial quantity of the valuable resource. Only a small part of produced gas is utilized by local field power plants with the total capacity of about 100 MW.

The high blendstock content makes the gas an economically attractive subject for implementation of large-scale projects in the sphere of comprehensive gas processing. The growing APG production, the rising demand for gas-to-chemicals and gas processing products in the global markets, the necessity of gas fields development are the factors that predetermined the need to develop INK Programme for utilization of gas resource of the Eastern Siberia (the INK Gas Programme). More details of the INK Gas Programme phases are provided in Section 5.2.

The proposed Polymer Production Facility (PPF) is intended for production of polyolefins, namely linear low density polyethylene (LLDPE) and high density polyethylene (HDPE) pellets. The main feedstock for production of polyolefins in Russia and Western Europe are petrochemical products, while in the US and Canada polyolefins are largely produced from ethane, which is a preferred method from environmental point of view.

The Project will complement the gas processing capacity of INK and utilize the benefits offered by the unique fraction composition of the produced gas (including associated petroleum gas) for production of marketable products. The wasteful and environmentally unfriendly practice of flaring or reinjection to formation will completely cease. Other expected economic and social benefits of the project include the following:

- significant reserves of natural gas and associated petroleum gas which are currently unclaimed, will be engaged for enhanced processing;
- production of product with a high added value;
- opportunity to develop new industrial facilities for manufacturing finished domestic and industrial products;

- infrastructural development of Irkutsk Region's northern areas, in particular Ust-Kut District (including enhanced electricity-generating capacities);
- development of the regional labour market;
- improvement of the living standard in Irkutsk Region, due to the increase in average wages and contributions to local public budgets;
- possibility to improve reliability of heat and gas supply systems in the city of Ust-Kut.

5.2 Gas Programme of Irkutsk Oil Company

The Long-term Gas Business Development Programme (INK Gas Programme) that INK initiated in 2010 consists of four stages (refer to Figure 5.1) and is intended to gradually enhance utilization of gaseous components of the produced hydrocarbon mixtures for production of commercial products for domestic and international markets. The activities started with the introduction of gas re-injection, with simultaneous recovery of heavy fractions. This technology allows to reduce the amount of emissions, and to maintain reservoir pressure, increasing the condensate recovery rate.

During the first stage covering the period of 2011 to 2018, a 3.6 million nm^3/year gas processing plant has been constructed which processes both natural gas and APG (NG&APG PP). An uploading terminal for receiving, storing, and shipping liquefied petroleum gas (LPG) with a capacity of 161,000 tons per year (the Terminal) close to the urban area of Ust-Kut was put into operation in 2018 as the first production facility in the Ust-Kut industrial area of INK. A subsurface pipeline is constructed for transportation of LPG mixture containing propane and butane from the field to the Terminal.

The second stage of the INK's Gas Programme (2016-2020) includes construction of two more NG&APG PP plants at Yaraktinsky field with a total capacity of 12 mln nm^3/year and an NG&APG PP plant at Markovsky field with a capacity of 6 million nm^3/year. This will result in production of: i) dry stripped gas (DSG), and ii) natural gas liquids (as a mixture of gas condensate, propane and butane, NGL). The latter will be transported to LPG Terminal in the Ust-Kut industrial area by the 200 km long pipeline which has already been constructed. A separate pipeline for transportation of DSG will be constructed in the same corridor with the existing one.

To expand a variety of products with industrial (normalised) propane and butane as well as stable gas condensate, the Company looks into options for constructing a gas processing facility near Ust-Kut (the Ust-Kut Gas Processing Plant), with prospective use of NGL as raw material.

At the third stage (2018-2023), a polymer plant will be developed in the same area to utilize ethane which is to be extracted from the produced ethane-rich gas. This polyolefin plant (the Polymer Production Facility, PPF) is designed to produce linear low density polyethylene (LLDPE) and high density polyethylene (HDPE) with a capacity of 650,000 tons per year. At this stage, annual gas processing is expected to increase to a tentative volume of 7 bln m^3.

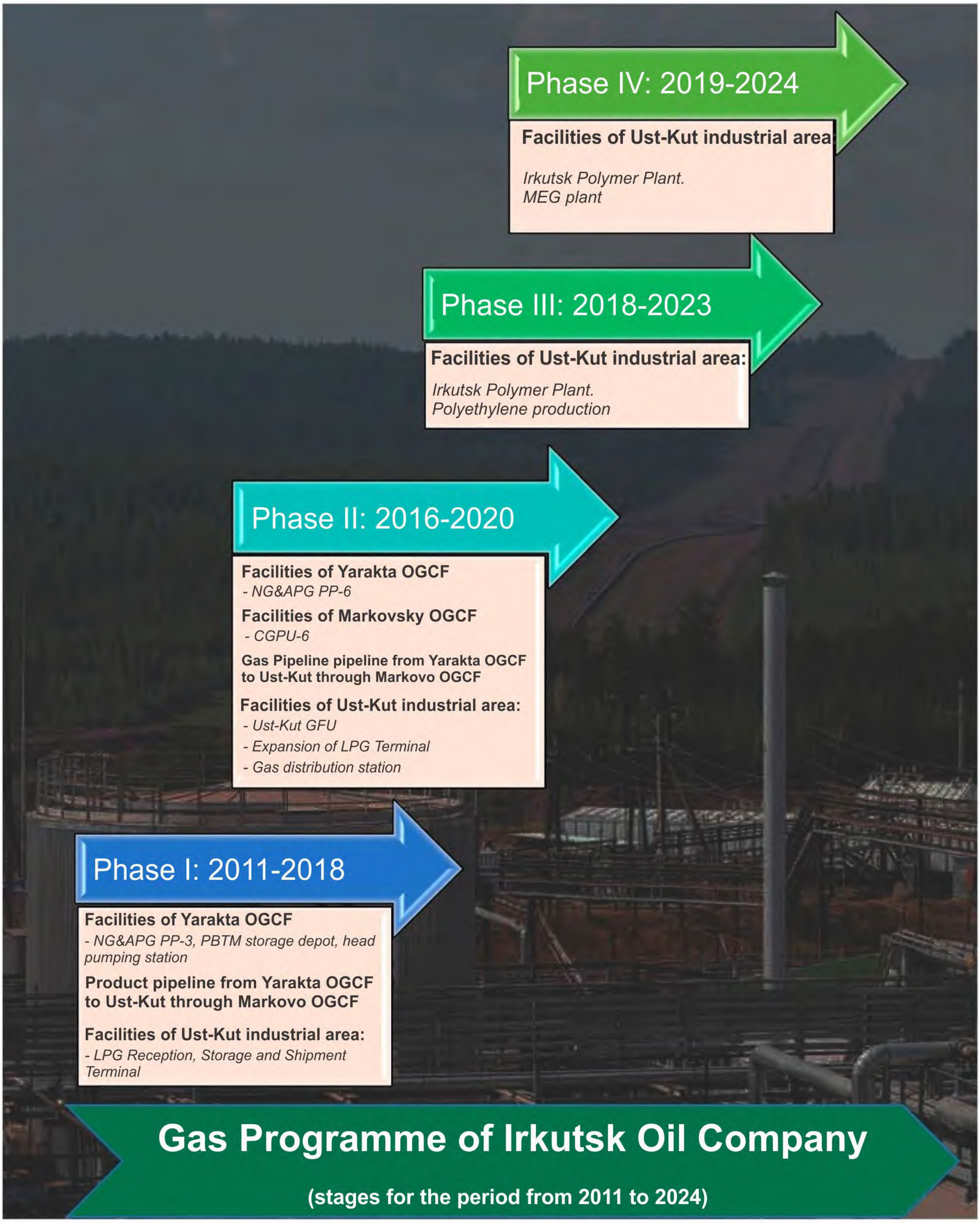

Figure 5.1: Irkutsk Oil Company's Gas Business Development Programme: phasing and timeframes

At the fourth stage (2019-2024), for the purpose of effective utilization of dry stripped gas, INK plans to construct the Irkutsk Gas Chemical Integrated Plant beside the PPF, to produce mono-ethylene glycol (MEG) and methanol in annual amounts of 600 and 70 thousand tons. DSG containing 96% of methane will be used as a feedstock for production of MEG and methanol.

The area adjoining the site of the polyethylene production facility to be developed and commissioned at the third stage of INK Gas Programme, will be used for construction of MEG Plant (refer to Figure 5.1).

Irkutsk Oil Company intends to implement the two plants as a common project titled **"Irkutsk Polymer Plant" (IPP)**.

Locations of the above elements of INK Gas Programme within the OGCF sites and the Ust-Kut industrial area are shown in the schematic map in Figure 5.2.

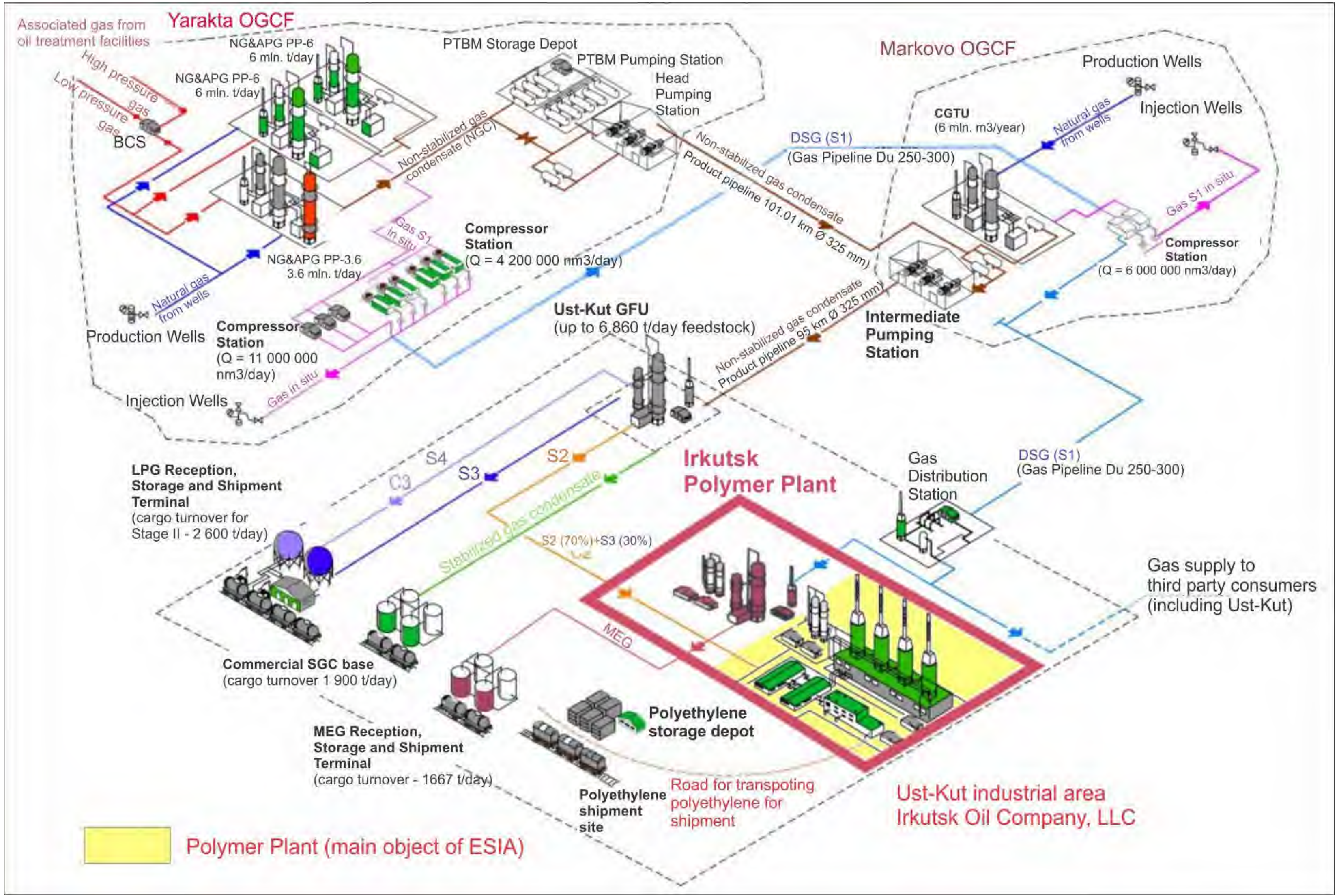

Figure 5.2: Structure of the INK Gas Business Development Programme and the role of the Polymer Production Facility in overall gas transport and processing system of Ust-Kut District

5.3 Proposed Project Area

The Polymer Production Facility considered by this ESIA is proposed for construction in the Siberian Federal District of the Russian Federation, in Ust-Kut District of Irkutsk Region, on the right bank of the Lena River (see Figure 5.3).

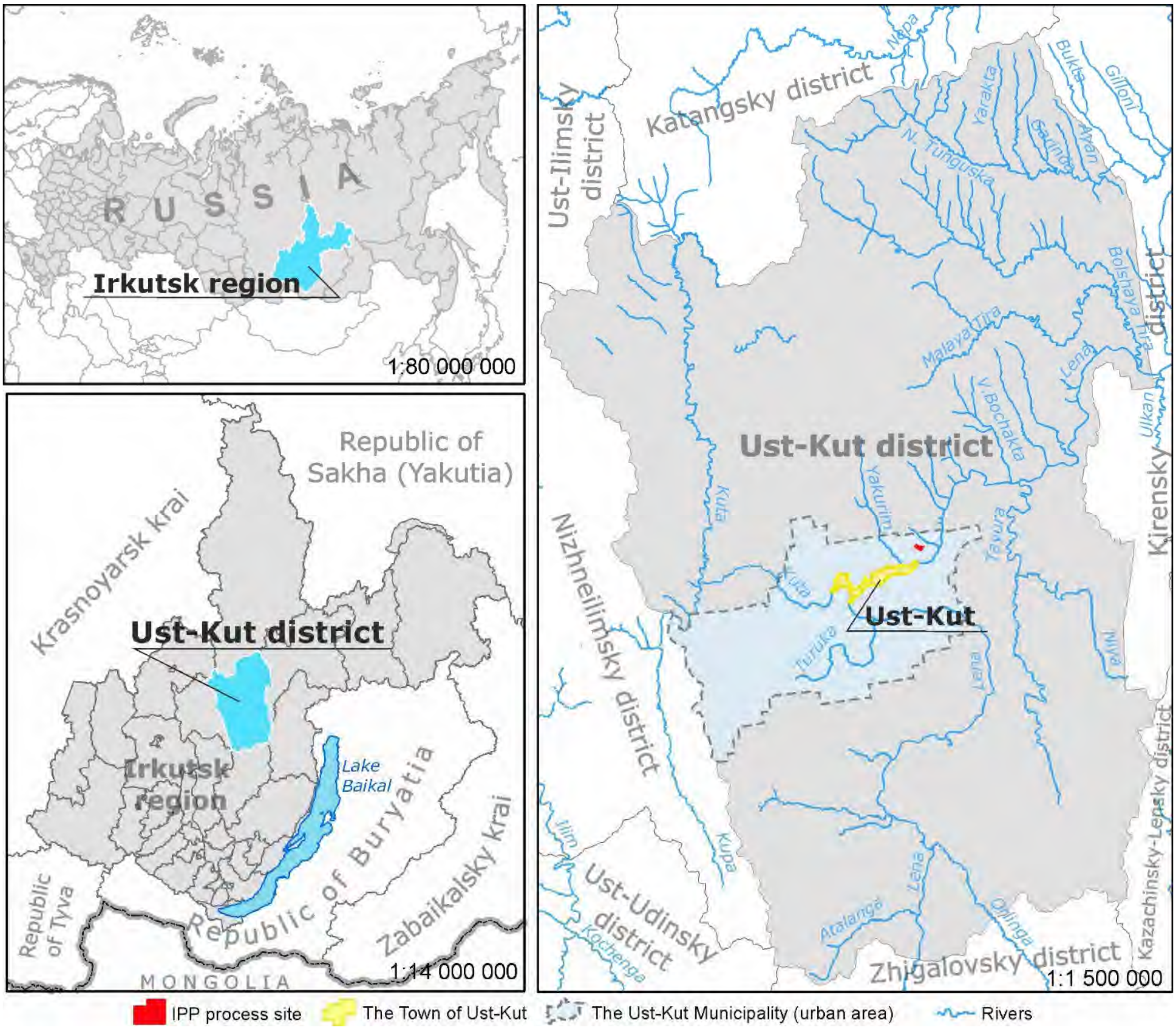

Figure 5.3: Proposed Project area

Location of the Project facilities is shown in Figures 5.4, 5.5, and schematic map with more details including the list of the plant units and sites, associated facilities, infrastructure, third-parties' facilities is provided in Appendix 4.

The PPF process area (Area 1), the construction shift camp, and the auxiliary process site are located 4 km to the north of INK's operating sites in Ust-Kut. Proposed location of PE storage, PE offloading terminal, certain administrative buildings with associated infrastructure (Area 2) is beside the LPG Facilities site in Ust-Kut.

Figure 5.4: Main operation areas of the proposed Polymer Production Facility

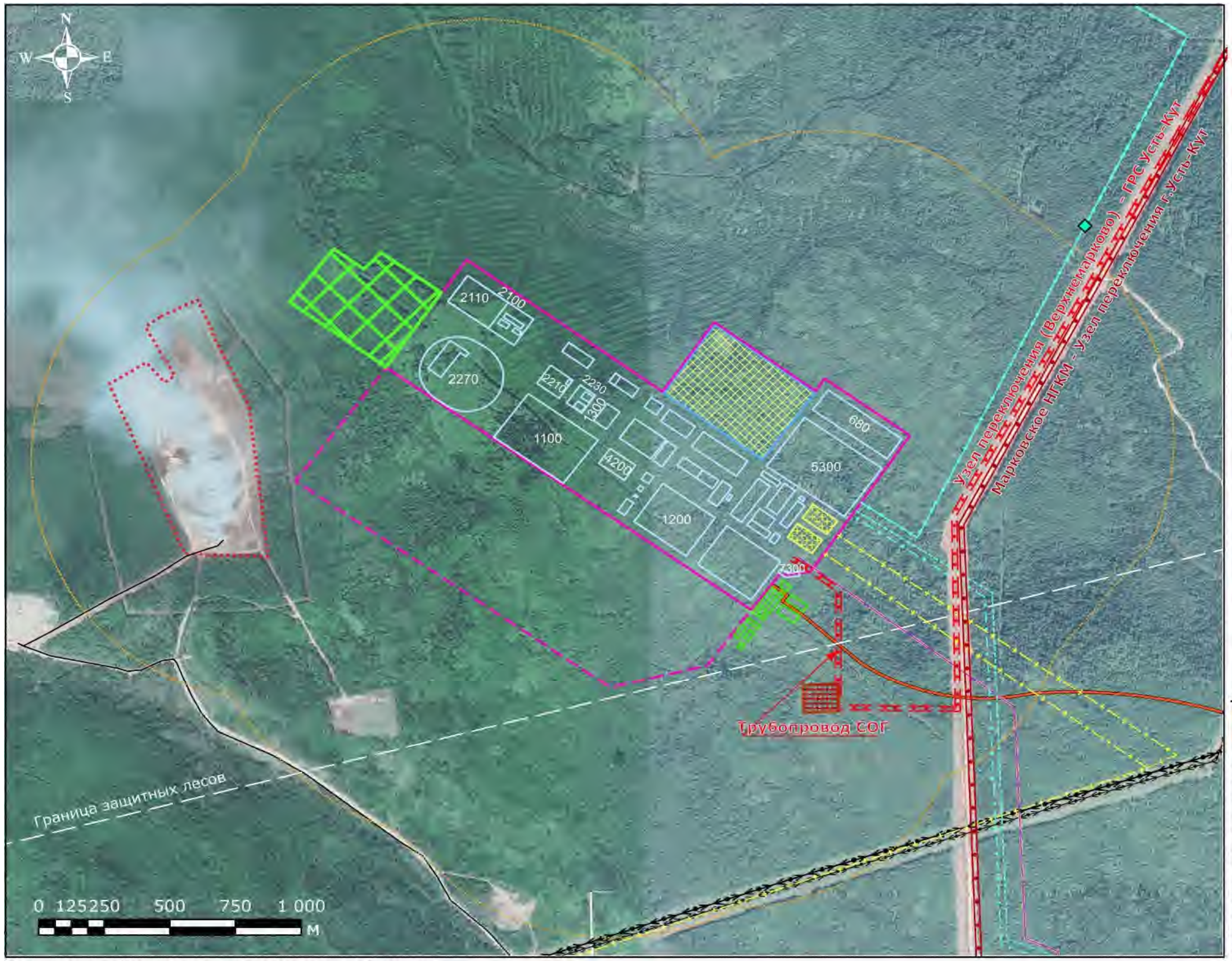

Таблица. Сооружения Завода производства полимеров (ЗПП)

№	Объект
2100	Объекты для хранения и транспортировки этана и этилена
2110	Парк хранения этана и этилена
2210	Промпарк №1
2230	Промпарк №2
1300	Установка производства бутена-1
1100	Установка производства этилена
5220	Водоблок оборотного водоснабжения
4200	Котельная
2510	Воздушная компрессорная с блоком осушки воздуха
2520	Азотная станция
5210	Блок пожаротушения и хранения технической воды
1200	Установка производства полиэтилена
4700	Главная понижающая подстанция с ГРУ-10 кВ
7300	Заводоуправление
680	Блок утилизации отходов и избыточного ила
5300	Комплекс очистных сооружений (зона 1)
2270	Факельное хозяйство

Источник основы: Космические снимки, предоставленные Заказчиком
Источник расположения сооружений: Иркутский газохимический комплекс. Раздел 2. Схема планировочной организации земельного участка. 70605-П-000-ПЗУ. - Нефтехимпроект, 2018. 30 с.
Граница защитных лесов: Лесохозяйственный регламент Усть-Кутского лесничества Иркутской области. - Филиал ФГБУ "Рослесинфорг" "Прибайкаллеспроект". - Иркутск, 2018. - 453 с.

Figure 5.5: Production and auxiliary facilities within the PPF site (Area 1)

5.4 Main and Auxiliary Components of the Polymer Production Facility

The main production units of the proposed Polymer Production Facility are ethylene, polyethylene and alpha-olefin (butene-1) units. The auxiliary systems (onsite infrastructure facilities) include:

Area 1: Onsite infrastructure facilities

- flare system (with HP subsystems for ethylene and polyethylene units and LP subsystems for the PE unit);
- ethane and ethylene storage tank farm with a pumping station and flash tanks;
- air and nitrogen facilities;
- water recycling system (WRS);
- wastewater treatment facilities;
- boiler house;
- fire suppression systems and other infrastructure.

Area 2:

- storage facilities
- PE loading platform;
- office and laboratory buildings;
- technical water facilities with a 2nd-lift pumping station.

Area 3:

- water intake facilities on the Lena River, for technical water supply;
- treated wastewater outlet to the Lena River.

Area 4:

- artesian water abstraction site (boreholes) in the area of Polovinnaya River, for drinking water supply to all facilities.
- A complete (itemized) list of the PPF facilities is given in Appendix 8.

5.4.1 Ethylene unit

The ethylene unit with the planned capacity of 600 thousand t/year is intended for production of polymer grade ethylene using ethane and propane thermal cracking process. Ethane gas is supplied by a pipeline from the Ust-Kut gas fractioning unit (GFU). Liquefied propane is supplied by a pipeline from the GFU or from the LPG reception, storage and offloading terminal (LPG Terminal) located near the GFU.

The unit will also produce hydrogen gas, which is additional raw material for polyethylene and bythen-1 production, for export to consumers outside the battery limit. By-products of the unit operation will be flue gas with high methane content (used as a fuel for cracking furnaces), gasoline cut (C5+), and pressure-still tar used in the Gas Chemical Integrated Plant. Comprehensive utilization of ethane and C3/C4 fraction is ensured by their recirculation from the ethylene fractioning column and fraction C3/C4 separation and hydrogenation unit.

Process systems and main processes used in the unit:

- furnace preheat system;
- cracking heater (including feedstock saturator, steam generation and superheated steam cooling systems, process gas feed and quenching);
- cracked gas quenching with water;
- feedstock saturation system;
- process gas compression;
- caustic scrubbing of acid gases;
- process gas drying and regeneration;
- de-ethanizer and acetylene converter;
- process gas cooling and demethanizer;

- hydrogen purification with PSA;
- ethylene extraction;
- hydrogenation C3/C4;
- debutanization;
- propane refrigeration and binary refrigeration;
- propane purification unit.

The unit also includes a central control room, electric substation, and a field control room.

The unit will be designed to produce polymer grade ethylene 8400 hours per year, with the performance shown in Table 5.2. Ethylene gas is fed to the PE unit and butene-1 unit to produce commercial products. In situation of low ethylene consumption, the PE unit produces liquid ethylene which is directed to the ethane and ethylene storage tank farm. Supply of gaseous ethylene from the storage tank farm to the unit is ensured by vaporisation of liquid ethane and ethylene.

Table 5.2: Ethylene unit design performance

Feedstock and product flows		Consumption and output (thousand tons per year)	
		Option 1	Option 2
Feedstock	Ethane feedstock	769.5	630.8
	Propane feedstock	0.0	269.3
Products	Polymer grade ethylene	650.0	650.0
	Hydrogen	1.0	1.0
	Methanized flue gas	91.0	203.9
	C5+	120.8	28.8
	Pressure-still tar	6.7	16.4

5.4.2 *Polyethylene unit*

Polyethylene unit is intended to produce linear low density polyethylene and high density polyethylene pellets (LLDPE density 0.915-0.935 and HDPE density 0.935-0.965), by polymerization of ethylene and comonomers (butene-1 and/or hexene-1).

Design capacity of the reactor line is 650 thousand tons of PE pellets per year, by polymerization of ethylene from the ethylene unit, and comonomers (butene-1 and/or hexene-1).

The unit configuration includes the following main processes:

- feedstock supply and purification;
- ethylene purification;
- polymerization reaction (including catalyst injection);
- resin degassing,
- purge trapping;
- seed bed system;
- resin additive treatment;
- pelletizing;
- pellets homogenizing;
- bagging;
- condensate collection, flare separation, wastewater treatment;
- storage of butane-1, hexane-1, and injected condensing agent (ICA).

The unit also includes a central control room, electric substation, and a field control room.

The PE unit will be designed to produce polyethylene 8000 hours per year, with stable operation within the range of 60% to 110% of the rated capacity (Table 5.3). Commercial product of the PE unit - PE pellets packed in 25 kg bags, either in bulk in 40 ’containers, or in combination - is transported by trucks to the packed PE reception, storage and offloading facilities in IPP Area 2 from where it will be dispatched to customers by railway.

Table 5.3: Polyethylene unit design performance

Feedstock and product flows		Consumption and output (thousand tons per year)
Feedstock (tentative flow range)	Polymer grade ethylene	138 – 603
	Hydrogen	0 –1.1
	Butene-1	0 – 30
	Hexene-1	0 - 9
	Isopentane	0 - 1.9
Product	Polyethylene	650

Source: 70591-OTR-PZ2-R04[37]

5.4.3 Linear alpha olefins plant

5.4.3.1 Linear alpha olefins synthesis unit

Linear alpha olefins synthesis unit with the planned capacity of 32 thousand t/year is intended for generation of comonomer used in production of polyethylene. The process scheme consists of five main sections as follows:

- ethylene purification section;
- reactor block;
- catalyst injection section;
- catalyst removal section;
- fractional distillation section for separation of the flows of butene-1 and heavy hydrocarbons fraction C6 and heavier.

Table 5.4: Energy resource consumption at the linear alpha olefins synthesis unit

Energy resource	Unit	Normal operation	Peak load
Medium pressure steam	tpa	22400	22400
Low pressure steam	tpa	4416	4416
Boiler feed water	tpa	2216	2216
Circulating water	m^3/a	1568000	1568000
Service water	m^3/h	0	5
Drinking water	m^3/h	0	5
Nitrogen	Nm^3/h	100	2720

The unit will generate butene-1 for production of commercial product at the PE unit, and hydrocarbons fraction C6+ which will be directed to the LPG Terminal.

[37] Construction of Irkutsk Polymer Plant offsite facilities and construction camp, and rationalization of inter-site communication lines within the Ust-Kut industrial area of INK. MAIN TECHNICAL SOLUTIONS. Book 2. Explanatory memo. Narrative part (end).

5.4.3.2 Pyrolysis gasoline (C5+ fractions) hydrogenation unit

The unit processes crude pyrolysis gasoline with a capacity of 28,795 t/year and is designed to remove diolefins and styrenes by selective hydrogenation. The technological scheme includes three main sections:

- feedstock supply section;
- reactor block;
- gasoline stabilization section.

Table 5.5: Energy resource consumption and performance of pyrolysis gasoline hydrogenation unit

Feedstock and product flows		Consumption and output (kilograms per hour)
Feedstock	Pyrolysis gasoline	3427
	Hydrogen	72
Product	Stable hydrogenate	3421

5.5 Feedstock and Product Characteristics of the Production Units

5.5.1 Ethylene production

Ethylene cracking feedstock is the gas mix from the field NG&APG PP, and ethane circulating within the unit. Feedstock specifications and battery limit parameters for the feedstock supplied from NG&APG PP are provided in Table 5.5. With Option 1, 100 % of the feed flow is ethane with specified parameters, while with Option 2 ethane / propane proportion 70% / 30% is assumed (Table 5.2).

Feed temperature of the ethylene unit may vary within the range of 20 to 35 °C for ethane, and 20 to 40 °C for propane. Design battery limit pressure of ethane and propane is 1.9 MPa.g and 1.2 MPa.g, respectively.

Table 5.6: Ethylene unit feedstock specifications

Parameter	Feedstock components	
	Ethane	Propane
Phase	Vapour	Liquid
Component fractions, mole%:		
He	0.00	0.00
N_2	0.00	0.00
CO_2	0.12	0.00
Methane	1.65	0.00
Ethane	96.70	Balance
Propane	1.52	95.0
C_4 +	0.01	Disregarded
Isobutane	Disregarded	
Butane		4.0
C_5+		0.01
Olefins		0.1
Methanol		0.005 % w
Water	Saturated	max 10 ppm w
Sulphur	max 20 ppm w	max 30 ppm w
H_2S	max 5 ppm w	max 5 ppm w
TOTAL	100	100

Unit output products:

- polymer grade ethylene gas: temperature 20-30 °C, pressure 3.4 MPa.g at the unit outlet, 3.28 MPa.g at the PE unit battery limit;
- hydrogen gas: temperature 40°C, pressure 3.1 MPa.g min;
- Pressure-still tar: temperature 40°C, pressure 0.5 MPa-g max;
- C5+ fraction: temperature 83°C, pressure 0.5 MPa-g max.

Design characteristics of the above products are listed in Tables 5.6-5.8.

Table 5.7: Characteristics of polymer grade ethylene product

Component	Unit	Value	Reference to range
Ethylene	% mole	99.95	min
Methane	% mole	0.05	max
Ethane	% mole	0.05	max
Hydrogen	ppm (mole)	5	max
Acetylene	ppm (mole)	1	max
Propylene and heavier isomers	ppm (mole)	10	max
CO	ppm (mole)	0.2	max
CO_2	ppm (mole)	3	max
Oxygen	ppm (mole)	5	max
Nitrogen	ppm (mole)	5	max
Nitrogen compounds (as NH_3)	ppm (mole)	1	max
Methanol	ppm (mole)	1	max
Chloride (as Cl^-)	ppm (mole)	1	max
Sulphur (as S)	ppm (w)	1	max
Water	ppm (mole)	5	max

Table 5.8: Characteristics of propane / butane mix product

Component	Unit	Value	Reference to range
C_2	% mole	1	max
C_3/C_4	C_3/C_4 ratio is defined by composition of feedstock		
Butadiene	ppm (mole)	100	max
C_5+	% mole	2	max
Olefins	% mole	1	max

Table 5.9: Characteristics of hydrogen gas product

Component	Unit	Value	Allowable range	
Hydrogen	% mole	99.99	99.9	min
Nitrogen + argon	% mole	0.01	0.1	max
Oxygen	ppm (mole)	< 0.5	2	max
CO and CO_2	ppm (mole)	< 0.2	1	max
Water	ppm (mole)	1	2	max
Total hydrocarbons	ppm (mole)		1	max

The quality indicators of the by-products of the C5+ fraction and the pressure-still tar are not standardized.

5.5.2 *Polyethylene production*

Polyethylene production feedstock includes the following:

- polymer grade ethylene (Table 5.6);
- hydrogen (Table 5.8);
- butene-1 at temperature from minus 10 to plus 40°C and minimum pressure of 0.6 MPa.g at the battery limit (Table 5.9);
- hexene-1 at temperature from minus 10 to plus 40°C and minimum pressure of 0.69 MPa.g at the battery limit (Table 5.10);
- isopentane (Table 5.11, supplied by road tankers).

Additional raw material specifications are provided below (Table 5.9-5.11).

Table 5.10: Polyethylene unit feedstock specifications: butene-1

Component	Unit	Design value	Allowable range	
Butene-1	% vol.	99.5	99.0	min
Combination of isobutylene, trans-2-butene, cis-2-butene, n-butene and isobutane	% vol.	0.5	1.0	max
1,3-butadiene +propadienes	ppm (vol.)	20	200	max
Methylacetylene	ppm (vol.)	2	10	max
CO_2	ppm (vol.)	5	10	max
CO	ppm (vol.)	1	5	max
Total carbonyls	ppm (vol.)	1	5	Max, as methyl ethyl ketone (MEK)
Oxygen	ppm (vol.)	0.5	1	max
Sulphur	ppm (vol.)	0.1	1	max, as S
Water	ppm (vol.)	5	20	max

Table 5.11: Polyethylene unit feedstock specifications: hexene-1

Component	Unit	Design value	Allowable range	
Mono-olefin	% w	99.96	99.8	min
n-alpha olefins	% w	99.3	99.0	min
Paraffines	% w	0.04	0.2	max
Carbon number C6	% w	100	99.9	max
Carbonyls	ppm (w)	0.2	1	max
Peroxides	ppm (w)	0.2	1	max
Water	ppm (w)	18	25	max
Benzene	ppm (w)	0.01	1	max
Colour	Saybolt	+30	+30	min
Appearance	Transparent, without visible impurities			

Table 5.12: Polyethylene unit feedstock specifications: isopentane

Component	Unit	Design value	Allowable range	
Isopentane	% w	98.0	95	min
Other hydrocarbons	% w	2	5	max
Unsaturated hydrocarbons	ppm (w)	100	500	max, as pentene-1
Water	ppm (vol.)	15	20	max
Oxygen	ppm (vol.)	0.5	1	max
CO	ppm (vol.)	1	5	max
CO2	ppm (vol.)	2	10	max
Sulphur	ppm (w)	0.1	5	max
Non-volatile matter content	g per 100 ml	0.001	0.001	max
Suspended solids	Absent			
Acidity	ppm (w)	2	2	max, as acetic acid
Colour	Platinum-cobalt	15	15	max

5.6 Estimated Resource Needs of the PPF

5.6.1 Water supply

<u>Technical water</u>

The main source of water for the PPF needs is the Lena River. Design capacity of the water intake facilities is 900 m^3/h, with a potential increase to 2500 m^3/h. Treated makeup water for all PPF systems will be supplied at the minimum temperature of 5°C and pressure of 0.3 MPa.g at the border of the border of the Plant site.

The design further provides for use of technical water with design pressure of 0.15 MPa.g and temperature above 5°C. The PPF water treatment system will provide water of the required quality for various water supply systems.

Design parameters of boiler water are shown in Table 5.12.

Table 5.13: Boiler water (BW) parameters for the Polymer Production Facility

Parameter	Superhigh pressure BW	High pressure BW
Pressure	14.5 MPa.g	6.0 MPa.g
Temperature	148ºC	148ºC
Mechanical design pressure	22.0 MPa.g	8.0 MPa.g.
Mechanical design temperature	210ºC	210ºC

The cooling circuits for the PPF are recycling water systems. Design parameters of cooling water are shown in Table 5.13.

Table 5.14: Cooling water parameters for the Polymer Production Facility

Parameter	Feed	Return
Pressure	0.55 MPa.g	0.2 MPa.g
Temperature	28°C	40°C
Mechanical design pressure	10.0 MPa.g	10.0 MPa.g
Mechanical design temperature	70°C	70°C

<u>Hot water supply</u>

Hot water for consumers within the PPF, for operation during cold season, heat supply for the tanks and other facilities, will be provided by a plant-wide system with characteristics shown in Table 5.14.

Table 5.15: Plant-wide hot water supply system parameters

Parameter	Feed	Return
Pressure	0.79 MPa.g	0.4 MPa.g
Temperature	135ºC	65ºC
Mechanical design pressure	1.2 MPa.g	1.2 MPa.g
Mechanical design temperature	150ºC	15 ºC

<u>Potable water supply</u>

It is planned to supply potable water from ground water wells with design capacity of 120 m^3/h located in the Polovinnaya River valley. The designed water treatment facilities will produce water to meet the requirements of SanPiN 2.1.4.1074-01. Water temperature in the domestic water supply system will be 5-15 ºC. Water supply to the Project facilities will be provided by the designed looped potable water network.

The design further provides for a <u>fire water system</u> with ambient temperature, mechanical design pressure 1.4 MPa.g, and mechanical operating temperature 40ºC. Fire water will be supplied from storage tanks by looped fire water network.

5.6.2 Energy carriers: steam and condensate

A boiler house will be constructed at the PPF site for generation of energy resources as follows:

Energy resource	Parameter		System where resource will be used
	Pressure	Temperature	
Steam	4.2 MPa	385 ºC	Compressor units driven by steam turbines, and equipment requiring process heat supply
High pressure feed water	14.5 MPa	148 ºC	Needed for generation of 12.2 MPa steam in transfer line exchangers of the PE unit
Medium pressure feed water	4.5 MPa	100 ºC	Needed for cooling down of steam in pressure-reducing cooling stations of the ethylene production system
Demineralized water	1.0 MPa	20 ºC	Used for auxiliary equipment within ethylene and butene production systems
Heating (network) water		150/70 ºC	Fed to the heating and hot water supply systems of the Plant buildings and facilities. Used for

			auxiliary systems' heating (pre-heating of natural gas, ethane, raw water, etc.).

The following equipment will be provided in the boiler house:

- three steam boilers of E type, capacity 70 t/h, with steam parameters as follows: pressure 4.4 MPa, temperature 400 °C;
- three hot water boilers KGVM-50-150 with combined heat capacity of 50x3=150 GCal/h.

The boiler house is designed for operation using natural gas as the main fuel and ethane as backup fuel. Design maximum consumption of natural gas is 36000 m^3/h, ethane – 21075 m^3/h.

Table 5.16: Condensate parameters for PPF operation

Parameter	Tentatively pure (turbine) condensate	Tentatively contaminated condensate (from consumers)
Pressure	0.3 MPa.g	0.3 MPa.g
Temperature	50°C	100°C

5.6.3 *Power supply*

Power supply for the PPF will be provided from high-voltage transmission line via step-down substation 500/220 kV. Two main step-down substations GPP-220/10 kV will be provided at the Plant site, to ensure reliable power supply for the Project facilities. Each GPP-220/10 kV will include two step-down transformers rated for 80 MVA.

The main parameters of power supply for consumers within the Plant are listed in Table 5.16.

Table 5.17: Design parameters of the plant-wide power supply system

Parameter	Primary high voltage system	Secondary low voltage system
Operating voltage	10 kV	0.4 kV / 240 V
Frequency	50 Hz	50 Hz
Phases / cores	3 phases / 3 cores	3 phases / 4 or 5 cores

5.6.4 *Air*

Parameters of air supply for consumers within the Plant (technical air, instrument air) are specified below (Table 5.17).

Table 5.18: Parameters of air used in the Plant systems

Parameter	Instrument air	Technical air
Dew point	minus 60°C at 0.7 MPa.g	saturated
Oil content	absent	absent
Temperature	ambient	ambient
Pressure	0.69 MPa.g	0.69 MPa.g
Mechanical design pressure	0.98 MPa.g	0.98 MPa.g
Mechanical design temperature	60°C	60°C
Quality	To GOST 17433-80, without oil and dust	To GOST 17433-80, without oil and dust

5.6.5 *Fuel gas*

Fuel gas is a product of the ethylene unit. Fuel gas deficit will be covered with imported fuel gas (Table 5.18). Fuel gas will be supplied via the DSG pipeline from the fields to the Ust-Kut industrial area of INK. The gas pipeline is routed within a common technical corridor with the existing pipeline for transportation of liquefied gas. All route options will have the gas distribution station (GDS) in the area of Ust-Kut city as their terminal point. The GDS functions include inter alia gas supply to industrial customers and households in urban settlements of Irkutsk Region.

Table 5.19: Parameters of imported fuel gas supplied for consumers within the Plant

Parameter	Unit	Value
Chemical composition:	% mole	
He		0.3
N_2		2.9
CO_2		0.20
Methane		96.19
Ethane		0.4
Propane		0.01
Total		**100.00**
Molecular weight	a.m.u.	16.42
Pressure	MPa.g	0.6
Temperature	°C	Ambient

5.6.6 *Nitrogen*

Nitrogen will be produced by the cryogenic separation unit, using cold energy from expansion of compressed gas. Its design characteristics are listed in Table 5.19.

Table 5.20: Design characteristics of produced nitrogen

Parameter	Value
Purity	99.9 % mole N_2 min
Oxygen	5 ppm-mole (max)
CO	1 ppm-mole (max)
CO_2	5 ppm-mole (max)
Water content	2 ppm-mole (max) (minus 60°C at 0,79 MPa.g)
Methane and C_2	2 ppm-mole (max)
Oil	Presence of oil is unacceptable
Pressure	0.69 MPa.g
Mechanical design pressure	0.98 MPa.g
Temperature	Ambient
Mechanical design temperature	60°C

5.7 Associated Activities

As defined in the description of the INK Gas Programme phases (see Section 5.2), the proposed Polymer Production Facility (the Project) will be integrated into a common gas transportation and processing system comprising the following key elements:

1) gas transportation system including a 200 km gas main with diameter 325 mm between the oil-gas condensate fields of INK and the gas processing and transportation facilities in Ust-Kut industrial area. Associated facilities of the gas transport system are: service driveway along the pipeline route, two-line overhead power transmission system, on-site facilities along the route;

2) liquefied petroleum gas (LPG) reception, storage and offloading terminal connected to the southern point of the gas main;

3) Ust-Kut GPP with the GFP, also connected to the southern point of the gas main.

Impacts related to the listed above facilities will be considered in Chapter 13 in terms of potential cumulative effects. Schematic map in Figure 5.2 visualises mutual positions of the above facilities and the designed Polymer Production Facility.

The IFC Performance Standard 1 (PS1) requires that ESIA considers both immediate impacts of the Project and impacts of any associated facilities. Associated Facilities are the facilities that are not funded as part of the Project and that would not have been constructed or expanded if the project did not exist and without which the project would not be viable.

Details of implementation status of neighbour facilities and their functional links with the Project are provided below (Table 5.20). Based on assessment of status of the Project auxiliary facilities and infrastructure, the following elements have been identified as Associated Facilities:

- water supply and wastewater disposal facilities;
- power supply facilities (offsite step-down transformer substation (SDTS) 500/200, power transmission line (TL) 220 kV from STDS 500/200 to the step-down substation at the Plant site);
- large equipment offloading berth (LEB);
- roads outside the Project sites;
- temporary construction camp;
- INK personnel accommodation facilities in Ust-Kut city.

The fuel gas pipeline is not included in the list of associated facilities for the reason that according to the Company, it would be constructed independently of the Polymer Production Facility to supply fuel gas to multiple consumers within the Ust-Kut industrial area and local municipalities.

Water supply and drainage system

Drinking water: Potable water supply for the designed facilities will be provided from ground water boreholes in the Polovinnaya River valley with a total design capacity of 120 m^3/h. The water of the aquifer does not comply with the hygienic requirements for the quality of drinking water of non-centralized water supply (SANPIN 2.1.4.1175-02, GN 2.1.5.1315-03). Chemical analysis of water samples taken from the well No. 1-G of Polovininsky UN dated 03/23/2019 showed an excess of iron content – 8.7 MPC[38]. De-ironing is required to bring water from this borehole to compliance with potable water standards, while standard requirements for all other parameters are met without any further treatment.

Construction of the drinking water treatment plant and clear water tanks is planned as part of the preparatory activities for the Project construction, to serve the household water demand of the construction camp and subsequently supply potable water for the Plant operation. Water temperature in the domestic water supply system will be 5-15 ^{o}C. Water supply to the Project facilities will be provided by the designed looped potable water network.

Technical water: Technical water for the Project will be supplied from water intake facilities on the Lena River comprising the following:

- water intake structure;
- 1st lift pumping station;
- 2nd lift pumping station;
- pressure pipelines.

The following design solution has been selected as a result of technical and economic assessment:

- water intake is located 120 m off the crossing of the Vilyui A331 road with the railway line;
- the preferred design option is based on underflow filtering intake structure which can be implemented without any protruding elements in the river channel and therefore offers the following advantages: no risk of structural damage by drifting ice; unobstructed navigation; the water intake system is suitable for shallow rivers and for operation during low-water season in winter;
- dry-type inlet chamber is adopted for the first lift, due to the lower cost of construction and operation of “dry” chamber compared to the “wet” one.

Maximum capacity of the 1st lift pumping station is 900 m^3/h and can be further increased to 2500 m^3/h. Maximum water lift from the lowest level in the Lena River to the Project technological site is 260 m. Water will be pumped to the Project site (Area 1) via two pipelines discharging to the service water tanks, from where it will be supplied to the looped network of river water, makeup water, and to the fire water system.

[38] Expert statement on compliance with regulatory documents of the results of laboratory studies, tests, measurements. 04.04.2019 FBUZ "Center for Hygiene and Epidemiology in the Irkutsk Region".

Wastewater discharge: In winter season when less makeup water is needed for the recycling water supply system, excessive volume of treated wastewater will be discharged to the Lena River via the filtering underflow outlet arrangement - a submerged structure in the river channel. Advantages of this scheme are similar to those of underflow water intake: suitability for shallow rivers which are covered with thick ice in winter, and no risk of structural damage in case of ice jamming. Design capacity of the water discharge facilities is 200 m^3/h, with a potential increase to 500 m^3/h.

The River Polovinnaya is currently considered as an alternative receiver of the treated effluents.

Berth on the Lena River

The Company plans to build a berth in the area of Cape Tolsty where large equipment will be offloaded from river transport to trucks (large equipment offloading berth, LEB). The land plot of 1.761 ha is allocated for the berth and 200 m access road.

The area is conventionally divided into two functional zones - pier (operational) stripe and back area.

The pier (operational) stripe is intended for all transshipment operations. It is recommended that equipment is unloaded from vessels using the LIEBHERR tractor crane, using the direct scheme (vessel-crane-truck). The following facilities will be provided in the pier stripe:

- quay;
- RC platform for the crane equipment;
- superlift assembly/dismounting area.

Graded back area outside the operational stripe will accommodate the following buildings and facilities:

- modular checkpoint building;
- modular office building;
- modular building for warming-up and dining;
- modular building for radio station facilities;
- local wastewater treatment facilities;
- transformer substation KTP-SESch-K;
- and
- site roads for motor vehicles;
- site utility networks (drainage, lighting, power supply).

Motor roads

It is planned to upgrade section km19+300 - km20+500 of the Vilyui A-331 road Tulun - Bratsk - Ust-Kut - Mirny - Yakutsk to enable transportation of large and heavy equipment to the construction site of the Irkutsk Polymer Plant.

Communication between the operational sites within Area I and Area II will be provided by the future access road which by the time of ESIA studies reached the stage of design development. Commissioning of the road for operation is scheduled for the end of year 2020.

The provided mutual links of the main components and facilities of the "gas hub" of the Irkutsk Oil Company in Ust-Kut City and Ust-Kut District has been taken into account at preparation of materials for this ESIA.

5.8 Land and Water Areas Allocated for the Project

The Polymer Production Facility (PPF) footprint is formed by a combination of the sites listed below to accommodate areal and linear capital construction facilities:

- Process site (Zone 1, "upper" site) - a land plot with an area of approximately 110 ha for placing process units of PPF;
- An offsite area - a land plot with an area of approximately 4 hectares, adjacent to Process zone;
- Export terminal (Zone 2, "lower" zone) of approximately 20 ha;

- Sites for proposed linear infrastructure facilities associated with the PPF process site of the total area 317 ha;
- Land plots of 0.9 ha for the installation of a technical water conduit and a treated wastewater sewer via two parallel corridors from the Lena river waterline to the IPP Zone 2, which will cross Federal Highway A-331 "Vilyui" and the access railway tracks to the Alrosa facilities.

Temporary PPF facilities of the construction stage will include:

- Three sites adjacent to PPF Zone 1: Rotational accommodation camp for 7000 people with an area of approximately 27.5 hectares and Temporary buildings and installations (TBI) site with an area of approximately 62 ha;
- Berth on the River Lena for unloading large-sized equipment with the onshore part of 1.8 ha and the adjacent water area of 1.1 ha.
- High Voltage 10 kV for power supply of the Accommodation Camp facilities, the land allocation for which is approximately estimated at 2.9 ha.

To sum up the total footprint of PPF will amount to **584 ha** (100%), of which **134.0 ha** (23%) will be allocated for the technological sites, **358 ha** (61%) for linear facilities, and **92 ha** (16%) for the temporary construction facilities.

Table 5.21: Facilities Included in the INK Gas Programme and their Links to the Project

No.	Official title (designation)	Designer	Design stage	Versions of facility titles and designations used in documents of the Company and other organizations	Status of the facility for the ESIA process			
					IFC criteria of associated facilities			Conclusion
					Not funded as part of the Project	Would not have been constructed or expanded if the Project did not exist	Facilities without which the project would not be viable	
INK Gas Programme Phase I								
I.1	Pipeline system for transportation of products of processing of natural gas and associated petroleum gas from Yaraktinsky OGCF, Markovsky OGCF to Ust-Kut. Stages 1 & 2 (design sections 1050, 1050.1...1050.6, 1050.2017)	PAO UKRNGI	Design is developed. Facility is constructed and put into trial operation in 2018	Product pipeline Interfield pipeline "Markovsky OGCF - Ust-Kut switching station"	√	X	√ Stage1[39] X Stage2	Impact of the facilities is considered by the assessment of cumulative effects
I.2	Liquefied petroleum gas reception, storage and offloading terminal. Code 9311-ИНК-СУГ[40]. Stages 1 and 2.	Irkutsk Research and Design Institute of Chemical and Petrochemical Engineering (IrkutskNIIhimmash)	Design documentation was prepared in 2016 and approved by the State Expert Review Board in 2017. Project Stage 1 consists of two commissioning packages (CPs): - CP1 with LPG tank capacity of 2400m^3 was implemented and commissioned in 2018; 70 thousand tons of propane/butane mix and 87 thousand tons of SGC were offloaded to customers by the end of year 2018 (transportation by road and railway); - CP2 with further LPG tank capacity of 2400m^3 is under construction; commissioning is expected in 2019 Stage 2 (future) provides for further extension of the LPG tank farm by 4800m^3	LPG Terminal. LPG RS&O terminal. LPG transferring facilities	√	X	X	Impact of the facilities is considered by the assessment of cumulative effects
INK Gas Programme Phase II								
II.1	Liquefied petroleum gas reception, storage and offloading terminal (extension). Stabilised gas condensate reception, storage and offloading terminal. Stage 1 (design package 1150.4/1) Ditto Stage 2 (design package 1150.4/2) Ditto Stage 3 (design package 1150.4/3)	PAO UKRNGI	Stage 1 design documentation was prepared in 2018. The design documentation package and survey reports for Stage 1 are currently under review by the State Expert Review Board. Design development for Stages 2 & 3 is in progress. Construction completion is planned in 2020.	SGC Terminal. SGC commercial product base. SGC RS&O terminal.	√	X	X	Impact of the facilities is considered by the assessment of cumulative effects
II.2	Ust-Kut gas fractioning unit	YUZHNIIGIPROGAS Institute	Design is developed. Approval from the State Expert Review Board and the construction permit are in place. The facility operator is Ust-Kut GPP, LLP. The GFU products include ethane fraction which will be used as a feedstock for the PPF. Meanwhile, NGL ethane will not be fed to the GFU before IPP is put into operation.	GFU. UKGFU Ust-Kut GPP	√	X	√ Stage1 X Stage2	Impact of the facilities is considered by the assessment of cumulative effects
INK Gas Programme Phases III and IV								
III.1	Irkutsk Polymer Plant. Stage 1: Ethylene unit (650,000 tpa) Polyethylene Unit Butene-1 Unit	General Designer - NEFTECHIMPROJECT, CJSC Designer - Toyo Engineering Corporation	Feasibility studies, technical and budget quote. Process technologies are selected. Design concept development (code 70605-П-000-П3) was completed in 2018. Completion of FEED is planned in 2019.	IPP. Ust-Kut Polymer Plant. Polymer Production Facility. In some documents is referred to as "INK Gas Chemical Integrated Plant". Consists of two operation areas - upper (the main one) and lower (logistics).	X	√	√	Project component
III.2	Irkutsk Polymer Plant. MEG Plant: Methanol unit Air separation unit Conversion, gas purification and hydrogen/carbon oxide separation unit Dimethyl oxalate unit MEG unit	General Designer - NEFTECHIMPROJECT, CJSC Designer and licensors to be appointed on competition basis	Design concept development (code 70605-П-000-П3) was completed in 2018. Feasibility studies have been completed. Completion of FEED is planned in 2019. The Company is reviewing the main process technologies. Project concept development is in progress.	Irkutsk Gas Chemical Integrated Plant (IGCP). MEG Plant. Designed location is beside the IPP facilities, to shape a common operation (upper) area with shared process piping. Most probably, the	X	√	√	Project component

[39] Hereinafter, IPP Stage 1 means construction and operation of the ethylene, polyethylene and butene-1 units, IPP Stage 2 means construction and operation of the MEG Plant

[40] Facilities associated with the LPG Plant are the temporary accommodation facilities, access railway and motor roads, quarries for production of soil-based construction materials, water supply/drainage and power supply facilities, other permanent and temporary facilities, most of which the Company currently operates. In addition, INK has a functioning office in Ust-Kut city (a detached office building at 6, Kalinin Street). A Service Centre supported by the Company was established in 2019, for maintenance of components of centrifugal pumps used in oil and gas wells.

No.	Official title (designation)	Designer	Design stage	Versions of facility titles and designations used in documents of the Company and other organizations	Status of the facility for the ESIA process			
					IFC criteria of associated facilities			Conclusion
					Not funded as part of the Project	Would not have been constructed or expanded if the Project did not exist	Facilities without which the project would not be viable	
				logistics (lower) area will be individual				
III.3	Construction of Irkutsk Polymer Plant offsite facilities and construction camp, and rationalization of inter-site communication lines within the Ust-Kut industrial area of INK	NEFTECHIMPROJECT, CJSC	Design concept was developed in 2017. Completion of FEED is planned in 2019. Preparation of design documentation is in progress.	Shared facilities for the whole IPP	X	√	√	Project component
III.4	Construction of water supply and drainage facilities for Irkutsk Polymer Plant, construction of construction camp and personnel accommodation facilities of Irkutsk Oil Company	NEFTECHIMPROJECT, CJSC. Design subcontractor - EASTECOIL, LLC	Design concept was developed in 2017. Completion of FEED is planned in 2019. Preparation of design documentation is in progress. Water intake wells will be constructed in the Polovinnaya River valley. Ground water will be transported by pipelines to water treatment facilities and then to the IPP site. Treated effluent will be discharged to the Lena River or Polovinnaya River (final decision is pending).		√	√	√	Associated facilities
III.5	Interfacility road	NEFTECHIMPROJECT, CJSC. Design subcontractor - VostSibTransProject, CJSC	Design stage. Scheduled for commissioning by end of year 2020. Status of FEED is to be clarified	IPP access road (Option 1 - routed around Cape Tolsty on its southern and western slopes, Option 2 - around the eastern side of Cape Tolsty)	√	√	√	Associated facilities
III.6	Section km19+300 - km20+500 of the Vilyui A-331 road Tulun - Bratsk - Ust-Kut - Mirny - Yakutsk to enable transportation of large and heavy equipment to the future construction site of the Irkutsk Polymer Plant in Ust-Kut city	NEFTECHIMPROJECT, CJSC. Design subcontractor - SibProjectNII, LLC	Design and detailed design documentation was prepared in 2018 and has been approved by the State Expert Review Board. The works are in progress (TBC)	Rehabilitation of Vilyui A-331 road section	√	√	√	Associated facilities
III.7	Large equipment unloading berth on the Lena River	NEFTECHIMPROJECT, CJSC. Design subcontractor - SIBRECHPROJECT, CJSC	Design concept was developed in 2018 (code 022-2018-00-OTP). Survey activities are planned for 2019.	Berth Berth facilities	√	√	√	Associated facilities
III.8	Power supply system for the Irkutsk Polymer Plant of INK	NEFTECHIMPROJECT, CJSC. Design subcontractor - BELNIPIENERGOPROM, RUE	Design concept is developed. FEED survey is in progress (scheduled for completion in 2019). Scope of the project: boiler house, water treatment unit, natural gas pre-treatment unit, main step-down transformer substation	In some documents, boiler house is referred to as "CHP". Its details in the design concept documents is outdated	X	√	√	Project component
III.9	Power supply for the Irkutsk Polymer Plant (title TBC)	NovosibirskStroyKompleks-Project (NSK-PROJECT), LLC The designer's activities are supervised by the Energy Department of INK	Design documentation development is in progress. The project consists of two commissioning packages: 1 - substation PS-220kV Polimer capacity 150 MW to be constructed specifically for IPP at the main site of the plant; 2 - two-line power transmission line 220 kV from substation PS-500 to PS-220kV Polimer (in the design documentation referred to as "VL-220kV Ust-Kut - IPP No.1" and "VL-220kV Ust-Kut - IPP No.2". Substation PS-220kV Polimer will be commissioned in two stages: 30 MW in 2020 and 120 MW in 2023 (target combined capacity 150 MW). The general technical design of IPP provides for implementation of substation PS-220kV Polimer as two sections to be constructed at a common site, with one power transmission line VL-220 kV connected to each section		Substation PS Polimer: X Power transmission line VL 220 kV: √	Substation PS Polimer: √ Power transmission line VL 220 kV: √	Substation PS Polimer: √ Power transmission line VL 220 kV: √	PS Polimer is a Project component. Offsite two-line VL-220kV from PS 500/220kV to PS Polimer is an associated facility.
III.10	Compressor station for transportation and reinjection of dry stripped gas (DSG) at Markovsky OGCF (design package 436/18-09/16.КС-МНГКМ)	Gaztranzit, LLC	The projects are implemented as part of development of respective fields. Planned commissioning times of the compressor stations at Yaraktinsky and Markovsky OGCFs are 01.06.2020 and 05.03.2021, respectively		√	X	√	Impacts of the two compressor stations are considered in the design documentation for the respective field facilities
III.11	Compressor station for transportation and reinjection of dry stripped gas (DSG) at Yaraktinsky OGCF (design package 297/19-09/16.КС-ЯНГКМ)				√	X	√	
III.12	Gas pipeline Yaraktinsky OGCF - Markovsky OGCF to Ust-Kut city (design package No.1117. Code 1117-ПП-001.000.000)	PAO UKRNGI	The gas pipeline is intended for DSG transportation from the fields to the Ust-Kut industrial area of INK. Three design options are considered for the	For Option 1 - Gas pipeline "Switching station	X	X	√[Stage2] X[Stage1]	Impact of the facilities is considered by the

No.	Official title (designation)	Designer	Design stage	Versions of facility titles and designations used in documents of the Company and other organizations	Status of the facility for the ESIA process			
					IFC criteria of associated facilities			Conclusion
					Not funded as part of the Project	Would not have been constructed or expanded if the Project did not exist	Facilities without which the project would not be viable	
			pipeline, each comprising line facilities with service driveways and on-site facilities along the route. All route options will have the gas distribution station (GDS) in the area of Ust-Kut city as their terminal point. The GDS functions include inter alia gas supply to industrial customers and households within the urban district (about 20% of the total volume of gas transported by the GDS pipeline). The main design solutions were developed in 2018. No design survey activities have been conducted. Decisions about the volume of gas to be transported and hence the pipeline diameter are pending. These parameters will inform identification of the width of land strip to be allocated for the project. There is a chance that no increase of I.1 corridor will be needed	(Verkhnemarkovo vil.) - GDS Ust-Kut". For Options 2 - As above, plus gas pipeline "Yaraktinsky OGCF - Switching station (Verkhnemarkovo vil.)". Alternative designation of the project - methane pipeline YOGCF - MOGCF - Ust-Kut city				assessment of cumulative effects
III.13	Accommodation facilities for 700 persons in the Ust-Kut industrial area of INK	Tender documentation is being prepared for selection of engineering, construction and procurement contractor. The facilities will be located outside the standard SPZ of IPP, but within the existing land allocation		Temporary accommodation facilities for 7000 persons will operate during the period of IPP construction. (included in item III.3). The III.13 accommodation facilities will be used after IPP commissioning for operation	X	√	√	Project component
III.14	INK residential quarters for 3000 persons in Ust-Kut city	NII Zemlya i Gorod, LLC (Nizhny Novgorod)	The facilities are intended for accommodation of personnel employed by the IPP operating organizations. Feasibility studies are being conducted with expected time of completion by 15.07.2019. Three main location options have been considered for the residential quarters: 1) in the existing Mostootryad residential area; 2) in the existing Stary REB residential area; 3) in the greenfield area adjoining the YGU residential area		√	√	X	Impact of the facilities is considered by the assessment of cumulative effects
Prospective development of hydrocarbon deposits in relation to IPP operation								
P.1	Associated petroleum gas (APG) supply from the Ichedinsky and Bolshetirsky oil fields to the gas transport system connecting the Yaraktinsky and Markovsky OGCFs with the Ust-Kut industrial area of INK (official designations have not been defined by now)	Not appointed	Licenses for development of the oil fields are issued to INK-Zapad, JSC (a joint venture of INK and Japanese companies JOGMEC[41], ITOCHU Corp. and INPEX Corp.). The Ichedinsky field is being exploited (produced oil is supplied to ESPO system by a pipeline). Geological exploration works are being conducted at the Bolshetirsky oil field. The project will require construction of APG pipelines from the Ichedinsky and Bolshetirsky fields to the gas transport system connecting the Yaraktinsky and Markovsky OGCFs with the Ust-Kut industrial area of INK	According to the existing estimations, MEG Plant is provided with dry stripped gas by nearly 100%, and the demand of the PE facilities for ethane and propane is satisfied by the fields operated by INK (Yaraktinsky, Markovsky) till year 2030.	√	X	√ Stage1 X Stage2	Impact of the facilities is considered by the assessment of cumulative effects

Source: Ramboll CIS, based on INK materials

[41] Japan Oil, Gas and Metals National Corporation

5.9 Project Timeframe

At the time of this ESIA Report, the Project activities of Irkutsk Oil Company were focused on finalization of basic design, arrangement of the second stage of engineering surveys, preparation of design documentation, and preliminary engagement of the Project stakeholders.

According to the Programme shown in Figure 5.6, INK plans to complete the Plant design activities by the beginning of 2020, and to submit the documentation package for the Environmental Expert Review. Approval by the Stage Expert Review (SER) Board is expected in QIV 2020. Preparatory activities at the construction site were initiated in January 2019. The main construction period is planned during 2019-2022 and the project commissioning is scheduled for QIV, year 2023.

Project Stages		The timing of works for years and quarters																							
№	Activities	2018				2019				2020				2021				2022				2023			
		I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
1	Selection of licensors and acquisition of licenses for the main production technology																								
2	Basic Engineering Design Package, BEDP																								
3	Acquisition and supply of licensed equipment																								
4	Process Design Project, PDP																								
5	Engineering survey																								
6	Project design documentation (PD) development																								
7	Disclosure of the EIA materials and Public hearings as per Russian legal requirements																								
8	PD is reviewed by the State Environmental Review Agency																								
9	PD is reviewed by the State Review Agency																								
10	Obtaining construction permit																								
11	Detailed design documentation development																								
12	EP-contractor selection																								
13	Conclusion of a contract for the supply of oversized equipment																								
14	Manufacturing of oversized equipment																								
15	Delivery of oversized equipment to the port of consolidation																								
16	Assembling and preparation of oversized equipment for shipment from the port of consolidation																								
17	Delivery of oversized equipment by sea from the port of consolidation to the port of Tiksi																								
18	Unloading and installation of oversized equipment in the port of Tiksi																								
19	Selecting C-contractor for construction and installation works																								
20	Pre-construction activities at the PPF sites																								
21	Manufacturing of long-lead items (LLI)																								
22	Delivery of LLI, other equipment and materials																								
23	Construction and installation works																								
24	Design supervision, personnel training, site supervision, other related services																								
25	Equipment and pipes testing																								
26	Ensuring mechanical availability of PPF																								
27	Test production																								
28	Warranty run																								
29	Signing of Delivery and Acceptance Certificate, commissioning																								

Figure 5.6: Proposed timeframes of design development, construction and commissioning of the Polymer Production Facility

(information provided by the Client)

6. PROJECT ALTERNATIVES REVIEW

6.1 Introduction

The Polymer Plant Project is a part of the Gas Programme of Irkutsk Oil Company LLC which is intended to develop natural gas and associated petroleum gas production facilities, transportation and processing infrastructure of the Yaraktinsky and Markovsky oil-gas condensate fields (OGCFs), and Ust-Kut Municipality.

Gas Programme of INK is divided into four main phases:

Phase 1. Construction of on-site natural gas and associated gas preparation plants (gas processing plants). Dry stripped gas (DSG) from the plants will serve as fuel-energy resource for auxiliary needs (electricity and heat generation) of the field operations. Construction of gas transport and gas processing infrastructure, including: construction of underground pipelines and a liquefied petroleum gas storage and offloading terminal (LPG Terminal).

Phase 2. Further development of the LPG Terminal, and construction of the Ust-Kut Gas Processing Plant. During Phase 2, it is planned to increase natural gas output at the Yaraktinsky and Markovsky OFCF to 21.6 M m^3/day and implement transportation of propane/butane/gas condensate blend (natural gas liquids - NGL) for further pipeline transportation to LPG terminal in Ust-Kut.

Phase 3. Construction of the Polymer Production Facility for annual production of 650 thousand tons of polyethylene, and associated activities including:

- Conversion of the field gas processing plants and the Ust-Kut GPP for extraction of ethane;
- Development of transport system gas processing products, including unstable gas condensate (mix of WLHF and ethane);
- Conversion of Ust-Kut GPP for fractioning of ethane-rich NGL for recovery of ethane;
- Construction of auxiliary boiler house for IPP operation.

INK plans to implement Phase 3 during the period 2017-2022.

The proposed Polymer Production Facility (PPF, the Project) is intended for production of polyolefins, namely linear low density polyethylene (LLDPE) and high density polyethylene (HDPE) pellets.

Phase 4. Construction of Irkutsk Gas Chemical Integrated Plant (MEG Plant) with annual capacity of 600 thousand tons of MEG. The MEG Plant will be constructed near the Polymer Production Facility, so that offsite facilities and infrastructure can be shared. Commissioning of the MEG Plant is planned in 2024.

6.2 Economic Prospects of the Project

Discussion of the future gas transport and gas processing infrastructure development by INK was initiated back in 2014, and its prospects are instituted in the Irkutsk Region Investment Strategy for the period until 2025 (Irkutsk Region Government Decree of 28 August 2014 No. 701-rp "On approval of the "Irkutsk Region Investment Strategy for the period until 2025"".

The proposed Polymer Production Facility and MEG Plant (Phases 3 and 4 of the INK Gas Programme) are the final elements of the processing and transportation chain of the associated petroleum gas produced at the oil-gas condensate fields of INK. The APG is reach in ethane and heavier hydrocarbon fractions.

The planned product output of 650 thousand tons per year of linear low density polyethylene (LLDPE) and high density polyethylene (HDPE) can be sold in the local and international markets.

At present Russian LLDPE market is underserved. In 2015, Russia imported 200,000 tons of linear polyethylene. The large volume of LLDPE import is explained by the lack of local capacities to satisfy the growing demand of the film production industries. Despite the decline in PE film and bags output in 2017 (many large retailers supported the call of the Greenpeace to stop using disposable bags), demand for PE pipes, packaging, boxes and bulk tanks is growing.

Various economic factors of which the main one is devaluation of ruble predefine the advantages of polyethylene production in Russia, both for the local market and for export. Furthermore, when oil prices in the global markets dropped, production of petrochemical products and especially polymers became more profitable than production and sale of crude oil.

6.3 Alternatives Analysis Approach

In accordance with the Guidance Note 1 "Assessment and Management of Environmental and Social Risks and Impacts", Performance Standards on Environmental and Social Sustainability of the International Finance Corporation (IFC), requirements of the Japan Bank for Reconstruction and Development and other finance organizations, ESIA process includes examination of technically and financially feasible alternative sources of impacts, and documented rationale for the selected solutions. Analysis of alternatives is intended to optimize project solutions for the construction and operation phases, with feasible alternative project locations, designs, or operational processes. This analysis helps to appreciate environmental and social criteria at the early stages of Project development.

The alternatives analysis in this chapter is structured as an "inverted pyramid" of a series of logical steps with high level alternatives at the start and further description of more elaborated alternative solutions. Project alternatives are considered at two levels:

1. *Preliminary review of Project development alternatives in general, and selection of preferred alternative*, including analysis of the following:
   - "No Project" alternative;
   - Assessment of Project location alternatives in Ust-Kut District by the following criteria:
     i. Land use and Project facilities location feasibility;
     ii. Availability and accessibility of existing infrastructure;
     iii. Environmental aspects of the alternative locations.
2. *Analysis and selection of technical alternatives for the selected Project option,* including consideration of alternatives for:
   - Feed streams arrangement;
   - Power supply schemes;
   - Water sources and water supply.

6.4 Preliminary Project Alternatives Review

6.4.1 "No Project" alternative

The "No Project" alternative means that the Project will not be implemented. This alternative will have the following consequences:

- Valuable components of natural gas, primarily ethane, will not be processed and instead will be reinjected into formation together with associated petroleum gas in accordance with the current practice, or will be partially flared. Such practice results in wastage of valuable resource, economic loss for the Company, and additional impacts on air, soil and ground water;
- Gas chemical products, primarily polyethylene, will not be produced, resulting in need to import polyethylene for the growing Russian market. This option further means lost opportunity to create high added value through processing of the valuable natural resource;
- The infrastructure development program in the north of Irkutsk Region will not be fully implemented, with consequential negative impact on the planned economic growth of not only Irkutsk Oil Company, but also other companies, due to the lack of multiplier effect in absence of the investment;
- No new jobs will be created in Ust-Kut District and other districts of Irkutsk Region, which is a clear negative factor for the region's socio-economic development;

- Public budgets of Irkutsk Region and Ust-Kut District will not receive additional revenues from the direct and indirect tax returns, thus the growth of social standards of living will largely depend on subsidies from the federal budget.

Without construction of the proposed Polymer Plant, anthropogenic impacts in the Project area and the extent of man-caused transformation of the environment components will remain at the current level which is characterized in Chapters 7 and 8, including the negative impacts associated with partial flaring of associated gas. In addition, selection of the "No Project" alternative will have significant economic losses, whereas implementation of the Project will produce benefits in terms of economic and social development of Irkutsk Region and RF in general.

6.4.2 Project location alternatives

The pre-design stage of the Project was focused on two main options for location of the Polymer Plant. Both sites are located in designated forest areas on the left bank of the Lena River. One site is on Cape Tolsty, 1 km from the water line, to the east of the gas pipeline between the INK fields and Ust-Kut city. The other site is located at a distance of 4.5 from the water line of the Lena River, to the west of the gas pipeline. Both sites are leased by INK for 49 years.

Selection of the preferred location of the plant took into account the following circumstances:

- Proximity of the Polymer Plant site to other components of INK gas complex, primarily the gas processing plant;
- Proximity of the Polymer Plant to the finished product (polyethylene) loading facilities, most importantly the distance to the nearest railway line;
- Distance from the Polymer Plant site to the Lena River being the source of technical water supply and receiver of treated wastewater;
- Activities of other companies that can influence the Polymer Plant construction plans;
- Presence of designated natural reserves, historical and cultural heritage sites, other use-restricted zones.

The land plot on Cape Tolsty is more attractive, due to its optimum location close by other components of INK gas facilities, the railway and the Lena River (about 1 km to the nearest boundary of the main operational site). However, this plot is located within the forest belt along the Lena River designated for protection of spawning areas and conservation of valuable species of fish. Furthermore, the protective forests are important element of the ecological framework that supports biodiversity.

The key distinctive feature of the second (alternative) site which is located 2-3 km to the north-east of Cape Tolsty and 4.5 km from the water line of the Lena River is the category of land – the site is located in merchantable forest land which is not designated as natural reserve. This site has been selected for construction of the Facility, not least in relation to minimization of impact on sensitive designated spawning-protection forests.

Certain facilities of the Project and associated facilities will be located separately from the main operational site. The product storage and loading facilities (operational area 2) will be located within the existing transport corridor of the federal road A-331 "Vilyui" and access railroad. The water intake facilities will be located on the bank of the Lena River, on the southern side of Cape Tolsty. Proposed location of the two relatively small sites is in residential lands (Ust-Kut urban settlement). Both land plots have been leased by INK, for the respective permitted use. The treated waste water discharge pipeline will approach water line of the Lena River at the site of water intake facilities, thus no further land allocation is required. Land allocation in the Polovinnaya River valley will be needed for drilling of a drinking water well.

6.4.3 Analysis and selection of technical alternatives

6.4.3.1 Feedstock composition

In the situation of overall lack of basic data about the nature of proposed operations, technologies and feed streams, the Client provided tentative information about material composition options of feed gas for the ethylene plant. In the first case the feed gas will be 100% ethane. Ethane and propane mix with the ration of 70/30% is considered for the second case. In the context of assessment of environmental impacts of the proposed operations, feed gas composition data is a required input for air emissions model. In particular, gas density is a parameter included the ratios which are used for emissions calculations.

Along with the feed flows, the Client is also considering different options of power and water supply schemes for the future operations.

6.4.3.2 Power supply

Options considered for power supply for the Polymer Production Facility included construction of a CHP with rated capacity of 100 MW using dry stripped gas as fuel, or arranging power supply from the existing grid of the Irkutsk power supply company.

Due to the inevitable environmental impact of CHP construction and operation, it has been decided to rely on the existing grid for power supply. To ensure reliable supply of power, it is planned to construct a two-line power transmission line 220 kV from substation PS-500 to substation PS-220kV "Polimer", with the first block scheduled for commissioning in 2020.

6.4.3.3 Water supply and waste water disposal

Water supply

The following water supply solutions have been considered to serve needs of the Polymer Production Facility:

- connection to municipal water network of Ust-Kut city or water delivery by road tankers;
- ground water intake at the adjacent LPG facilities of INK, with delivery of artesian water by road tankers;
- construction of water intake wells in the Polovinnaya River, with pipeline transportation of water to treatment facilities and further to the Project site;
- surface water intake (from the Lena River), with construction of the intake facilities and pipelines.

The main option implies a combined solution with potable water supply for consumers on the plant site from ground water intake facilities in the Polovinnaya River valley, and technical water sourced from the Lena River and treated before use as required. The ground water intake at the LPG site is designed for 20-30 service life, and its resource can be used to a limited extent, to supply water for certain consumers at the Project construction stage.

According to the documents provided by the Client, water supply system for the Polymer Plant can use river water abstracted at two points located at a distance of 650 m from each other. Various abstraction schemes are being considered: filter wells or infiltration tube collectors, 1st lift pumping station with "dry" or "wet" pump sump.

The main preferred option which is recommended by the design institute is based on underflow filtering intake structure and a 1st lift pumping station in a leak-proof tube shaft with axial pumps. The key advantages of the selected option are described as follows:

- suitability of the scheme for shallow rivers which are covered with thick ice in winter;
- absence of protruding structural elements in the river channel, hence no obstructions for navigation;
- no risk of structural damage in case of ice jamming.

Wastewater disposal

At the current stage, wastewater disposal system of the Polymer Production Facility is designed as a four-loop system with separate collection of sanitary effluents, industrial wastewater, storm and industrial-storm wastewater and combined treatment of sanitary, industrial and industrial-storm wastewater at the Wastewater Treatment Facilities to be constructed at the technological site of PPF. Stormwater after mechanical treatment will be directed to the process water supply system. A mixture of treated industrial, industrial-storm and sanitary wastewaters will be used to feed the recycled water system.

Excess effluents treated to the fishery standards will be discharged into a surface water body. Currently, two possible receivers of treated wastewaters are being considered - the Lena River, or its first-order tributary - the Polovninnaya River. The final decision will be made at the next design stage.

Operating Polymer Production Facility will generate waste water with high mineral content (highly-mineralized waste water, HMWW) with the average flow of 5 m^3/h and salinity of 300 g/l. Due to its inherent properties, HMWW cannot be feasibly reused or discharged to surface water bodies, therefore, the Company considers HMWW as industrial liquid waste which is subject to recycling, decontamination and disposal. At present, several options are being considered for recycling of HMWW (Table 6.1).

Table 6.1: Main alternatives for recycling of highly-mineralized waste water

Item No.	Recycling options	Benefits	Disadvantages
1	Transportation of liquid HMWW to the field by pipeline or road, and injection into oil formation.	Water saving from use of pre-treated waste water to increase reservoir recovery rate	Technical complexity and high cost, due to significant volumes of waste water and long distance to the fields (about 200 km)
2	Concentration of HMWW by boiling off to 40 m^3/h followed by transportation to the fields and injection into oil formations	Reduced volumes of river water abstraction, as purified water from the HMWW treatment will be recycled as makeup for the water recycling system (WRS)	Cost of HMWW boiling off, additional emissions to air from burners
3	HMWW concentration for subsequent production of sodium bicarbonate (baking soda)	Reduced volumes of river water abstraction, due to recycling of purified water from the HMWW treatment in the WRS Production of valuable product	Cost of HMWW boiling off, emissions to air from burners
4	Complete boiling off of HMWW and burial of solid waste (salt) at specialized landfill	Reduced volumes of river water abstraction, due to recycling of purified water from the HMWW treatment in the WRS	Cost of HMWW boiling off, emissions to air from burners Specific measures to be applied to mitigate environmental impact of the specific waste disposal site

From the perspective of Russian law, all proposed methods of recycling are acceptable. Injection of highly-mineralized water into oil formation is allowable provided that wastewater is pre-treated for compatibility with formation water. It must be noted that discharge of highly-mineralized waste water into surface water bodies will be prevented no matter which of the above options is selected.

7. BASELINE ENVIRONMENTAL CONDITIONS

7.1 Climate and Atmospheric Air

With regard to its climatic conditions, the territory of Irkutsk Region differs from other regions of the country located at the same latitude, but in the European part of Russia or in the Russian Far East. Due to the location of this territory far from any sea and in the central part of Eurasia, the climate is extremely continental and harsh with long winters with little snow and warm summers with abundant rains. A specific feature of this region is irregular permafrost occurrence of island type. Sharp variations of ambient air temperature from month to month, from day to day and within one day are possible during any season of a year.

During the cold period of a year, the climatic conditions are dependent on the influence of the Asiatic anticyclone associated with intrusion of cold Arctic air masses moving southwards from the Kara sea or from the central part of the Arctic region. During the warm season the air circulation conditions are substantially different due to the fact that the huge territory of Asia is warmed to a significant degree and atmospheric air pressure decreases. A high amplitude of the ambient air temperature variations in the Arctic zone and the warm air masses above the continent facilitate development of cyclonic activity in the north of the territory. Formation of cyclones is especially probable during the second half of summer, i.e. during the period of the maximum annual air temperatures.

7.1.1 Radiation factors of the climate

Solar radiation as one of the climate-forming factors is dependent to a significant degree on the air mass circulation and specific features of the Earth's surface relief. The Project area has a rugged topography with alternation of high mountainous plateaus and ridges, on the one hand, and deep river valleys, on the other.

The annual sunshine time is 1,822 hours[42] (Table 7.1.1). The sunshine duration decreases in winter, which is attributed to a shorter daylight time.

Table 7.1.1: Average duration of periods with sunshine, hours/year

I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
29	88	171	216	246	288	296	216	143	75	42	12	1822

The highest monthly number of sunshine hours is recorded in May-July and the minimum number in December. In spring, monthly number of sunshine hours is by 1.5 to 2 times more than in autumn, which is due to the high degree of cloudiness during the autumn period. The sunshine duration decreases in the vicinity of Ust-Kut due to cloudiness on average approximately by as much as 45%.

According to the data reported by the actinometric station of Ust-Kut, the annual short-wave radiation inflow is as high as 4,390 MJ/m2; the sunshine time is 1,763 hours. During 76 days per year there is no sunshine due to cloudiness. The annual radiation balance varies close to the level of 1,400 MJ/m2; during the period from November through February it has a negative value with a minimum in January and a maximum in July.

7.1.2 Ambient Air Temperature

Climate in the Project area is extremely continental, with harsh winter and short summer. The intermediate seasons are short and with significant daily ambient air temperature variation amplitudes. The annual and daily air temperature variation ranges might exceed 80°C and 30°C, respectively. The difference between winter and summer air temperatures and the daily and night air temperature increases from south to north.

[42] Climate Reference Book. Multiannual Data. Parts 1-6. – Leningrad, Hydrometeoizdat, 1991.

According to the data obtained at the Ust-Kut weather station located in the vicinity of the Project area, the average multiannual ambient air temperature is −2.3°C (Table 7.1.2). The absolute maximum temperature was recorded in July and reached +38°C. The absolute minimum temperature was recorded in January and is as low as −52°C. This means that the amplitude of the absolute temperatures variation is 90°C.

Table 7.1.2: Average monthly and average annual ambient air temperatures, °C[43]

I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
-24.9	-20.2	-9.4	0.9	7.8	16.1	18.1	14.7	7.1	-1.6	-13.7	-22.1	-2.3

The cold season with average daily air temperature below the freezing point starts during the second 10-day period of October and lasts for approximately 7 months. Intensive radiation cooling under the Asian anticyclone conditions results during the third 10-day period of December in persistent frosts below −25°C lasting until March. The coldest month is January with average monthly air temperature of −24.9°C. The period with persistent frosts, when average daily air temperature is not above −10°C lasts for 144 to 161 days.

An increase in the ambient air temperature in the course of the annual cycle takes place from March to April. Combination of frequent night frosts and intensive rise of the day temperature is reported during the last 10-day period of April – the first 10-day period of May.

The summer season begins in late May and lasts until September. Average monthly air temperature reaches its maximum in July (−18.1°C). However, along with high daytime temperature, light frosts (-1°C) might occur during nighttime. Average daily air temperature varies within a rather wide range due to varying terrain. For example, the temperature difference between gentle (slope less than 10 degrees) mountain slopes exposed northwards and southwards might be 2°C to 4°C and even more on steeper slopes.

The first night frosts are reported in late August; in river valleys in early September. Average monthly air temperature in autumn is above the freezing point. The least amplitude of ambient air temperature variations is reported in autumn. Autumn frosts are reported on average during the second 10-day period of September, but in some years they are possible in the middle of August or in late September.

7.1.3 Soil Temperature and Soil Freezing Depth

Annual soil surface temperature variations follow a pattern similar to that of the ambient air temperature. The minimum soil surface temperature is reported in January and is as low as −36°C, and the maximum temperature is in July (+41°C). The multiannual average soil surface temperature is −4°C (Table 7.1.3).

Table 7.1.3: Average monthly, maximum and minimum soil surface temperature, °C [44]

Soil surface temperature	Month												Year
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
Moderate	-29	-25	-16	-3	10	20	22	18	-	-2	-16	-27	-3
Average maximum	-23	-16	-2	7	24	38	41	35	22	5	-10	-21	8
Average minimum	-36	-33	-26	-12	-1	7	11	9	9	-7	-23	-33	-12

Permafrost ground is one of the most important natural factors influencing the drainage system formation of the subject area. The seasonally thawed ground thickness is dependent on heat exchange between the

[43] Unless indicated otherwise, the data here and below is based on information from the Ust-Kut weather station of 2006-2016.

[44] Data from the Kirensk weather station.

ground and the atmospheric air and is determined both by the latitude of a specific locality, and by combination of physical geographical factors as a whole. The seasonally thawed ground thickness varies from 0.5m to 5m. Due to the relatively large thickness of snow cover and low ambient air temperatures in winter, ground is subjected to significant seasonal freezing. The permafrost ground thickness might reach 25 m and is distributed in river valleys in an irregular manner of island type, as well as in swampy areas and on mountain slopes exposed northwards.

The normative ground freezing depth in area free of permafrost ground is as follows:

- Sandy silts and clays 2.47 m;
- Silty sands and sands 3,01 m;
- Gravelly sands and sands of medium grain size 3.22 m;
- Coarse detrital ground 3.65 m.

The climate change in Eastern Siberia is associated with a decrease in the ice cover thickness on minor and medium-size rivers, deeper ground freezing of permafrost ground and swampy areas, as well as with release of greenhouse gases, especially methane, which can result in turn in a local increase in the subsoil temperature[45].

7.1.4 Moisture Conditions

7.1.4.1 Relative Air Humidity

The Project area belongs to a zone with sufficient and excessive moistening conditions. Average annual relative air humidity varies from 61% to 80%. The high air humidity is attributed to low ambient air temperatures in winter and to abundant atmospheric precipitation in summer. In spring, relative air humidity decreases and reaches its minimum values in April-May. The highest air humidity values are reported in November-December. Average relative air humidity of the warmest and coldest month of the year is 73% and 79%, respectively.

The relative air humidity values recorded at the Ust-Kut weather station are summarized in Table 7.1.4.

Table 7.1.4: Average monthly relative air humidity, %

I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
79	76	70	62	61	65	73	77	77	79	80	80	73

7.1.4.2 Precipitation

Precipitation conditions in the Project area are determined by the atmospheric circulation conditions, the geographic location and specific features of the Earth's surface relief. Western air mass streams, not infrequently causing abundant atmospheric precipitation, prevail in the subject area throughout a major part of the year. Most of the precipitation caused by the cyclonic activity is reported during summer period. A significant part of precipitation is recorded on windward slopes and in the water divide part of mountain ranges located in the way of air masses. The influence of windward slopes extends also to the adjacent areas. The precipitation intensity at the leeward side is less significant.

The average multiannual precipitation rates vary from 300 mm to 500 mm (Table 7.1.5). They are not uniform throughout the year; about 65% to 70% of the annual precipitation is recorded during the warm season. The annual maximum is reported in July (an average of 86.7 mm). Not infrequently, rains are accompanied by thunderstorms; their duration is short, but the intensity is rather high. Hailstorms are also possible. The minimum precipitation rate is reported in March (up to 12 mm).

[45] Dzhamalov R.G., Potekhina E.V. Natural climatic and anthropogenic causes of changes in the underground discharge in the Lena river basin. Geological cross-section. - 2010. - No. 1. - P. 1-25.

Table 7.1.5: Average monthly and average annual precipitation rates, mm

I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
17.8	13.8	11.6	18.0	32.8	46.4	86.7	61.5	28.3	28.6	24.2	21.4	391.0

First rainfalls are reported in spring, in late April – early May and last for approximately 10 to 20 days. First snowfalls are reported in autumn, in late September – early October. In spring months longer periods of mixed solid and liquid atmospheric precipitation are reported. In April, 10 to 20 days after the first snowfall, a consistent snow cover forms, which persists for 7 to 8 months, i.e. for up to 260 to 280 days (Table 7.1.6). The dates of snow cover formation and disappearance are dependent on the altitude and the latitude of a particular locality, as well as on the exposure of mountain slopes.

Table 7.1.6: Snow cover formation and disappearance dates[46]

Snow cover formation date			Persistent snow cover formation date			Snow cover disintegration date			Snow cover disappearance date			Length of the period with snow cover, days
Average	Earliest	Latest	Average	Earliest	Latest	Average	Earliest	Latest	Average	Earliest	Latest	
10.X	1.IX	5.XI	22.X	3.X	26.XI	25.IV	9.IV	10.V	1.V	9.IV	25.V	192

The snow cover is on average 30 cm to 50 cm thick. Its maximum thickness is reported from late February through March. An increase in the snow cover thickness throughout the winter is dependent on the precipitation rate and snow distribution by wind. In areas protected against wind the snow cover thickness is normally larger by 5 cm to 15 cm as compared to open spaces, from which snow is blown away.

A characteristic parameter of snow cover in the subject area is low snow density, because most frequently the precipitating snow is dry and is compacted during the winter only to some insignificant degree. By the time when the snow cover begins to melt the snow density does not exceed 0.16-0.18. The largest water reserve of the snow cover is reported in March (up to 90 mm).

7.1.5 Wind Conditions

Westerly transfer of air masses prevails in the Project area throughout the year and it is especially intensive from April through October, when warm and humid air masses move from west and south-west. Seasonal changes in pressure fields determine the wind conditions in the subject area, but specific features of the ground relief introduce certain variations. In winter, redistribution of atmospheric pressure fields facilitates development of southerly, south-westerly and westerly winds. In summer, due to the opposite position of the baric systems, northerly, westerly and north-westerly directions prevail with an exception of the mountainous areas and river valleys, where the wind direction depends on the position of such areas and the degree of their protection.

The wind conditions in the Project area are characterized by moderate wind velocities with an increase in the latter during the spring-autumn period, and with a high occurrence rate of calms. Average annual wind velocity is 1.3 m/s.

South-westerly (18%) and westerly (11%) winds prevail in the subject area; calms are reported in 44% of observations. Statistical data on occurrence frequency of winds of different directions for the period of 2006-2016 is presented in Table 7.1.7.

[46] Data from the Kirensk weather station.

Table 7.1.7: Occurrence frequency of winds of different directions and calms, %

N	NE	E	SE	S	SW	W	NW	Calms
3	4	3	4	9	18	11	4	44

7.1.6 Atmospheric Pressure

The average atmospheric pressure at the level of the Ust-Kut weather station is 987 hPa; the maximum and minimum values are 996 hPa and 976 hPa, respectively. Average monthly atmospheric pressure values are presented in Table 7.1.8 below.

Table 7.1.8: Average monthly atmospheric pressure, hPa

I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
996	994	990	984	981	977	976	980	986	988	991	995	987

7.1.7 Atmospheric Phenomena

7.1.7.1 Cloud conditions

Annual variations of the cloud conditions depend on the atmospheric circulation conditions. In winter, the subject area is influenced by the periphery of the Asiatic anticyclone, resulting in low air temperatures, powerful inversions and lower moisture content of the atmosphere. In this connection, the lower cloudiness is insignificant (from 1 to 2 points in January-March), although the total quantity of clouds is virtually not inferior to that during the summer period (due to clouds of the upper and medium layers) and only slightly varying throughout the year.

The annual number of cloudy days can reach 211 days. In summer the number of days with clear sky decreases considerably as compared to the winter season. The largest number of cloudless days is reported in spring (April-May). The annual number of cloudless days with regard to general cloudiness is low, i.e. 11 days. The least number of cloudless days is reported in late autumn (September-October). The quantity of total average annual cloudiness is 7 to 7.2 points. The lower cloudiness is assessed on average as 3 to 3.2 points. The proportion of clouds in the lower layer (2km and below) in the general cloudiness is 43%: 19% in winter and 55% in summer. The number of cloudless days with regard to lower cloudiness (0-2 points) is 150-160 days; the number of cloudy days is 25 days.

7.1.7.2 Fogs

Fog formation in the Project area is possible throughout the year. Formation of fogs, glaze and hoarfrost phenomena is caused by radiation cooling. Often frogs of continuous advective radiation type are formed as a result of daily exchange air circulation during warm months between river valleys and elevated water divide areas, above which air cools during night hours to a more significant degree. On average, the number of days with fogs varies from 44 to 74 days. The maximum number of days with fogs in an annual cycle is reported during the period of especially sharp thermal contrast between valleys and water divide areas, i.e. in July (17 days) and August (19 days). In water divide areas due to more significant heat loss as compared to valleys and in connection with a rapid increase in the thermal radiation intensity at nighttime, the fog formation processes are rather well pronounced also in September (14 days).

During the cold season, frost fogs (ice fogs) form in areas with specific landforms and under other specific physical geographical conditions at temperatures of –42°C and lower. They form due to additional inflow of moisture to the atmospheric air as a result of fuel combustion and other industrial and household activities. Stability of such fogs is attributed to powerful surface inversions, persistent low ambient air temperatures and low wind velocity. Such fogs are reported only in residential settlements and are of localized character.

7.1.7.3 Blizzards

A large number of blizzards is recorded mainly in the late autumn period (November) and early spring (March), when the Asiatic anticyclone is in the process or formation or disappearance or when rather active cyclonic activity is in progress. The average number of days with blizzards is 22 to 25 days, with an average duration of a blizzard of 4.3 hours per day with blizzard. In half of the cases, blizzards take place when the wind velocity is less than 6 m/s. Blizzards are especially hazardous at low ambient air temperatures when loose snow is readily blown by wind.

7.1.7.4 Thunderstorms

Twenty thunderstorms are recorded on average annually. Most frequently thunderstorms occur in July, but sometimes also in May and September. Associated hazardous weather phenomena include squalls often accompanying thunderstorms. Squalls are characterized by a sharp increase in wind speed up to as high as over 20 m/s and short torrential rainfall or sometimes hail and snow.

Thunderstorms in the subject area, similarly to the rest of the entire Eastern Siberia, are associated with movement of a cold air front with waves and processes of convection. The largest number of days with thunderstorms is reported in July (15 days). The average duration of thunderstorms per year is 45 to 54 hours; the longest average monthly duration of thunderstorms is typical of July (up to 18 hours).

7.1.7.5 Hail

Hailstorms are commonly reported during warm season. They are often associated with torrential rainfalls, thunderstorms, and squall wind. Thunderstorms with hail are in most cases caused by intrusion of cold air masses. Hailstones of large size are not uncommon.

Average number of days with hail is small - 0.1 to 0.6 days per months.

7.1.7.6 Disastrous Weather Phenomena

Disastrous (especially hazardous) weather phenomena are the phenomena which due to their intensity, extension and duration can inflict substantial damage and cause natural calamities.

In the Project area such phenomena may potentially include the following:

1. Wind, including squalls and tornados with a wind velocity of 25 m/s or more;

2. Heavy rainfalls with a precipitation rate of 50 mm and more during a period of less than 12 hours (30 mm in mountainous areas prone to mudslides and avalanches);

3. Heavy snowfall at a rate of 200 mm and more during a period of less than 12 hours;

4. Severe blizzards during daytime or nighttime with prevailing wind velocities of 15 m/s or more;

5. Severe frost: the absolute minimum ambient air temperature recorded during the recent decade was as low as –47.3°C;

6. Severe heat: the absolute maximum ambient air temperature recorded during the recent decade was as high as 36.7°C;

7. Heavy fogs with a visibility of 100 m or less;

8. High level of fire hazard.

7.1.8 Climatic Conditions for Construction in the Project Area

According to the construction standard SP 131.13330.2012 "Construction Climatology. Updated version of SNiP 23-01-99", the site planned for the project construction is classified as climatic sub-area 1D. The applied criteria for this sub-area are as follows: average monthly air temperature is from –14°C to –32°C in January and from +10°C to +20°C in July.

According to the zoning of the northern climatic zone, the Project area is located within a region with harsh climatic conditions. The integrated indicator K calculated on the basis of the proportion of the average monthly precipitation rate per month during the frost-free period, relative air humidity at 3:00 PM in the warmest month, average annual total solar radiation to a horizontal surface, and annual amplitude of average monthly (January and July) air temperatures permits to categorize different zones with regard to the moisture degree. The Project area belongs to the dry zone (K<5).

The basic climatic parameters recorded at the weather station nearest to the Project (Kirensk weather station) are as follows[47]:

(a) Temperature:

(a.1) Ambient air temperature

Absolute minimum temperature in winter	-54°C
Average minimum temperature during the coldest 5-day period with a probability of 0.92	-49°C
Ambient air temperature during the warmest month	+26.7°C
Maximum temperature during the summer period (dry-bulb thermometer)	+36°C

(a.2) Design conditions

Design air temperature for air cooling equipment, fans and compressors	+27°C
Design air temperature (wet-bulb thermometer) for water-cooling towers	+24°C
Design temperature for mechanical strength	-49°C
Maximum air temperature for gas turbines	+36 °C
Design maximum ambient air temperature for cables and electrical equipment	+36 °C

(b) Ambient air humidity

Maximum relative air humidity during the coldest month	80%
Maximum relative air humidity during the warmest month	73%
Relative air humidity at a maximum temperature of +35 °C	70%
Air temperatures in winter and summer at 100% ambient air humidity	
Summer	+35°C
Winter	-40°C

(c) Atmospheric precipitation, rainfall and snowfall

Average precipitation rate during November-March	92 mm
Average precipitation rate during April – October	332 mm
Maximum annual precipitation rate in the form of rainfall	424 mm
Maximum daily precipitation rate in the form of rainfall	66 mm
Maximum hourly precipitation rate in the form of rainfall	42 mm
Design rainfall intensity with a duration of 20 minutes, at P = 1 year, g-20	72 mm/hour
Maximum snow cover depth on 1 m2 of horizontal ground surface, SP 20.13330.2012	1.8 kPa

[47] Based on the parameters specified in SP 131.13330.2012

(d) Wind

Maximum of the average wind velocities in January	25 m/s
Absolute wind velocity taking into account squalls	37 m/s
Direction of prevailing winds	NW

(e) Ambient air quality

Reactivity of air in industrial zone	Low reactivity (gas group “B”) according to SP 28.13330.2012

(f) Barometric pressure

Barometric pressure at the site varying between the following values	696 and 742 mm Hg
Average annual value (for technology design)	716 mm Hg

7.2 Air Quality

7.2.1 Background

Ust-Kut is an important transportation hub and an industrial center in Siberia with a large river port (Ostrovsky Rechnoy Port Company) and a railway station Lena, part of the Baikal-Amur Main Railroad Line). The industry is represented by the oil and gas sector (Irkutsk Oil Company, Ust-Kut Neftegaz Company), logging operations (TSLK and PetroLes Companies), thermal energy and water supply (Ust-Kut Heating Networks and Boilers Company), etc.

7.2.2 Baseline Atmospheric Air Conditions

The following baseline concentrations of pollutants in the atmospheric air in the vicinity of Ust-Kut have been reported by the Irkutsk Environmental Monitoring Center, Division of the FSBI "Irkutsk Department of Meteorological Service" (Letter No.ЦМС-813 of 16.08.2017):

- Nitrogen dioxide 0.083 mg/m^3;
- Nitrogen oxide 0.043 mg/m^3;
- Sulphur dioxide 0.013 mg/m^3;
- Carbon oxide 2.5 mg/m^3;
- Formaldehyde 0.016 mg/m^3;
- Benz(a)pyrene 0.0000037 mg/m^3.

The above data demonstrate that pollution levels in air in the area of Ust-Kut city are within the permissible limits set as MPC_{20min}[48].

Survey activities in the Project area also included measurements of pollutant concentrations in air. Results of the measurements are shown in the table below.

Table 7.2.1: Results of air quality survey in the Project area

Description of pollutants	Measured concentration, mg/m^3									MPC_{20min}, mg/m^3
	T-1	T-2	T-3	T-4	T-5	T-6	T-7	T-8	T-9	
Nitrogen dioxide	0.056	0.047	0.07	0.061	0.082	0.096	0.091	0.077	0.077	0.2
Sulphur dioxide	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.5
Carbon monoxide	0.7	0.7	0.6	0.6	0.9	0.9	0.8	0.8	0.9	5.0
Particulate matter	<0.26	<0.26	<0.26	<0.26	0.28	0.26	<0.26	0.27	0.29	0.5
Alkanes C12-C19 (as C)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	1.0

Therefore, pollution levels in air meet the requirements of GN 2.1.6.1338-03 - Maximum Permissible Concentrations of Pollutants in Atmospheric Air in Residential Areas, and GN 2.1.6.1983-05 - Maximum Permissible Concentrations of Pollutants in Atmospheric Air in Residential Areas. Amendments and changes No.2 to GN 2.1.6.1338-03, and are within the permissible limits.

[48] MPC_{20min} – is one-time maximum permissible concentration of a chemical substance in the ambient air in residential areas, mg/m^3. Inhaling of air with this concentration level of a pollutant during a period of 20 to 30 minutes should not cause any reflex reactions in the human organism.

7.2.3 Atmospheric Air Pollution

Atmospheric air quality monitoring in Irkutsk Region has been performed by FSBI "Irkutsk Department of Meteorological Service in 18 cities and settlements at 36 stationary monitoring stations, but the city of Ust-Kut and other settlements in Ust-Kut District are not covered by this network[49]. Therefore, emissions data in the State Reports of the Irkutsk Region Ministry of Natural Resource and Environment (2016, 2017, 2018) are solely based on the information provided by business entities operating in the municipality. According to this information, the total quantity of pollution emissions from all reported fixed sources in Ust-Kut District (without Ust-Kut city) in 2015, 2016 и 2017[50] was 18, 58 and 64 thousand tons, respectively, i.e. about 3, 9 and 10% of the total amount of pollution emissions in Irkutsk Region. The emissions quantity has been growing as new oil-and-gas industry facilities were put into operation in the district's northern area.

Information on emission sources within Ust-Kut City is provided in the State Report 2015-2016: 20 and 24 thousand tons, respectively. The main polluters of the atmospheric air in Ust-Kut city are heat energy facilities, motor vehicles, waste disposal facilities and private housing heating systems[51]. The lack of adequate treatment of emissions from boiler houses, especially those fired by coal and woodchips, is recognised as a region-wide problem which is also present in Ust-Kut District[52].

Based on the data provided by the Baikal Authority of the Federal Service for Environmental, Technological, and Nuclear Supervision, a list of companies operating in the Ust-Kut Municipality has been drawn up, which are the main atmospheric air polluters as of 2009[53,54] (Table 7.2.2).

Even though no updated information is available, the SPZ dimensions data and description of the general contribution of industries and economic sectors to the air pollution in Table 7.2.2 is generally valid. In particular, the largest mass share of reported emissions belongs to the oil-and-gas industries, while waste disposal, transport, municipal service facilities and wood processing industries still make a significant contribution. As of year 2018, 4, 12, 113 and 26 industries had controlled sanitary protection zones with respective sizes of 1000, 300, 100 and 50 m.

It should be noted that unaccounted sources make a significant contribution to air pollution in Ust-Kut city[55], including the source nearest to the Ust-Kut industrial area of INK - the wood processing waste dump of IND Timber (former TSLK company): uncontrolled burning of the dumped wood wastes has lasted for multiple years and resulted in high concentrations of combustion products in air in a vast territory including the eastern area of Ust-Kut and designed sites of the IPP facilities (refer to Figure 7.2.1).

The above referenced support materials for the Master Plan of Ust-Kut Municipality (2018) also mention a significant but not accounted for contribution of the frequent forest fires (69 forest fires were reported in 2017) into the environmental pollution in the municipality, the lack of emission permits and SPZ design documents at many industrial sites, and presence of a significant number of permanent residents within the controlled sanitary protection zones.

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[49] Governmental Reports "On Environmental Conditions and Environmental Protection in Irkutsk Region in 2015, 2016, 2017". - Irkutsk: The Ministry of Natural Resource and Environment.

[50] The 2018 data have not been published by the time of this Report

[51] Ust-Kut City Sanitation Master Plan. Vol.1. Characterization and condition of the territory of Ust-Kut city. / Report. – Chelyabinsk: OOO Research and Production Firm 'Ekosistema', 2012.

[52] Ust-Kut Municipality Socio-economic Development Strategy for the period till 2030. Appendix 1 of the Ust-Kut Municipal Duma Resolution of 20.12.2018.

[53] Area planning. Comprehensive urban-planning assessment of the area. Vol. 2. Ust-Kut Municipality Territorial Planning Scheme. // Report. - Irkutsk: – OJSC "Irkutsk GiproDorNII", 2010.

[54] Project design documentation "Territorial Planning Scheme for the Ust-Kut Municipality, Stages 3, 4 and 5". Part 2. Project rationale. – OJSC "Irkutsk GiproDorNII", 2011.

[55] Updates for the Master Plan and Land Management and Development Regulations of Ust-Kut City Municipality. Vol. 2. Draft Master Plan amendments. Book 3. Rationale. - Design Planning Workshop "Master-Plan", 2018.

Table 7.2.2: Sector attribution of the main air pollution sources in Ust-Kut District, and standard size of sanitary protection zones of the respective industrial sites

Pollution source owner entity[56]	Sector	Gross emissions		Hazard class	Standard SPZ size, m
		tpa	%		
Ust-Kut Neftegaz, OJSC	Hydrocarbons production	2691.561	57.4	III	300-1000
Irkutsk Oil Company, LLC	Hydrocarbons production	955.163	20.4	III	300-1000
SpetsAvto, LLC	MSW transportation	430.893	9.2	N/A	1000
INK division for oil transportation, LLC	Hydrocarbons production	281.936	6.0	III	300
Siberian Forest, LLC	Wood processing	78.011	1.7	III	300
Severny Les, LLC	Wood processing			III	300
Severnoye, LLC	Wood processing			III	300
Veles, CJSC	Wood processing	N/A		III	300
Ust-Kut Les, CJSC	Wood processing			III	300
Osetrovsky LDK, LLC	Plywood manufacture			III	300
Ust-Kut subsidiary of the Road Maintenance Service Company, JSC	Transport	58.396	1.2	IV	100
INK Service, CJSC	Hydrocarbons production	40.430	0.9	III	300
Transrail, LLC	Wood processing	38.994	0.8	III	300
Lena Les Service, LLC	Wood processing	35.055	0.7	III	300
Lena division of the railway section PCh-21, East Siberian Railway Division of the Russian Railways Company	Transport	21.118	0.5	N/A	
INK NefteGazGeologia, LLC	Hydrocarbons production	17.967	0.4	III	300
Surgut Neftegaz UPRR	Exploration and production of hydrocarbons; gas processing, electricity generation	12.131	0.3	III	300
Alrosa-Terminal, OJSC	River transport	8.469	0.2	V	50
Yakurimsky RC Plant, LLC	Manufacture of reinforced concrete products	6.723	0.1	III	300
North-Baikal Electricity Supply Network ECh-10 (Zvesdnaya and Niya stations), East Siberian Railway Division of the Russian Railways Company	Power supply	6.049	0.1	N/A	
Severnaya Gruppa, LLC	Power supply	5.406	0.1		
Surgut Neftegaz Lyant VME, OJSC	Exploration and production of hydrocarbons; gas processing, electricity generation	1.862	0.0	III	300
North Baikal trucking company (Lena and Kirenga stations), East Siberian Railway Division of the Russian Railways Company	Transport	1.515	0.0	IV	100
Vostok Oil Pipeline, Subsidiary of Lena RNU, LLC	Hydrocarbons transportation	0.293	0.0	III	300
North Baikal regional communications center, Irkutsk Directory of Communications, TsSS RCS-4, Subsidiary of the Russian Railways Company	Communications	0.100	0.0	N/A	
Sibir Telekom, SP Ust-Kut CTE, OJSC	Communications	0.097	0.0		
Osetrovsky ship-building and repair yard	Maintenance and repair of vessels			III	300
Vektor, LLC	Maintenance and repair of vessels	N/A		III	300
Vita, LLC	Manufacture of dairy products			IV	100

[56] Names of the legal entities are provided as of 2009 (information source). Some of them (including Ust-Kut Neftegaz OJSC) have been reorganized and assets transferred to other companies.

Reported total volume pollution emissions in 2017 from all fixed sources in Ust-Kut Municipality is 66,973 tpa, of which 2,827 tons of pollutants were captured and neutralized, including 0,520 tons of recycled materials. 63,648 tons of pollutants were emitted to air without treatment and utilization, including 56,990 tons emitted by fugitive sources.

The atmospheric air is polluted due to release of the following pollutants:

- Fuel combustion products from boiler stations;
- Gaseous and particulate substances from different industrial processes;
- Exhaust gas from motor vehicles;
- Evaporation of storage vessels used for storage of chemicals and fuel;
- Gaseous emissions from landfills for municipal solid waste disposal;
- Dust emitted from the surfaces of quarries, dump sites, transfer, unloading and sorting of construction materials, fuel, etc.

Such factors as increasing intensity of traffic flows obsolete truck fleet, lack of detour motor roads for transit transport, poorly developed system of atmospheric air protection, insufficient quantity of instruments for exhaust gas toxicity monitoring contribute to air pollution. The high level of atmospheric air pollution in the city is attributed not only to the increasing fleet of motor vehicles, but also traffic congestion and unsatisfactory condition of the roads, congestion at road crossings and at street lights resulting in an increase in the pollutants concentrations in the ambient air in residential zones. With an increasing air pollution level, the air temperature and humidity change, resulting in intensification of cloud formation, affecting the degree of illumination and insolation parameters and intensifying the glaze formation phenomena.

The air mass motion is of special significance for the atmospheric air quality. Winds with a velocity of 2 m/s to 3 m/s prevail in the subject area. In winter and summer the average wind velocity is in the range of 0.4 m/s to 1.6 m/s. During the cold season the air self-purification processes are hindered by the anticyclone weather with low wind velocities, frequent occurrence of calms lasting for prolonged periods of time and powerful temperature inversions. The average calm occurrence frequency in the vicinity of Ust-Kut is approximately 44%. In summer, the occurrence frequency of low-speed winds decreases, but in general the self-purification potential of the atmospheric air remains low. The maximum wind velocity during a 5-year and a 20-year period of time is as high as 22 m/s and 26 m/s, respectively.

In 2014, one more atmospheric air pollution source was reported, i.e. burning dump site for wood processing wastes of the Trans-Siberian Wood Company located 5 km south-east of the city of Ust-Kut, at a distance of less than 0.5 km from western boundary of the Project site (Figure 7.2.1).

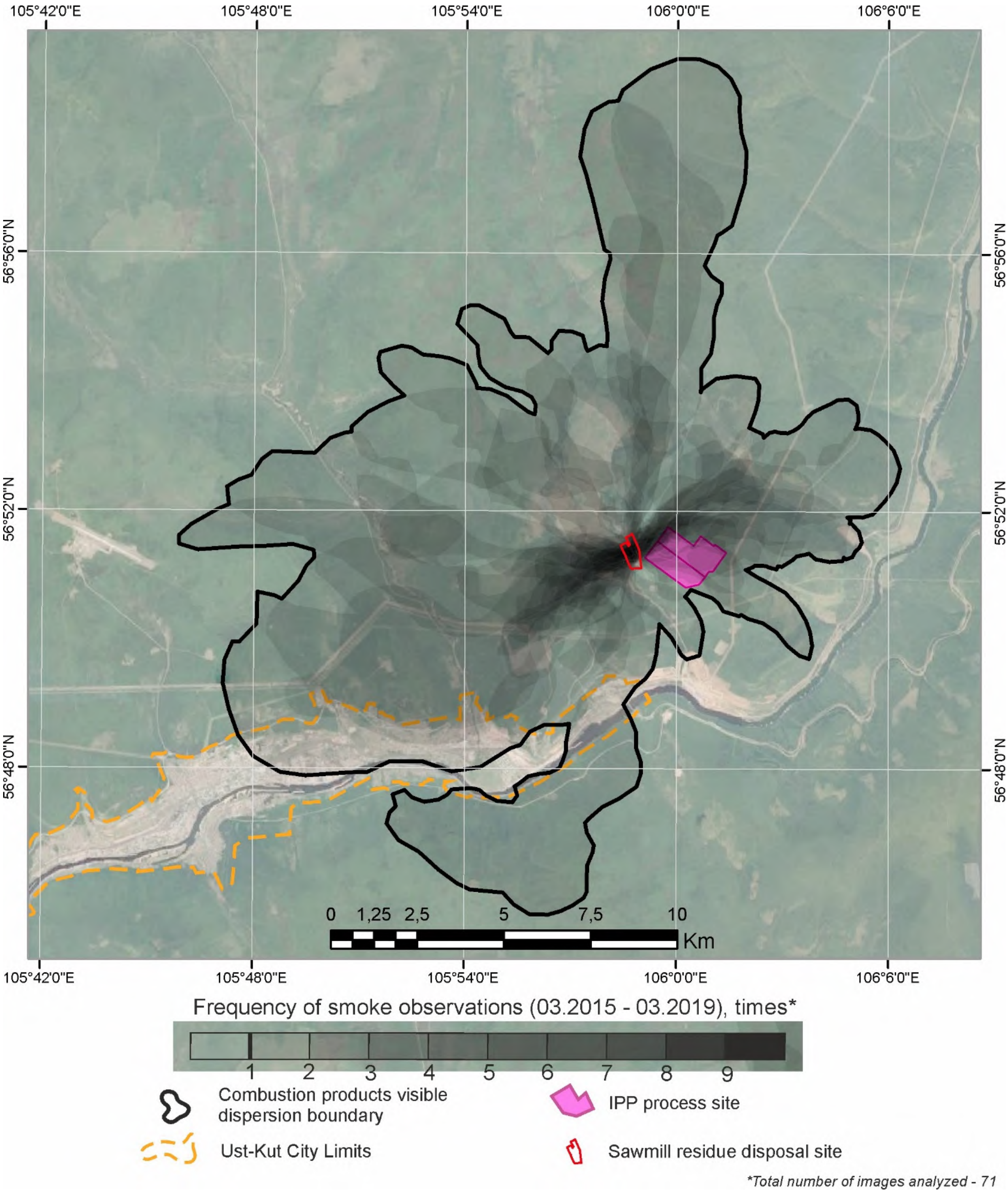

Figure 7.2.1: Wood processing dump location in relation to the Project area and Ust-Kut city, and contours of visible smoke plume

A plume of smoke from the burning dump site affects the territory of the city of Ust-Kut in case of prevailing north-easterly winds and especially heavily impacts the city districts of Mostootryad and Yakurim. Particulate matter is always present in air in the process site of IPP which is located in direct vicinity of the burning dump (Figure 7.2.2). Currently, the fire has not been suppressed and the atmospheric air quality is not being monitored.

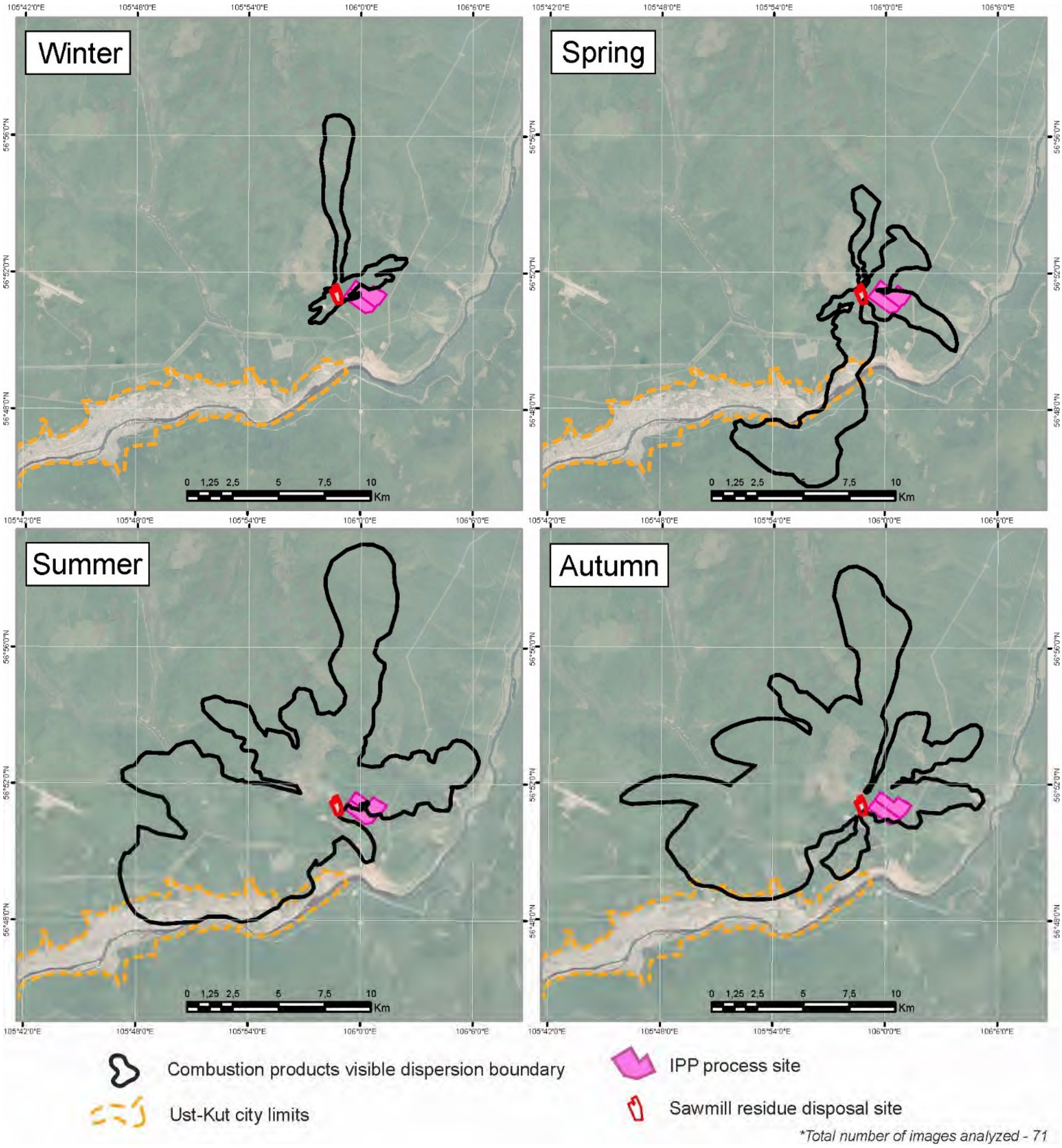

Figure 7.2.2: Seasonal patterns of combustion products spread

The use of fire wood as fuel at boiler stations, stove heating of dwellings in the private housing sector with firewood and the waste dump burning in combination with unfavorable weather conditions and the location of the city of Ust-Kut in a river valley, result in contamination of the ambient air in the city with smoke, smog formation and odour nuisance from burning and smoldering. Despite the fact that the pollutants concentrations do not exceed the respective MPC levels, the ambient air quality still remains unsatisfactory.

7.3 Harmful Physical Impacts

7.3.1 Noise and Vibration

The proposed site for construction of the Polymer Production Facility is characterized by absence of sources of continuous noise within 3 km from the main process area (Area 1).

On the other hand, Area 2 is located within the industrial hub comprising the GFU and LPG/SGC RS&O facilities. According to the territorial planning documents of Ust-Kut city and district, the following sources of noise dominate in Ust-Kut (listed in descending order of significance): motor vehicles, aircraft flight operations on ground and in air, railway transport, wood processing operations (primarily power saws). Following gradual commissioning of the GFU and LPG/SGC RS&O facilities, continuous noise sources will include the equipment and transport used for the hub operation. The seasonal noise sources related to water transport and operation of port facilities, one of which is located in the direct vicinity of the designed project area, will also contribute to the level of noise within Area 2.

No noise monitoring activities have been arranged in the city or rural settlements in the district. In the context of the proposed construction of the Polymer Production Facility, it is necessary to make allowance for potential restrictions which may be imposed in Ust-Kut city on heavy vehicles traffic at night time, such traffic being the strongest source of noise in residential areas.

According to observations made by Ramboll, the main sources of anthropogenic noise in the PPF Area 2 (refer to schematic map in Appendix 4) are:

- Federal motor road A-331 "Vilyui" (the road is routed along the contour of Cape Tolsty, in the direct vicinity of operational Area 2);
- Construction site of the GFU and LPG/SGC RS&O facilities of the Irkutsk Oil Company;
- Wood processing facilities and port of TSLK LLC;
- Access spur from BAM railroad, with warehouse facilities of Alrosa company (in the common transport corridor with federal motor road A-331, on the southern side of Cape Tolsty, along the left bank of the River Lena).

Further acoustic impacts at local level are related to operation of the service road (low traffic intensity compared to federal motor road A-331, mainly haulage vehicles).

In general, it can be concluded that no significant sources of continuous anthropogenic noise are present in the vicinity of the designed site of operational Area 1.

Designed location of operational area No.2 within the transport corridor predefines a high level of background noise from railroad and motor transport, with less significant acoustic impacts from other sources.

7.3.2 Electromagnetic fields

The nearest sources of electromagnetic fields are the 110kV and 220kV power transmission lines. Operational Area 1 has been designed to allow for the respective protection belts and sanitary buffer zones. No data is available on background levels of regulated parameters of electric and magnetic fields in the study area.

7.3.3 Radiation situation

The nearest area with proven technogenic radionuclide contamination – the site where underground nuclear explosions were conducted in 1977 ("Meteorit-4" Project) - is located at a distance of 120 km (near Verkhnemarkovo village). The chance that this contamination may affect the area of the polymer plant is zero. Published results of the regular radio-environmental monitoring within 100-kilometer zone of the explosion site indicate absence of signs of technogenic radionuclide contamination.

However, ground water in Ust-Kut is characterized by increased alpha activity, due to presence of radon. The radionuclide is a contributing factor of useful properties of the healing waters at the local health resort which is also recognized as a nature conservation area. However, radon present in ground water (including artesian water at the adjacent site of LPG Facilities and the sources used for water supply in the city) is the most significant factor of natural radioactivity at the local level and must be closely monitored.

Measurements of gamma radiation and radon flux density were arranged as part of ecological engineering survey at the site of LPG Facilities of INK in October 2013. Gamma radiation survey was conducted along lines of 5m grid.

The measured equivalent gamma radiation exposure rate was 0.09-0.14 μSv/h, i.e. below the acceptable level of 0.3 μSv/h. No local sources of ionizing radiation were identified.

Radon flux density from the earth was 37-70 mBq/(m^2s), i.e. within the acceptable range of up to 250 mBq/(m^2s). This means that no specific measures are required to protect buildings and structures against radon.

Alpha and beta nuclide activity of artesian water produced at the site of LPG Facilities is within the acceptable limits: 0.096 Bq/l for alpha activity (whereas the maximum permissible level is 0.2 Bq/l); 0.121 Bq/l for beta activity (MPL – 1.0 Bq/l).

7.4 Topography and Subsoil

7.4.1 Overall Assessment of Geological, Geomorphologic and Hydrogeological Information

Systematic studies of the geological setting of the area selected for the Irkutsk Polymer Plant (INK) were initiated in the early 1950s in connection with the need for a water supply source for the city of Ust-Kut and the growing interest for the mineralized underground water sources discovered earlier in the subject area. The drilling activities within the alluvial deposits in the vicinity of the Lena River resulted in construction of an underground water abstraction facility near the Osetrovsky river port. Geological surveys were carried out in 1963-1966 (detailed hydrogeological mapping for the purpose of water supply and prediction of the operational underground water resources), in 1973-1980 (large-scale structural prospecting surveys along the Baikal-Amur Railroad route with special attention to search for construction material resources) and in 1975-1980 (national hydrogeological and engineering geological surveys on a 1:200,000 scale).

Subsequent studies were of sporadic and non-systematic character and were carried out on requests of individual enterprises and organizations. In 2013-2018, the Irkutsk Oil Company initiated engineering geological surveys for construction needs, which were performed by OOO "INGEO" Company within the outlines of the areas selected for the Liquefied Petroleum Gas (LPG) Facilities and the Polymer Plant[57]. In addition, OOO GGK "Razdolye" Company carried out in 2014 drilling of two hydrogeological wells and prepared corresponding assessments and calculations relating to the underground water-bearing horizons at the LPG Facilities site. The assessment of the geological and hydrogeological conditions of the subject area presented in the materials of this ESIA Report is based mainly on the findings of the surveys performed by the INGEO and Razdolye Companies[58].

7.4.2 Tectonic Conditions

The tectonic structure of the subject area is determined by its location at the south-eastern margin of the Siberian Platform. The general structure comprises a foundation of the Doriphean age and a sedimentary mantle with varying dislocation degrees. The sedimentary mantle structure consists of three sublayers, i.e. subsalt, salt and suprasalt sublayers. The studies conducted in the bedrock and Quaternary rocks refer to the structural sublayer and, with regard to regional scale, to the western part of a major structure of the Siberian platform, i.e. the marginal Angara-Lena downwarp. The site selected for the Irkutsk Polymer Plant is associated with the western flank of the gently sloping syncline structure, which is a part of the tectonic Karolikhinsky rampart (swell) within the Mark-Icherskaya zone of gently sloping uplifts. A leading role in the formation of this zone belongs to the salt tectonics reported in the rocks of the halogenic stage. Salt cores have a tendency to form in central parts of uplifts and are associated with gently sloping structures of both orientations in the rocks of the suprasalt sublayer.

Tectonic dislocations with a break in continuity of upthrust displacement type up to a few tens of kilometres long have been reported along the axial parts of uplifts. The vertical amplitude of these deep-seated Precambrian structures is determined by dislocations of strata and ranges from a few tens to hundreds of meters. The survey findings have indicated that they are associated predominantly with the north-eastern part of the subject area. The largest tectonic fault nearest to the boundaries of the project area is the crush zone within which the Polovinnaya river valley is located (Figure 7.4.1).

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[57] The gas chemical complex (GCC) in the Ust-Kut District, Irkutsk Region. Findings of Engineering Surveys. Technical Report referring to the performed engineering geological surveys. Code 1127-1373-ИГИ. Irkutsk: OOO "INGEO", 2013.

Liquefied petroleum gas reception, storage and offloading terminal. Findings of Engineering Surveys. Technical Report referring to the performed engineering geological surveys. Code 2108/1-1182-13146/1-ИГИ1.1. Irkutsk: OOO "INGEO", 2014.

[58] Geological statement made on the basis of the results of drilling of hydrogeological well No. SUG-1G at the site of the integrated facility for LPG reception, storage and offloading terminal in Ust-Kut. - Irkutsk: OOO GGK "Razdolye", 2014.

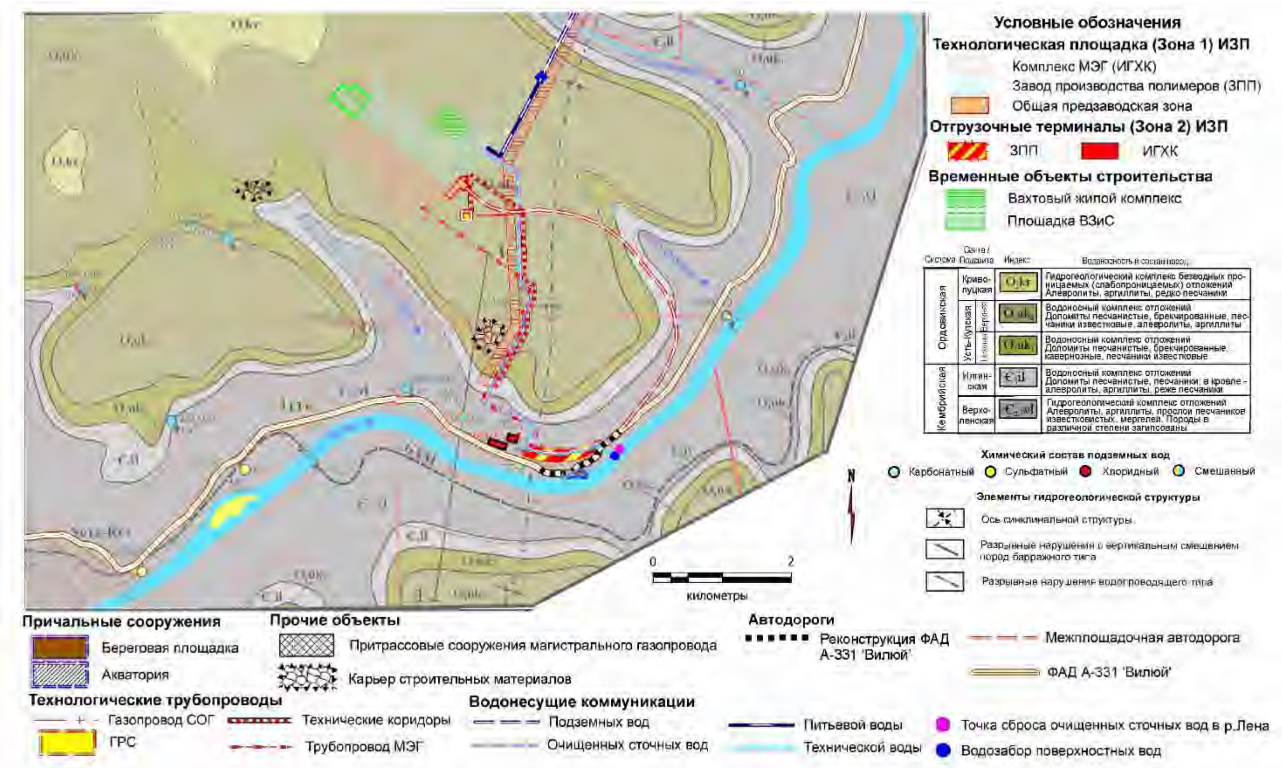


Figure 7.4.1: Schematic geological map of the Project area

The tectonic structure of the Lena River valley has not been studied in sufficient detail. Similarly to other major rivers of this region, it is assumed that valley has a mosaic structure formed by a network of dislocations with a break in continuity. Such tectonic jointing predetermines complicated hydrodynamic and hydrochemical conditions in the subject region in connection with inflow of saline water and brines to the deposits of the suprasalt sub-layer, and influences flow patterns and hydrochemical parameters of the river water.

Due to remoteness from the Baikal rift zone, potential seismicity of the subject area is low, with a maximum design earthquake magnitude of 5 points for mass-scale construction facilities, 6 for more important facilities, and 7 for critical facilities (OSR-2016; SP 14.13330.2014). Converted into earthquakes occurrence frequency units, the first of the above categories corresponds to a period of 500 years (or 10% probability that magnitude 5 will be exceeded during a period of 50 years), the second category corresponds to 1000 years (5% probability of exceeding magnitude 6 during 50 years), and the third one corresponds to 5000 years (1%). Considering the significant volumes of combustible and flammable gases and liquids to be handled, the Irkutsk Polymer Plant will include hazardous process facilities which must be designed for the maximum magnitude of potential earthquake. Based on the microseismic catalog data, earthquake magnitude 6 is adopted for IPP facilities' design.

7.4.3 Geomorphologic Conditions

In the geomorphologic respect the subject area selected for the planned polymer plant is associated with the northern margin of the Angara-Lena plateau (Lena upland), one of the largest orographic elements of the south-eastern region of the Middle Siberian upland with elevations of the water divide areas in the order of 500 m to 650 m (Figure 7.4.2).

In Ust-Kut city and its vicinity, the peneplain-like upland is crossed by a sub-latitudinal asymmetric meandering section of the Lena River with three levels of above-floodplain terraces and two levels of floodplains (Figures 7.4.3, 7.4.4). The valley walls along this river section are characterized by deep and complicated dissection by minor localized drains and watercourses at average distances of 1 km to 5 km from each other (Figure 7.4.5).

The planned location of the main process facilities is on graded site at the top of a large ridge branch composed of bedrock, with absolute surface elevation of 600-625 m. The site is drained by two left-bank tributaries of the Lena River: Sukhoy and Gremyachiy creeks (Figure 7.4.5). The offloading facilities will be constructed at the foot of the main bank of the Lena River valley, above the high-water elevation (HWE, 1% probability of flooding during high-water period). The low-water line of the Lena River in the subject section is 277 m, which means a 348 m elevation drop between the IPP upper and lower sites which are located at a lateral distance of 4 km from each other. In such geomorphological conditions, provision of technical corridors and roads between the operational areas is a complex task, due to the need to construct communications on slopes with different gradients and shape.

Figure 7.4.2: The terrain of the Lena upland in the area of the planned polymer plant site:

plateau-like areas of the interfluves (above), bedrock outcrops (at the bottom left: special protected nature area 'Mir Cliff') and deep dissection of the area by valleys of small streams and creeks (at the bottom right: INK gas trunk main route to the north of design boundaries). Photo: Ramboll 17.05.2017

The creek valleys are deeply incised and lack floodplain-terrace complex. The subject area features a combination of lithogenic base conditions, climate and top soil that generally does not support water erosion, therefore, erosion landforms, e.g. ditches and ravines, are scarcely present. Most of them are located in small stream valleys (Figure 7.4.3) and sloped segments of the main bank of the Lena River valley.

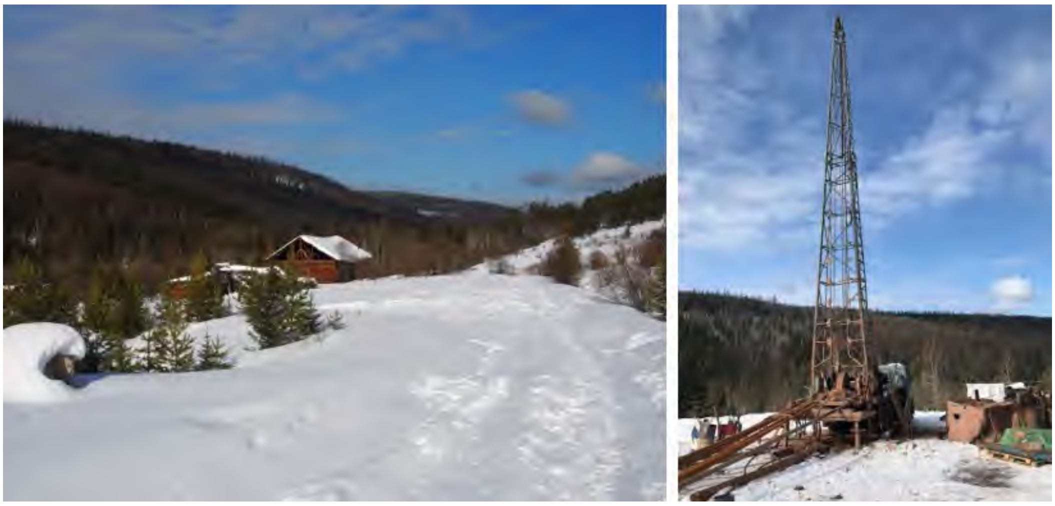


Figure 7.4.3: Valley of the Polovinnaya River at the location point of eponymous lodge. On the right - drilling of ground water well for the Project

Photo by Ramboll CIS, 20.03.2019

Figure 7.4.4: Overall view of the Lena River valley in Ust-Kut

Photo by Ramboll on 17.05.2017 (top left) and 20.03.2019 from the LPG Facilities site (top right) and GFU construction site

The local erosion basis is the Lena River, the streambed of which within the project sites and linear facilities is 250m to 280m wide and from 0.5m to 2.5m deep. The surface relief of the floodplain and the lower level of the terrace complex of the Lena River within the subject area has been transformed to a significant degree as a result of anthropogenic impact and virtually has lost its original natural features (Figures 7.4.4, 7.4.5). Among other things, the lower part of the floodplain has been impacted by construction activities and the mooring facilities; the areas at higher elevations have been filled and levelled in the process of railroad and motor road construction. The slightly protuberant or level erosion slopes at the elevations of 310-360 m above sea level within the LPG site have been transformed and constitute currently a combination of terraces with reinforced man-made wall slopes with designed slope angles. The GFU site has a similar technogenic surface (Figure 7.4.4).

Figure 7.4.5: The floodplain and terrace complex of the Lena River valley

Photo: Ramboll 17.05.2017

Operational area 2 (also referred to as the "lower site" or "offloading site") will be located within the floodplain area and on the first above-floodplain terrace of the Lena River transformed in the process of construction of the transport facilities.

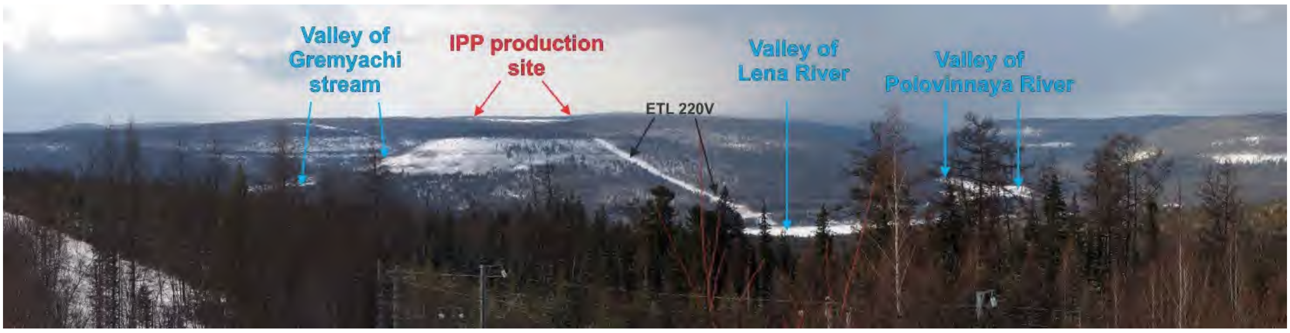


Figure 7.4.6: Overview of the project area for the IPP process facilities (background):

flat-top and gentle slopes of mountain ridge branch in Lena upland, dissected by valleys of small streams - left-side tributaries of the River Lena (view from the right river bank). Photo: Ramboll 20.03.2019

According to the original plan (2017), the communication lines corridor connecting the upper and lower operation areas was to cross the erosion slopes of the river valley in the form of a serpentine line, the main loop of which would be parallel to the Vilyui road toward the Gremyachiy creek. At present, preference is given to constructing the interfacility road around Cape Tolsty on its eastern foot, and ascending the ridge branch on its less steep north-eastern slope.

Figure 7.4.7: Technogenic surface relief within the LPG Facilities site: combination of terraces and reinforced slopes

Photo: Ramboll, 17.05.2017

7.4.4 Geological Settings and Stratigraphy

7.4.4.1 Bedrock

The described surface relief of the subject area selected for construction of IPP is predetermined by the character of occurrence and stratification of the foundation bedrock. The flat top of the ridge branch is formed by an eroded horizontal block of dolomitic limestones of the Lower Ordovician Ust-Kut rock series. The total thickness of this rock series varies from a few tens of meters up to 120 m. Its upper levels are composed of dolomites and limestones containing some terrigenous material (5% to 30%). They are underlain by mudstones and siltstones: the former consist of hydromica (illite) minerals with admixture of carbonates and clastic material and the latter comprise debris of quartz and potassium feldspars cemented with carbonates and hydromica. The lower sub-suite of the Ust-Kut rock series is composed of dolomites with interbeds of flat-pebble carbonate conglomerates and siltstones. Due to their high strength, these rocks often form bedrock outcrops and debris of large blocks. Some dolomites of this rock series occur in the form of massive, algal and oolite-like varieties. In general, the carbonate rocks of this rock series contain typically dolomites (60-90%), calcite (5-10%) and terrigenous quartz (10-20%). Sandstones are of subordinate significance and consist of quartz (75-80%), feldspars and plaginklase (10-20%); their debris having a size of 0.08 to 0.8 mm are cemented with dolomite.

The upper portions of slopes within the outlines of this rock series (within an interval of absolute elevations from 520m to 460m) constitute steep slopes formed as a result of deluvial ablation with areas of steep rock cliffs and with average slope angles of up to 20-25 degrees.

At lower elevations (450-470m), there is flattened step 10m to 20m wide associated with the sandstone roof of the Upper Cambrian Iglinskaya rock series. The thickness of this rock series is 30m to 40m. Its upper horizons are composed of sandstones and mudstones of chocolate-brown, grey-violet and grey color; the lower horizons comprise predominantly interbeds of siltstones, dolomites and mudstones. The sandstones in this rock series are mainly of quartz and feldspar-quartz composition, fine- and ultrafine-grained, with dolomite or hydromica-dolomite cement. Dolomites in this rock series have an admixture of quartz and clastic material (10-25%).

At lower elevations, the slope becomes gradually flatter (10-12 degrees) due to accumulation of deluvial material. The lower part of the slope is dissected by originally poorly defined terraces, transformed by construction activities, and stretching for distances from 100-250m to 600m with a width varying from 50-70m to 200m. The natural substrate of the hill foot consists of terrigenous layer of red mudstones and siltstones of the Upper Lena rock series of the Upper Cambrian age. The roof of the rock series can be identified along a horizontal line at an absolute elevation of 400m. The rocks comprising this rock series include monotonic red layer of marls, mudstones and siltstones with subordinate inclusions of sandstones and dolomites. The marls in this rock series consist of fine-grained dolomite (50-70%) and a cryptoflaky aggregate of hydromicas (25-40%), which have an intense color due of iron hydroxides. Mudstones consist of cryptoflaky hydromicas with an admixture of dolomite (up to 15%) and have also an intense color due to iron compounds. Siltstones in the Upper Lena rock series consist of quartz and carbonate-quartz debris typically of 0.01mm to 0.03mm size, with carbonate or liinite-hydromica cement with a debris to cement ratio of 1:1. Sandstones are of subordinate significance in the composition of this rock series; they are represented by feldspar and silty micaceous fine-grained varieties.

7.4.4.2 Crust of Weathering and Quaternary Deposits

The rocks listed above and comprising the three geological rock series belong to the category of ancient sedimentary rocks and are main bedrocks in the subject area. Their upper horizons, modified by the weathering processes, form *eluvial formations* of varying thickness. Especially affected by weathering are marls, siltstones and mudstones of the Upper Lena rock series: in some areas they are weathered to such a degree that they form a sandy silt layer up to 7 m thick underlain by massive pebble and platy layer of poor water permeability. In the south-east part of the subject area at the lower portion of the slope a bedrock protuberance is bordered by a strip of linear crust of weathering 150m to 200m wide and stretching laterally; it has been identified in the process of the surveys for a distance of approximately 1.5 km. All deposits inside of this zone down to the investigated depth of 30 m are represented by sandy silts. Within the outlines of dolomites, sandstones and limestones of the Ust-Kut rock series, the crust of weathering consists of coarse rock debris 2.5 m to 3.5 m thick underlain by moderately fissured water-permeable massif. In the slope areas comprising the Iglinskaya rock series, the weathering zone is shifted and covered with colluvial-deluvial formations. The total thickness of the mantle and debris deposits reaches 5-7 m. The underlying sandstones form an intensely fissured water-permeable massif.

The *Quaternary hillslope deposits* overlying the eluvium are divided into *colluvial* and *deluvial* deposits. The colluvial deposits occur within the subject area only to a limited extent: large-block (0.3-0.5m) debris 2.5m to 4m thick formed at the foot of rocky monadnocks. Deluvial accumulations, on the other hand, occur mantle-like virtually throughout the entire subject area and are composed of red sandy silts saturated with gruss and dolomite debris, marls, mudstones and siltstones of low strength. The roof of these deposits coincides with the day surface (i.e. they serve mainly as soil-forming rocks); their foot is supported by the roof of eluvial formations. The composition of the large-size detritus part of the diluvium is differentiated from the top downwards depending on the character of underlying rocks: prevailing in areas of Ust-Kut rock series outcropping (upper portion of slopes) are debris of grey slightly weathered strong dolomites, limestones and sandstones; in the middle and lower portions of slopes there are red strongly weathered detritus and gruss of marls, mudstones and siltstones of the Upper Lena rock series.

The Quaternary eluvial formations in the road corridor routed along the northern and north-eastern slopes of Cape Tolsty are composed of gruss-rich light pulverous sandy silts of variable thickness (from 1.5 to 7.6 m) on semi-rocky and rocky ground of the Ordovician Ust-Kut rock series (eO1uk) - mainly siltstones of low and medium strength, slightly weathered, macerating, in some areas - strong dolomite, slightly weathered, non-macerating.

In areas where the surface relief has been transformed by LPG RS&O and GFU construction activities, the foundations of structures have been made of filled ground (weathered gruss and debris of siltstones and mudstones predominantly from the Upper Lena rock series, as well as of red-brownish sandy silts. *Technogenic ground* has in some places inclusions of gruss and other fragments of solid wastes.

Present-day alluvial deposits in permanent watercourses form streambed and floodplain parts of the Lena River valley. They are underlain by coarse detritus facies, while the upper horizons are composed of silty sand and sandy silt material. The alluvium forming the high floodplain and the first above-floodplain terrace of the Lena River along the site of the planned IPP facilities has a thickness varying from 5-6m to 9-15m; the thickness of streambed deposits reaches 10m.

Proluvial-alluvial and proluvial-deluvial formations are reported in the Sukhoy and Gremyachiy creek valleys and at the bottom of dry gullies. They have a low degree of roundness and sorting of detritus.

A complete stratigraphic column for the designed location area of communication corridors and offloading site is presented in the form of a legend to the schematic engineering geological zoning map (Figure 7.4.8). Updated information on rocks within the IPP process facilities site will be obtained during engineering-geological survey in 2019.

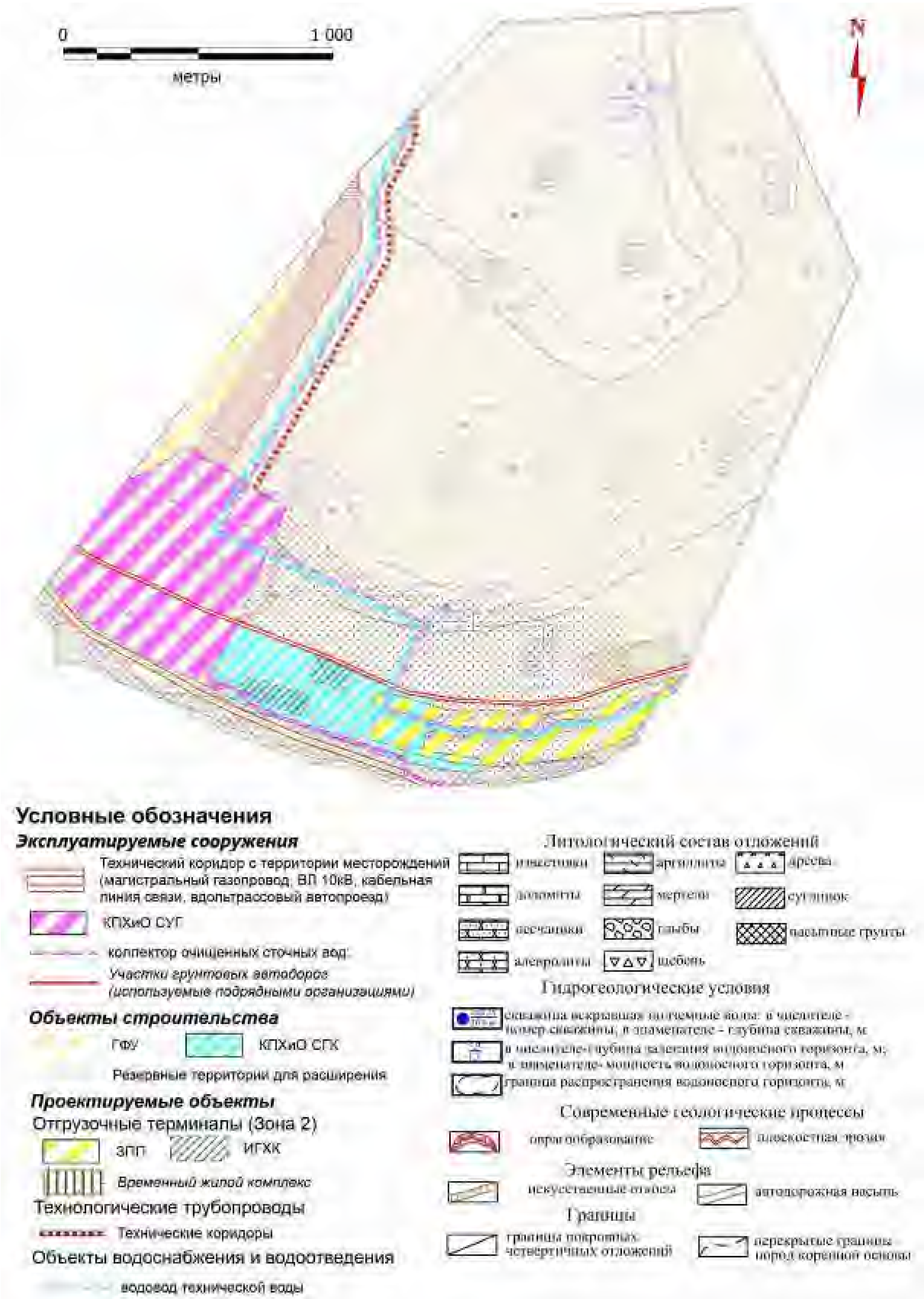


Figure 7.4.8: Schematic map of the engineering-geological conditions within one the IPP sites

7.4.5 Engineering Geological Conditions. Hazardous Exogenous Processes

7.4.5.1 Engineering Geological Zoning

The complexity of the engineering geological conditions in the areas of IPP facilities, which is illustrat-ed by the schematic map (Figure 7.4.9) prepared by the INGEO survey team for the southern and eastern slopes of Cape Tolsty.

The gently sloping areas of the ridge branch selected for the site of operation area No.1 have espe-cially stable and favorable conditions for construction; these conditions are of low or medium com-plexity and do not require any complicated engineering preparations. One of the exogenous geologi-cal processes (EGP) typical of these area is weathering of rocks in the bedrock basement. In this connection it is recommended for any constructions on the top of the ridge branch and in adjacent gently sloping areas to construct foundations on a natural base with some insignificant vertical grad-ing, ensure surface runoff drainage and protect the rocks in the natural bedrock basement from weathering processes (see the Table to Figure 7.4.9).

The erosion slopes around the hilltop having a slope angle of 12 to 25 degrees and consisting of col-luvial and clayey eluvial-deluvial accumulations of large-size detritus have been assessed as unsuita-ble for large-scale construction due to the need for complicating engineering preparations. Relatively stable under the original natural conditions, those slopes would lose their stability in case of under-cutting of terraces for the planned engineering lines corridor. Another secondary exogenous geologi-cal process which can be provoked by construction is accelerated weathering of rocks in the bedrock basement, because they are fissured and of carbonate composition. Typical of areas with a significant thickness of deluvial sandy silts (Area IV-4 of the map in Figure 7.4.9) is occurrence of linear erosion causing gully formation. The recommended countermeasures to prevent technogenic EGP are similar to those proposed for the ridge top area.

Gently sloping areas with a slope angle of 6 to 12 degrees with deluvial accumulations are not suita-ble for construction without any complicated engineering preparation in connection with the predict-ed loss of stability and development of weathering processes as a result of earthmoving operations, piling and other civil engineering work. In addition to the EGP mentioned above, surface erosion will be added, which is most typical for the III-2 circuit. The recommended abatement measures to pre-vent the impact of technogenicaly provoked EGP are similar to those proposed for the top areas and steep slopes. The importance of measures ensuring the surface runoff drainage is especially signifi-cant in this case due to the susceptibility of the local ground to heaving and softening in case of its exposure to moisture.

No signs of deformation have been detected in the process of the surveys in the areas with the sur-face relief impacted earlier by transformation (provision of terraces, filling of ground as a cushion for structures to be constructed). Non-reinforced terrace slopes are affected by surface erosion.

Special engineering geological conditions exist within the floodplain complex of the Lena River with typical seasonal flooding and floods occurring with different periodicity, as well as probability of wash-out of loose ground material and accumulation of gravel, pebble and sandy material entrained by the river.

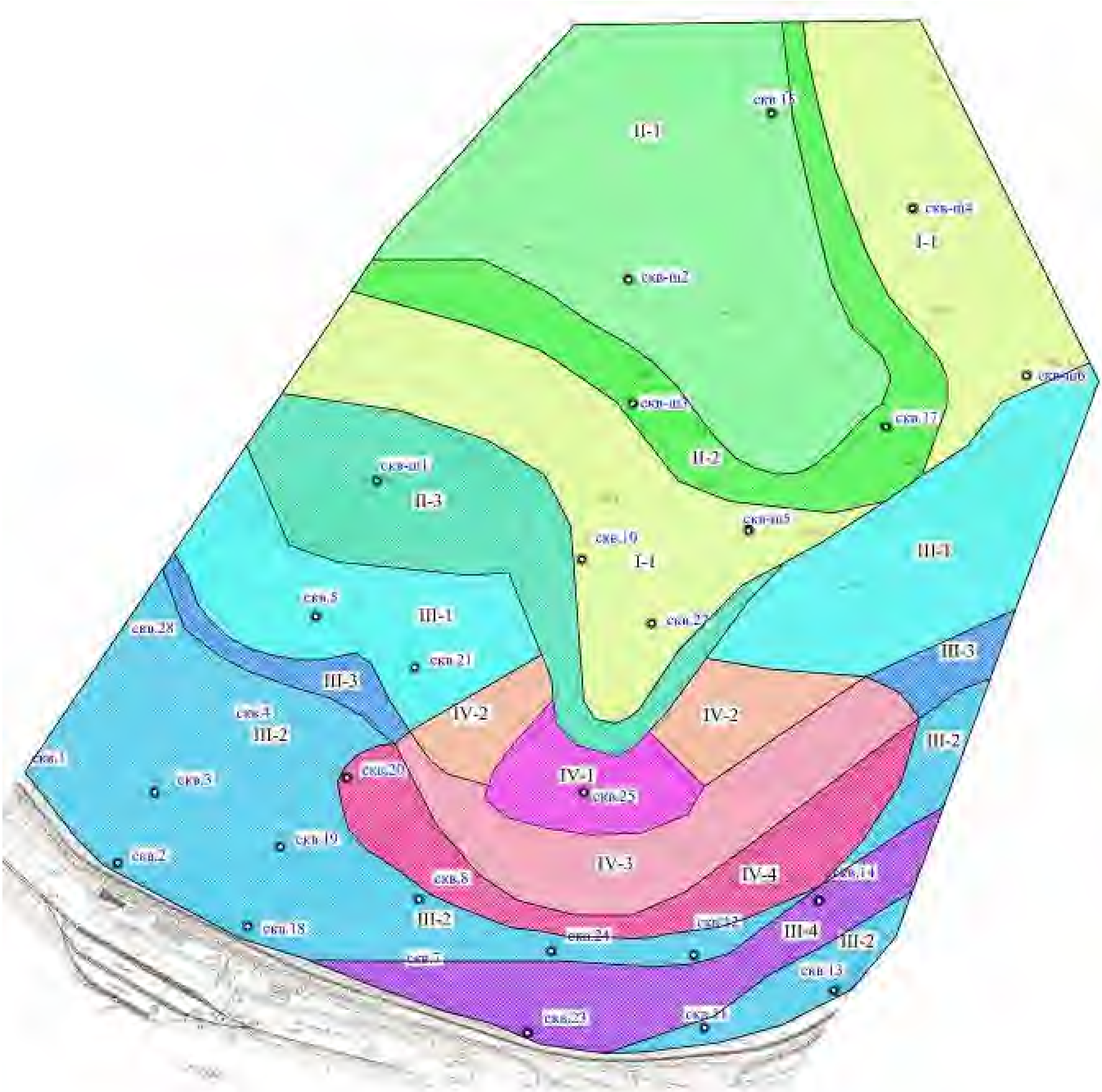
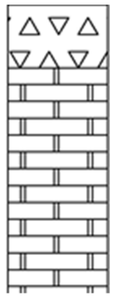
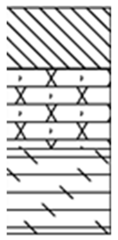
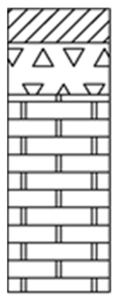
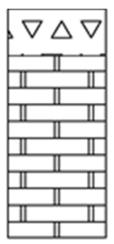
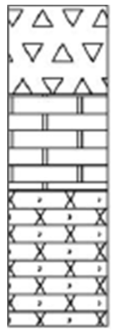


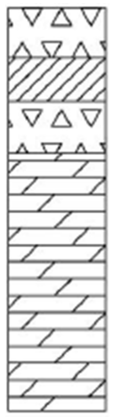
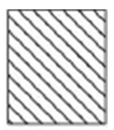
Figure 7.4.9: Engineering geological zoning of one of the IPP sites (INGEO, 2016)

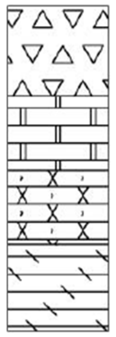
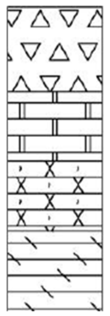
See legend to the schematic map on next 6 pages

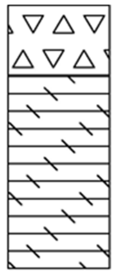
Category of areas (depending on complexity of engineering geological conditions)	Classification of engineering geological areas (according to geological genetic rock complexes)	Group of engineering geological areas (according to the surface relief and micro-relief character)	Types of engineering geological areas (according to their structure, properties and ground conditions of active zone)				Brief characterization of deposits	Ground condition			Specific ground properties	Depth of underground water occurrence, m	Processes complicating construction				Recommendations for use of bases and engineering preparation of sites
								Fluidity indicator and natural moisture content		Ultimate strength in water-saturated condition, MPa Softening coefficient							
			Types of areas	Genesis and age of ground	Lithologic column	Layer thickness, m		Cohesive ground	Non-cohesive ground	Semi-solid ground			Seismic activity (Map B, Map C)	Present-time geological processes and phenomena	Hazard category (SNiP 22-01-95)	Technogenic (predicted)	
I. Areas suitable for construction, with simple engineering geological conditions not requiring any complicated engineering preparation	Thin mantle of present-day eluvial, coarse detrital formations over sedimentary carbonaceous Lower Ordovician stratum I	Peneplain-type massive water divide area (0-3O)	I-1	eQ4 O1uk1		1)2.0-3.5 2)>30	1. Clastic material, detritus and boulders of dolomite, limestone, sandstone, slightly weathered I 2) Dolomite, limestone and sandstone, strong and moderately strong; slightly weathered, slightly fissured		- 4.6% - 1.3%	59 0.50%	Resistant to weathering	None	6	None	-	None	Vertical structuring, provision of surface runoff drainage, construction of foundations on a natural base
II. Areas suitable for construction, with engineering geological conditions of medium complexity, not requiring any complicated engineering preparation	Mantle of present-day eluvial-deluvial, clayey and coarse clastic formations over sedimentary terrigenous carbonaceous Lower	Peneplain-type massive water divide area (0-3O)	II-1	eQ4 O1uk2		1)4-7 2)>30	1) Sandy silts, solid with inclusions of mudstone and siltstone detritus, of low strength, highly weathered 2) Mudstone, siltstone, sandstone, highly weathered, highly fissured to disintegrated	<0 13%	- 3%	6.5 0.15	Prone to heaving Not resistant to weathering; prone to softening	6 m	6	None	-	Weathering of solid rock base after exposure (excavations, foundation pits, etc.)	Insignificant vertical structuring, provision of surface runoff drainage, protection of the solid rock base against weathering

Category of areas (depending on complexity of engineering geological conditions)	Classification of engineering geological areas (according to geological genetic rock complexes)	Group of engineering geological areas (according to the surface relief and micro-relief character)	Types of engineering geological areas (according to their structure, properties and ground conditions of active zone)				Brief characterization of deposits	Ground condition			Specific ground properties	Depth of underground water occurrence, m	Processes complicating construction				Recommendations for use of bases and engineering preparation of sites
								Fluidity indicator and natural moisture content		Ultimate strength in water-saturated condition, MPa Softening coefficient							
			Types of areas	Genesis and age of ground	Lithologic column	Layer thickness, m		Cohesive ground	Non-cohesive ground	Semi-solid ground			Seismic activity (Map B, Map C)	Present-time geological processes and phenomena	Hazard category (SNiP 22-01-95)	Technogenic (predicted)	
			II-2	edQ4 eQ4 O1uk1		1)1-1.5 2) 2-3 3)>30	1) Sandy silts, solid with inclusions of mudstone and siltstone detritus, of low strength, highly weathered 2) Clastic material, detritus and boulders of dolomite, limestone, sandstone, slightly weathered 3) Dolomite, limestone and sandstone of high and medium strength, slightly weathered, fissured	<0 16%	- 4.6% - 1.3%	59 0.50%	Resistant to weathering	None	6	None	-	None	Insignificant vertical structuring, provision of surface runoff drainage, construction of foundations on a natural base
		Gently sloping slopes of deluvial aggradation, near water divide areas (3-6o)	II-3	eQ4 O1uk1		1)2-3 2)>30	1) Clastic material, detritus and boulders of strong, slightly weathered dolomite, limestone, sandstone 2) Dolomite, limestone and sandstone of high and medium strength, slightly weathered and fissured		- 4.6% - 1.3%	59 0.50%	Resistant to weathering	None	6	None	-	None	Vertical structuring, provision of surface runoff drainage, construction of foundations on a natural base

Category of areas (depending on complexity of engineering geological conditions)		Classification of engineering geological areas (according to geological genetic rock complexes)	Group of engineering geological areas (according to the surface relief and micro-relief character)	Types of engineering geological areas (according to their structure, properties and ground conditions of active zone)				Brief characterization of deposits	Ground condition			Specific ground properties	Depth of underground water occurrence, m	Processes complicating construction				Recommendations for use of bases and engineering preparation of sites
				Types of areas	Genesis and age of ground	Lithologic column	Layer thickness, m		Fluidity indicator and natural moisture content: Cohesive ground	Fluidity indicator and natural moisture content: Non-cohesive ground	Ultimate strength in water-saturated condition, MPa Softening coefficient: Semi-solid ground			Seismic activity (Map B, Map C)	Present-time geological processes and phenomena	Hazard category (SNiP 22-01-95)	Technogenic (predicted)	
III. Areas restrictedly suitable for construction, with engineering geological conditions of medium complexity, requiring special engineering preparation in connection with:	slope steepness (6o-12o)	Thick mantle of present-day eluvial-deluvial, clayey and coarse clastic formations over sedimentary terrigenous carbonaceous Lower Ordovician and Middle-Upper Cambrian stratum III	Gently sloping slopes of delubial aggradation (6o-12o)	III-1	eQ4 O1uk1+ Є3il		1)5-7 2)>30	1) Clastic material, detritus and boulders of low strength and strong weathered dolomite, limestone, sandstone, mudstone and siltstone 2) Dolomite, limestone, sandstone, mudstone and siltstone of low strength, as well as strong and moderately strong, weathered and fissured		- 4.6% - 1.3-2.1%	32-59 0.50-0.54%	Deposits O1uk1 resistant to weathering. Є3il Readily weathered, prone to softening	None	6	None	-	Surface erosion, solid rock weathering after exposure (excavations, foundation pits, etc.), loss of stability in case of undercutting of slopes	Vertical structuring, provision of surface runoff drainage
	slope steepness (6o-12o) and covered at the ground level with unstable soils prone to washing-out and with partial occupation with technogenic landforms			III-2	tQ4 edQ4 Є2-3vl		1) up to 6 m 2)1.5-2.5 3)>30	1) Sandy silts, solid with inclusions of mudstone and siltstone detritus, of low strength, highly weathered 2) Clastic material, detritus of low-strength marl, mudstone, siltstone, highly weathered 3) marl, mudstone, siltstone, highly weathered, highly fissured to disintegrated	<0 13-20%	- 5% - 4.6%	7/4 0.27	Packed Readily weathered, prone to softening	None	6	Planar erosion	Moderately hazardous	Surface erosion, solid rock weathering after exposure (excavations, foundation pits, etc.), loss of stability in case of undercutting of slopes	Vertical structuring, organization of surface runoff drainage; protection of solid rock base against weathering

Category of areas (depending on complexity of engineering geological conditions)	Classification of engineering geological areas (according to geological genetic rock complexes)	Group of engineering geological areas (according to the surface relief and micro-relief character)	Types of engineering geological areas (according to their structure, properties and ground conditions of active zone): Types of areas	Genesis and age of ground	Lithologic column	Layer thickness, m	Brief characterization of deposits	Ground condition: Fluidity indicator and natural moisture content: Cohesive ground	Non-cohesive ground	Ultimate strength in water-saturated condition, MPa Softening coefficient: Semi-solid ground	Specific ground properties	Depth of underground water occurrence, m	Processes complicating construction: Seismic activity (Map B, Map C)	Present-time geological processes and phenomena	Hazard category (SNiP 22-01-95)	Technogenic (predicted)	Recommendations for use of bases and engineering preparation of sites
slope steepness (6o-12o) and complex geological structure			III-3	dQ4 dQ4 eQ4 Є2-3vl		1) up to 6 m 2)1.5-2.5 3)1.5-3 4)>30	1) Clastic material, detritus of low-strength and strong dolomite, limestone, sandstone, mudstone and siltstone, weathered 2) Sandy silts, solid with inclusions of mudstone and siltstone detritus, of low strength, highly weathered 3) Detrital ground, detritus of low-strength marl, mudstone and siltstone, highly weathered 4) Marls, mudstone and siltstone, highly weathered, highly fissured	<0 16%	- 4.6% - 4.3% - 4.3%	7/4 0.27	Readily weathered, prone to softening	None	6	None	-	weathering of solid rock after exposure; loss of stability in case of slope undercutting	Vertical structuring, organization of surface runoff drainage; protection of solid rock base against weathering
slope steepness (6o-12o) & presence of a thick linear crust of weathering			III-4	edQ4		1)>30	1) Sandy silts, solid with inclusions of mudstone and siltstone detritus, of low strength, highly weathered	<0 13%			Prone to heaving	None	6	None	-	Surface erosion	Vertical structuring, organization of surface runoff drainage

Category of areas (depending on complexity of engineering geological conditions)	Classification of engineering geological areas (according to geological genetic rock complexes)	Group of engineering geological areas (according to the surface relief and micro-relief character)	Types of engineering geological areas (according to their structure, properties and ground conditions of active zone): Types of areas	Genesis and age of ground	Lithologic column	Layer thickness, m	Brief characterization of deposits	Ground condition: Fluidity indicator and natural moisture content: Cohesive ground	Non-cohesive ground	Ultimate strength in water-saturated condition, MPa Softening coefficient: Semi-solid ground	Specific ground properties	Depth of underground water occurrence, m	Processes complicating construction: Seismic activity (Map B, Map C)	Present-time geological processes and phenomena	Hazard category (SNiP 22-01-95)	Technogenic (predicted)	Recommendations for use of bases and engineering preparation of sites
IV. Areas suitable for large-scale construction, with engineering geological conditions of medium complexity, requiring special engineering preparation in connection with: very steep slope angle (18o-25o)	Thick mantle of present-day eluvial-deluvial, clayey and coarse clastic formations over sedimentary terrigenous carbonaceous Lower Ordovician and Middle-Upper Cambrian stratum IV	Steep slopes of deluvial ablation and aggradation (12-25o)	IV-1	dQ4 O1uk1+Є3il + Є2-3vl		1)1.5-2 2)>30	1) Detrital material, detritus and boulders of low-strength dolomite, limestone and sandstone, weathered 2) Dolomite, limestone, sandstone, mudstone and siltstone of low and medium strength, weathered, fissured within the boundaries of occurrence of the Upper Lena rock series, of very low strength, disintegrated		- 4.6% - 1.3%	32-59 0.2-0.54%	Resistant to weathering	5.5	6	None	-	Loss of stability in case of undercutting of a slope	Vertical structuring
considerable slope steepness (12o-18o)			IV-2	dQ4 O1uk1+ Є3il + Є2-3vl		1)1.5-2 2)>30	1) Detrital material, detritus and boulders of low-strength and strong dolomite, limestone, sandstone, mudstone, siltstone, weathered 2) Dolomite, limestone, sandstone and siltstone of low strength, strong and of medium strength, weathered, fissured		- 4.6% - 1.3	32-59 0.2-0.54%	Resistant to weathering	None	6	None	-		Vertical structuring

Category of areas (depending on complexity of engineering geological conditions)	Classification of engineering geological areas (according to geological genetic rock complexes)	Group of engineering geological areas (according to the surface relief and micro-relief character)	Types of engineering geological areas (according to their structure, properties and ground conditions of active zone)				Brief characterization of deposits	Ground condition			Specific ground properties	Depth of underground water occurrence, m	Processes complicating construction				Recommendations for use of bases and engineering preparation of sites
								Fluidity indicator and natural moisture content		Ultimate strength in water-saturated condition, MPa Softening coefficient							
			Types of areas	Genesis and age of ground	Lithologic column	Layer thickness, m		Cohesive ground	Non-cohesive ground	Semi-solid ground			Seismic activity (Map B, Map C)	Present-time geological processes and phenomena	Hazard category (SNiP 22-01-95)	Technogenic (predicted)	
considerable slope steepness (12o-18o) and occurrence from the surface of unstable readily dissolved ground, occasional occurrence of technogenic landforms				dQ4 Є2-3vl		1) 3-5 2)>30	1) Detrital material, low-strength detritus of marls, mudstone and siltstone, highly weathered 2) Marls, mudstone and siltstone, highly weathered, highly fissured to disintegrated		- 5% - 4.3%	7.4 0.27	Readily weathering, prone to softening	None	6	None	-	Loss of stability in case of undercutting of a slope of solid rocks after exposure (foundation pits, excavations, etc.)	Vertical structuring; provision of surface runoff drainage; protection of solid rock base against weathering
considerable slope steepness (12o-18o) and occurrence from the surface of unstable readily dissolved ground, occasional occurrence of technogenic landforms				dQ4 Є2-3vl		1) 3-5 2)>30	1) Sandy silts, solid with inclusions of mudstone and siltstone detritus, of low strength, highly weathered 2) Marls, mudstone and siltstone, highly weathered, highly fissured to disintegrated	<0 16%	- 4.3%	7.4 0.27	Readily weathering, prone to softening	None	6	Gully formation	Moderately hazardous	Loss of stability in case of undercutting of a slope of solid rocks after exposure (foundation pits, excavations, etc.)	Vertical structuring; provision of surface runoff drainage; protection of solid rock base against weathering

7.4.5.2 Cryogenesis and Permafrost Ground

The planned IPP site is located within a permafrost zone of insular type. Permafrost ground occurs only in some specific areas, normally in river and creek valleys and at lower parts of slopes facing northwards and having a considerable cover of accumulative organogenic material (a peat and moss cover). The surveys conducted in the previous years in adjacent areas had indicated that the permafrost ground thickness can reach 20 m. There is no permafrost ground zones immediately within the project area (which has been demonstrated during the earlier surveys in the LPG RS&O site and the interfacility road corridor), however, technogenic frozen grounds of varying thickness have been identified in the area of earth works at the GFU site. This observation indicates a high chance of ground freezing in areas with stripped soil, and potential persistence of this effect for several years, as a minimum.

The seasonal ground freezing within the subject area is attributed to the long duration of a period with ambient air temperatures below the freezing point and the ground freezing depth varies from 1.5m to 3.7m. In the process of the engineering surveys conducted during the third 10-day period of December the exposed depth of the seasonally frozen ground was 0.8m.

The seasonal ground freezing depth is dependent on the particle size distribution and the moisture content of the ground. High-amplitude deformations and formation of heaved ground are characteristic of water-logged organogenic grounds and sandy silts. Coarse detritus ground is more resistant, but the ground freezing depth is maximum. In case of slopes a combination of cryogenesis with ground creep and solifluction results in formation of ridges and slow movement of the material down the slope. No well-defined signs of cryogenic heave and solifluction have been identified within the project area, but at the same time the earthmoving operations and formation of technogenic surface relief can promote development of such processes. In particular, technogenic loosening and moistening of the ground can convert the local ground from the category of low and medium susceptibility to frost heaving to the category of highly susceptible ground.

7.4.6 Hydrogeological Conditions

In the hydrogeological respect the project area is located in the north-eastern part of the Irkutsk artesian basin of the first order at the northern margin of the Upper Lena basin of the third order. It has been found in the process of the engineering hydrogeological surveys conducted in the LPG Facilities area adjacent to the project site, that underground waters favorable as a water supply source for industrial needs are available in the lower part of the suprasalt level. The main characteristics of the water-bearing complexes of the considered territory are presented briefly below.

Hydrogeological water-bearing complex of the disintegrated Quaternary deposits includes also waters of lithophytic deposits discharged to fissured zones of mixed genesis in the deluvial-proluvial and alluvial formations. They are reported near the LPG Facilities site in the form of natural outlets (Figure 7.4.1). Normally, their yield does not exceed 0.1-0.3 l/s. A water spring (2/2013) with a yield of 3.5 l/s is associated most probably with the latent zone of tectonic jointing. With regard to its chemical composition, the water is of sulphate and hydro-carbonate facieses; its salinity seldom exceeds 0.4 g/l.

Within the process area of the designed plant, the shallowest aquifer has sporadic occurrence. This observation is supported by survey data from Cape Tolsty: water-bearing horizons were exposed only in two engineering geological wells - well No.15 drilled near the top of a bench (groundwater level approximately 6m, horizon thickness of 1.3m) and at its foot (No.25, with the groundwater level of 5.5m and horizon thickness of 2.7m) (see the schematic map in Figure 7.4.7).

The alluvium at the Lena river is water-logged everywhere, but not uniformly due to high degree of variability of the streambed and floodplain facies; because of its insignificant thickness it cannot contain considerable underground water reserves.

The hydrogeological terrigenous complex of deposits of the Upper Lena rock series of the Middle-Upper Cambrian system has been assessed as a localized water-bearing or even aquifuge formation depending on the particular geological / hydrogeological conditions. Within the LPG Facilities area studied earlier and having an outlet to the surface of the complex deposits its potential water-bearing capacity is attributed to:

- development of a zone of exogenous and inherited fracturing having a thickness of 150m;
- zones of tectonic jointing connecting the ruptured structures of the Lena River valley and playing a role of water-conducting canals.

The water-bearing capacity of the zone with exogenous and inherited fracturing is extremely variable. A water-bearing zone having different hydrogeological parameters has been identified in the LPG site. The upper part of the zone up to 60 m thick is located above the erosion baseline (Lena River) and is characterized by a high degree of flushing of the host rocks. Underground water in this zone is slightly confined / unconfined. Recharging is by atmospheric precipitation with overflow from the aquifers located at higher elevations. The water discharge rate of water springs is a few litres per second. The specific well yield normally does not exceed 0.2-0.3 l/s. The chemical composition of underground water is of hydro carbonate – sulfate facies; the salinity is a few grams per litre.

The fracturing degree decreases in the middle part of the cross-section of the rock series resulting in lower water-bearing capacity; the water yield decreases down to 0.1 l/s; the chemical composition varies from sulfate-hydro carbonate to sulfate-chloride facies.

Starting from a depth of over 200m the water-bearing capacity becomes extremely low; the specific yields do not exceed 0.01-0.02 l/s; the chemical composition at a distance from the Lena River valley is of sulfate facies. Within the zone influenced by inflow of saline water the chemical composition is extremely variable, similarly to the salinity reaching a few tens of grams per litre.

The zones of tectonic fracturing within the deposits of the Upper Lena rock series have different depths and distribution character: from continuous to discontinuous depending on the particular tectonic conditions. The specific hydrodynamic feature of underground water of this type is high pressure with an outflow from 1-0.3m to -2-2.0m. The outflow yield varies from 8 to 24 l/s. The depth of tectonic zones is determined based on an increase in the chloride concentration, which is as high as 100 g/l (Table 7.4.1, well 1-ГМ).

The hydrogeological well nearest to the project area was drilled and equinked by the "Razdolye" Company at the LPG Facilities site (Well No. СУГ-1Г). The target aquifer was in this case the Upper Lena rock series of the Middle-Upper Cambrian system. The true piezometric level was 73.4 m; the water head was 0.6m. With a well yield of 6.11 l/s the level lowered by 8.0 m (the steady dynamic level of 81.4 m). The specific well yield was estimated at 0.76 l/s/m. The transmissibility coefficient was calculated approximately as Km =130q = 99 m^2/day; accordingly, for the 13.0m thick aquifer the permeability coefficient was K=7.6 m/day.

The well yield is 9 m^3/day, which is a high value for this water-bearing complex; the water temperature is 2-2.5°C. With regard to the chemical composition, the water from the СУ-1Г well is freshwater of magnesium-calcium sulfate- hydro carbonate facies with a salinity value of 0.5-0.6 g/l. No significant variations in the chemical composition of underground water had been recorded during the testing period of three days. More detailed data relating to the chemical composition of underground water is presented in Section 7.7.

With regard to the natural protection of underground waters, the aquifer under study is rated as reliably protected, because it is overlain by clayey deposits of a considerable thickness (approximately 70m). No sanitary protection zone is required for the water well, because it is recommended to use the underground water for industrial needs. The radius of a standard protection zone for a water well used for industrial water supply is 30m. The degree of protection of the shallowest aquifer has not been assessed in the survey documentation.

7.4.7 Conditions for Use and Protection of the Geological Environment

According to Statement No.25710/ЦС-10-25 of 06.12.2016 issued by the Division of Geology and Licensing for Irkutsk Region (IrkutskNedra), Department for Subsoil Resources Management in Central Siberia (CentrSibNedra), no mineral and underground water reserves have been registered within the outlines of the LPG Facilities construction site. At the same time, the LPG site is located within the areas included in the following licenses for use of subsoil resources:

1) IRK 15448 NR, granted to CJSC "DITEKO" Company for geological prospecting, exploration and production of hydrocarbons within the area "Ust-Kut";

2) IRK 02521 NR, granted to OOO "Ust-Kut NefteGaz" Company for geological prospecting, exploration and production of hydrocarbons within the area "Kazarkinsky";

3) IRK 03029 VE, granted to OOO "Irkutsk Oil Company" for exploration and abstraction of underground water resources in the area "Mysovoy";

4) IRK 02815 VE, granted to AK "ALROSA" for underground water abstraction in the areas "Alrosovsky" and "Prichalny".

The groundwater abstraction facility "Prichalny" operated by the Alrosa-Terminal Company is located at a distance of 2 km to the north-east of operational area No.2 and approximately 5 km to the south-east of operational area No.1. The underground water abstraction facility "Alrosovsky" provides water for the explosives store of the company (4 km to the east of boundary of operational area No.1). The general layout plan of the city of Ust-Kut and the public cadastre map do not provide any information relating to the respective sanitary protection zones. In one of the two cases mentioned above ("Prichalny" groundwater abstraction facility), such zone may overlap an area located at a higher elevation on the slope within the designed IPP site (Figure 7.4.12).

The groundwater abstraction facility nearest to the project area is the facility operated by the Irkutsk Oil Company and located at the LPG Facilities site (wells Nos. СУГ-1Г and СУГ-2Г). That water abstraction facility (Figure 7.4.10) is used only for industrial water supply needs and no sanitary protection zone has been established for that facility.

Table 7.4.1: List of water wells and underground water occurrence points in the vicinity of the polymer plant project area

Item No.	Description	Abs. elev., m	Depth, m	Index of geol. unit /interval	Water-bearing interval (testing interval)	Static level	Yield, l/s Level lowering, m	Kurlov's formula	Salinity, g/l	Water hardness, mg-equiv./l	Year of survey, remarks
1	Water spring 39	292		Є$_{2-3}$vl			0.6	$\frac{HCO_3 97\ Cl3}{Ca51Mg49}$	0.31	4.10	1981
2	Water spring 222	525		O_1uk_1			3.0	$\frac{HCO_3 97\ Cl3}{Ca51Mg40\ Na9}$	0.36	4.60	2011
3	Water spring 388	500		O_1uk_1			25.0	$\frac{HCO_3 98\ Cl2}{Ca51Mg40\ Na9}$	0.35	4.10	Outflow along a distance of 40m, 1981
4	Water spring 703	297		Fracturing zone			89.0	$\frac{HCO_3 80\ SO_4 16}{Mg42\ Ca36\ Na20}$	0.33	4.05	A group along a distance of 170 m, 1981
5	Water spring 706	570		O_1uk_2			3.5	$\frac{HCO_3 97\ Cl3}{Ca49Mg46\ Na5}$	0.30	3.70	Outflow along a distance of 750m, 1981
6	Water spring 708	510		O_1uk_1			0.6	$\frac{HCO_3 78\ Cl22}{Ca49Mg49\ Na2}$	0.31	3.80	1981
7	Water spring 1/2013	315		dQ_{IV}			0.23	$\frac{HCO_3 79\ SO_4 17\ Cl4}{Mg60\ Ca38\ Na2}$	0.37	5.00	2013
8	Water spring 2/2013	280		alQ_{IV}			3.5	$\frac{HCO_3 57\ Cl25SO_4 18}{Ca41\ Na34\ Mg25}$	0.41	3.80	2013
9	Water well 1101	586	17	O_1uk_2 3-17	13.5-17.0	13.5	$\frac{0.39}{0.17}$	$\frac{HCO_3 79\ SO_4 18}{Ca57Mg42\ Na\ 10}$	0.30	4.0	Well for construction materials, 1977
10	Water well 111	296	52	Є$_{2-3}$vl 9.5-52	9.5-52.0	3.9	$\frac{0.6}{4.9}$	$\frac{SO_4 87\ HCO_3 13}{Ca51Mg36\ Na\ 13}$	2.27	22.0	1981
11	Water well 1016	290	40	Є$_{2-3}$vl 20-40	23.0-38.0	7.0	$\frac{4.4}{19.0}$	$\frac{SO_4 84}{Ca57Mg40}$	2.37	32.9	1975
12	Water well У-12	285	102	Є$_{2-3}$vl 10-102	14-102	5.0	$\frac{1.5}{23.0}$	$\frac{SO_4 89}{Ca54Mg37}$	3.7	42.9	1976
13	Water well 63 пр	297	374	Є$_{2-3}$vl 23-337 Є$_{1-2}$lt 337-374	37.5-137 37.5-374	+1.0 self flow. +1.5 self flow.	$\frac{0.94}{-}$ $\frac{0.79}{-}$	$\frac{HCO_3 52\ SO_4 28}{Ca47Mg49}$ $\frac{Cl96}{Na90}$	0.45 80.70	5.6 130.8	1963, Lena River bank, 12km upstream of Yakurim river mouth
14	Water well 65 пр	290	362	Є$_{2-3}$vl 8-362	8-362	self flow.	$\frac{24.0}{-}$	$\frac{Cl86\ SO_4 13}{Na86\ Ca8Mg6}$	44.8	108.2	For structure mapping, 1963
15	Water well 66 пр	282	333	Є$_{2-3}$vl 8-333	28-129 28-333	self flow. self flow.	N/A	$\frac{HCO_3 54\ SO_4 39}{Ca54Mg44}$ $\frac{HCO_3 58\ SO_4 36}{Ca51Mg40}$	0.42 0.48	5.9 6.0	Ditto

Item No.	Description	Abs. elev., m	Depth, m	Index of geol. unit /interval	Water-bearing interval (testing interval)	Static level	Yield, l/s Level lowering, m	Kurlov's formula	Salinity, g/l	Water hardness, mg-equiv./l	Year of survey, remarks
16	Water well ГМ-1	291	252	Є$_{2-3}$vl 9-61 Є$_{1-2}$lt 61-164 Є$_{1-2}$an 164-252	9-57 63-185 190-252	+0.3 +0.5 +8.0	$\frac{17.8}{1.15}$ $\frac{20.0}{3.6}$ $\frac{9.85}{14.6}$	$\frac{Cl95}{Na93}$ $\frac{Cl95}{Na95}$ $\frac{Cl95}{Na94}$	126 142 150	141 126 141	Exploration and production well, Ust-Kut resort, 1979

Nevertheless, as follows from Statement No.25710/ЦС-10-25 of 06.12.2016, the authorized agency that issued this document, recognizes potential impact of construction and operation of the LPG Facilities on the quality of underground waters and defines in this connection a requirement to coordinate the respective project design solutions with the Irkutsk territorial centre for geological environment monitoring (ITC GMGS).

Figure 7.4.10: Well No. СУГ-1Г of the underground water abstraction facility at the LPG Facilities site

Photo: Ramboll 18.05.2017

The bedrocks common in the subject area of IPP are dolomites, limestones and marls having a potential for their use for construction needs. Limestone quarries nearest to operational area No.1 (approximately 2km to the south-east and 1km to the south-west) are operated by the Irkutsk Oil Company. According to the interview with the INK representatives, the first quarry was in operation until the beginning of construction of INK's facilities (gas pipeline and LPG terminal) and some of the abandoned quarry parts were used for unauthorized dumping of solid wastes. No signs of waste dumping had been identified in the course of the visit at the quarry site by Ramboll team. Information relating to the current user of subsoil resources is displayed on a poster at the entrance to the quarry site (Figure 7.4.11).

Figure 7.4.11: Limestone quarries operated by the Irkutsk Oil Company:

on the left - quarry located on the northern side of GFU (photo by Ramboll, 18.05.2017), on the right - quarry located on the western side of waste storage site of TSLK, LLC (photo by Ramboll, 20.03.2019)

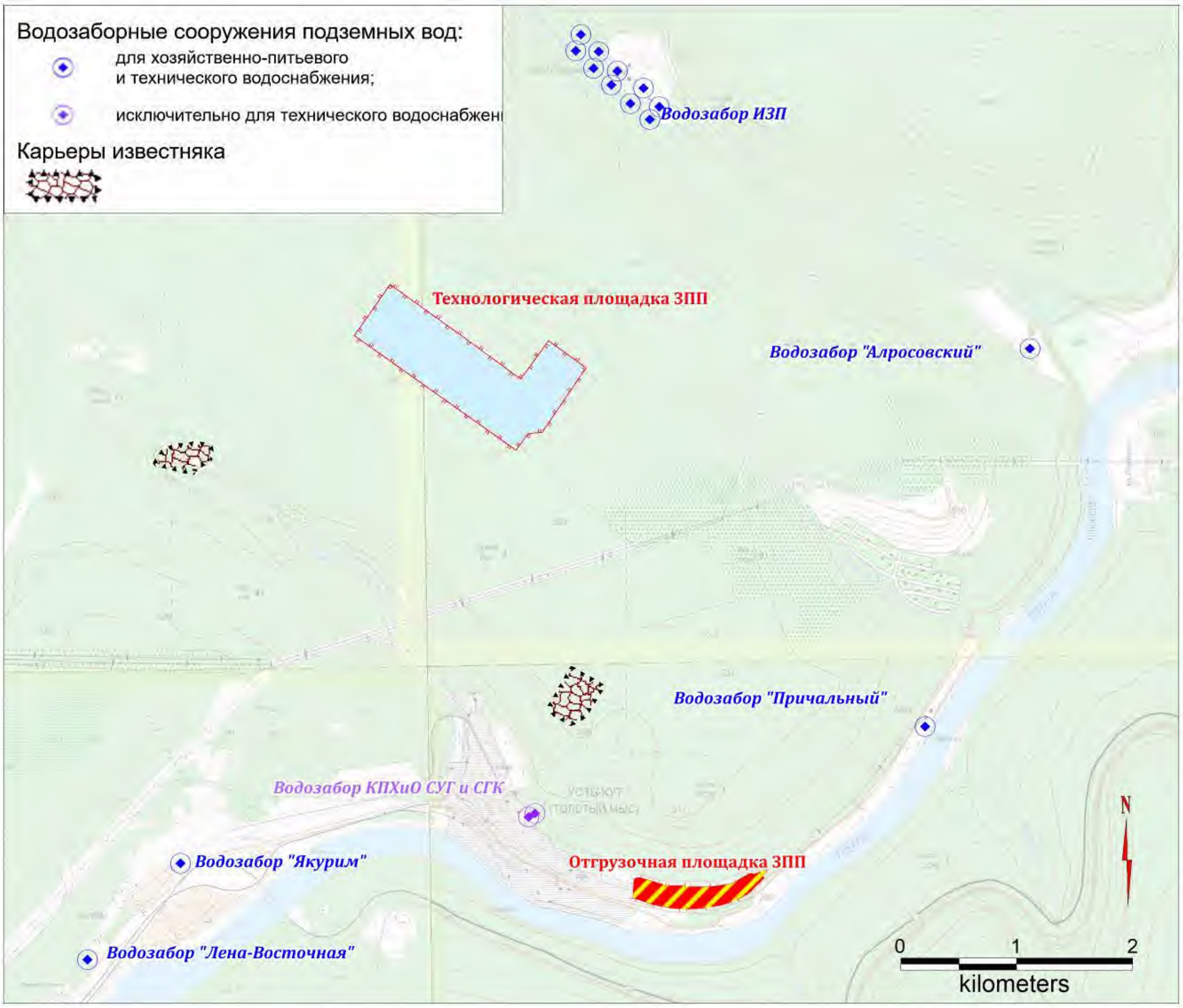


Figure 7.4.12: Location of ground water wells and quarry sites in relations to the main operations areas of IPP

Along with the mineral deposits and ground water sources of drinking and technical quality, geological environment in the subject area has certain unique features which provide grounds for assignment of conservation status. The nearest objects of the geological environment with a special protection status are the Ust-Kut water spring (hydrogeological nature monument of regional significance, 20 km to WSW) and Mir rock cliff (geomorphologic nature monument, 15 km to the west of the project area).

7.5 Soil Cover

7.5.1 Geographic soil zoning

According to the Environmental Soil Zoning Map of the RF[59], the IPP project area including the MEG Plant belongs to the Lena-Angara Soil Province of the East-Siberian region of the Boreal Belt and is located in its northern part close to the boundary of the Angara Plain Province with sod-podzol soils, sod-calcareous soils and boreal forest sod soils (Kerenga-Lena District of sod-calcareous soils and detritus-containing soils overlying eluvial-deluvial deposits with shallow occurrence of carbonate bedrock).

The National Soil Atlas of the Russian Federation[60] also recognizes that sod-podzol soils (residual calcareous soils) and sod-calcareous soils prevail within the subject area. According to the State Soil Register of Russia, the proportion of the two above soil types in the soil fund of Irkutsk Region is estimated at 4.8% and 18.7%, respectively, which indicates their rather common occurrence.

The schematic regional soil geographic zoning map[61] indicates a border between soils districts along the Lena River: to the north of the border it is the district of sod-podzol soils, sod-calcareous soils and podzolic soils; to the south – a district of podzolic soils, peat-containing humus soils and sod-podzol soils. Both districts belong to the landscape sub-zone of southern boreal forests (taiga), sub-province of soils of high and medium plateaus, province of podzolic soils, forest sod soils, sod-calcareous soils and grey forest soils of the Irkutsk Amphitheatre.

In the system of the agrolandscape zoning of Irkutsk Region[62] the entire area of Ust-Kut District belongs to the Northern Angara-Lena Southern Boreal Forest District with cold and freezing soils, including boreal forest plain land (placor land) on high plateau and terraced river valleys with sod-podzol soils and sod-calcareous soils.

In general, the degree of studies of soils within Ust-Kut District should be considered as insufficient due to the low level of land development in this area. In addition, the soil conditions of the planned project area for the polymer plant were subjected to engineering surveys during 2013-2018 in connection with the project design development for the LPG Facilities and the gas transport system with supporting facilities along the routes.

7.5.2 General characterization of soil formation conditions

Topsoils in the Ust-Kut industrial area include a combination of peneplain-type upland forest soils and forest-and-meadow soils of the left bank of the Lena river valley with three levels of above-floodplain terraces and two levels of floodplains.

The variety of soils in the area is attributed to the space-time transformations of soil formation factors, the current status of which is discussed in the corresponding sections of this Report.

The most significant features of the local climate from the viewpoint of soil formation is the well-defined seasonality with long cold winter, short moderately warm summer and moist intermediate seasons with a significant prevalence of atmospheric precipitation over evaporation, as well as significant variability of climatic parameters from year to year.

Another important factor that determines properties of local soils is a combination of the surface relief and lithogenic basement ensuring adequate draining of the territory, and high levels of calcium carbonate in soil-forming rock. Historically, the valley network is not well developed, but the mesorelief constitutes a combination of slopes, including also steep slopes, with a small thickness and coarse detrital character of the surficial sediments underlain by a fissured carbonate crust of weathering and the bedrock not affected by weathering. The shallowest aquifer is sporadic, a fact due to which most of the soils outside

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[59] Environmental Soil Zoning Map of the RF Scale 1:2 500 000. M.: Soil Science Department, M.V.Lomonosov Moscow State University, 2013

[60] The National Soil Atlas of the Russian Federation. - M.: Soil Science Department, M.V.Lomonosov Moscow State University, Publishing House 'Fstrel', 2011, 632 pp.

[61] Atlas: Irkutsk Region, Environmental Conditions for Development. – Moscow-Irkutsk, 2004. 142 pp.

[62] V.A.Seryshev, V.I.Solodun. Agrolandscape zoning of Irkutsk Region // Geography and natural resources. 2009. No.2. pp. 86-94.

of the floodplain complex are not exposed to hydromorphism. Therewith, seasonal ground freezing depth is 2-4 m (depending on particle size distribution and terrain and topsoil properties).

The most important condition for soil formation, available virtually throughout the project area, is predominance of forest vegetation, especially mixed coniferous and small-leaved forests and secondary small-leaved forests. Non-uniformity of forests in the subject area is attributed to successions of trees of different ages in areas subjected to logging operations and affected by forest fires. The impact of forest fires on organogenic horizons is visible throughout the subject area, with variable recurrence, whereas technogenic physical impacts are site-specific and attributed to logging and other economic activities.

The described soil formation conditions are augmented by the low degree of soil development for agricultural purposes, with most anthropogenic impacts within the project area associated with forestry activities, use of earth roads, and construction. The natural soil cover within the floodplain and on the first above-floodplain terrace of the Lena River, as well as at the foot of the main valley slope, is replaced to a significant degree with imported technogenic soils, hard paving and development.

7.5.3 *Main soil types and soil cover structure*

The described soil formation conditions refer to the general characteristics of the soil cover in the subject area; sod-calcareous soils in stone land of different thickness and species varieties prevail in interfluves and on valley slopes of the Lena River. In areas with a considerable thickness (over 0.5-1m) of deluvial sandy silts or fine-grain weathering products, stone soil varieties are replaced with sandy silts.

According to the terminology used in the Classification and Diagnostics of Soils in the USSR[63], the soil cover structure in interfluvial areas comprising the hilltops and slopes of the ridge branches, including also the area within the boundaries of operational area No.1 of the designed plant, comprises variations of sod-calcareous soils, typical and leached, not completely developed, thin and moderately thick, stony at the surface and in shallow horizon, belonging to the facies subtype of cold and freezing for a long period of time (Figure 7.5.1).

Figure 7.5.1: Sod-calcareous soil over thin coarse detrital crust of weathering composed of dolomites of the main ground surface of the interfluve and erosion valley slopes

(Photo by OOO "Raritet" Company, 2014[64])

[63] Classification and Diagnostics of Soils in the USSR - M.: 'Kolos', 1977. 224 pp.

[64] R&D Report: Implementation of measures aimed at conservation of an area having indications of archaeological heritage located within the land area requested for construction of the integrated facility for LPG reception, storage and offloading terminal, access road to the above facility, 10kV power transmission line from Yakurim substation to the site of the LPG reception, storage and offloading terminal, oil and gas facilities with railway tracks in Ust-Kut District, Irkutsk Oblast. - Irkutsk: OOO "Raritet", 2014

The Classification of Soils of Russia[65] implies a different approach to the soil diagnostics in thick crusts of weathering of carbonate rocks and their derivates: this model of the soil cover in the interfluve and on slopes in the subject area provides for the following series of soil types with an increasing degree of weathering of the soil-forming rock and the profile thickness: (1) carbo-petrozem; (2) carbo-lithozem dark humus soils; (3) dark humus residual calcareous soils. The international soil classification system World Reference Base[66] attributes sod-calcareous soils to the category of Rendzic Leptosols.

The following profile structure is characteristic of sod-calcareous soils:

- organogenic horizon, the properties of which are predetermined by the vegetation cover conditions: a litter layer up to 2-3cm thick is formed in forests and a sod layer up to 5-7cm thick is formed under meadow vegetation;
- a humus accumulative horizon from 3-5cm to 15-20cm thick: mineral, structured (normally friable-cloddy or fine-grained), densely interwoven with root systems, with inclusions of gruss and detritus of carbonate rocks;
- transitional horizon in relation to soil-forming rock, of variable thickness: it differs from the previous soil type by a lower humus content and less defined structure; poorer abundance of root systems; higher content of inclusions and larger average size of the latter;
- soil-forming horizon: eluvium of carbonate rocks or products of their re-decomposition, deluvial detritus-containing sandy silts.

The soil presented in Figure 7.5.2 and having a fertile layer thickness of over 10 cm has most of the above characteristics.

According to the regional investigations[67] of the sod-calcareous soils in Irkutsk Region, they are divided into grey and red sod-calcareous soils; both these types are available within the project area and are associated with weathering products of carbonate rocks of the Ust-Kut and Iglinskaya rock series (grey soils) and the Upper Lena rock series (red soils). Depending on the local conditions of the lithogenic base, ground surface relief and the moisture content, sod-calcareous soils can be attributed according to their morphology to typical, leached or podzolized soil type.

Sod-podzol soils of loamy and sandy loamy type over deluvial sediments on gently sloping aggradational slopes at the foot of the ridge branch (Photo made by specialists of OOO "Raritet" Company, 2014) In the lower flatter parts of the aggradational slopes, the podzolized sod-calcareous soils are replaced by one of the varieties of the zonal soil type, i.e. sod-podzol loamy and sandy loamy soils (Figure 7.5.2).

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[65] Classification of Soils of Russia. - Smolensk: 'Oikumena', 2004. 432 pp.

[66] World Reference Base for Soil Resources (WRB-2014). – Rome: FAO UN, 2014. 190 p.

[67] G.A. Vorobyova. Soils of Irkutsk Region. - Irkutsk: Irkutsk State University, 2009. 149 pp.

Figure 7.5.2: Sod-podzol soils of loamy and sandy loamy type over deluvial sediments on gently sloping aggradational slopes at the foot of the ridge branch

(Photo by OOO "Raritet", 2014)

The presented variety of the sod-podzol soil has well-defined signs of polygenesis in the form of a buried lighter horizon – podzolic or gleyey-podzolic. Its sharply outlined roof is indicative of the washout process preceding the accumulation of the overlying reddish-brown loam, the upper 10-15 cm thick layer of which has been modified by the present time to form a combination of organogenic and coarse humus horizon (a fertile layer) and the further 10-20 cm thick layer has changed to form a lighter podzolic or gley-podzolic horizon. The time required for such profile differentiation is hundreds or a few thousands of years, which indicates durable stability of the geomorphologic conditions of the subject area.

The less stable conditions associated with the intensity of erosion and aggradation processes are characteristic of the bottoms of minor erosion landforms and creek valleys located along the boundary of the ridge branches. The soils confirming this statement have well-defined lateral stratification and lithological non-uniformity (Figure 7.5.3). In some areas, the soils show some signs of development – horizons with clearly defined lower boundary of – historic plowing (Figure 7.5.4), – as well as deposited and buried horizons of various genesis. Deposition causes an increase in the thickness of the fertile humus-containing layer up to 20-30 cm.

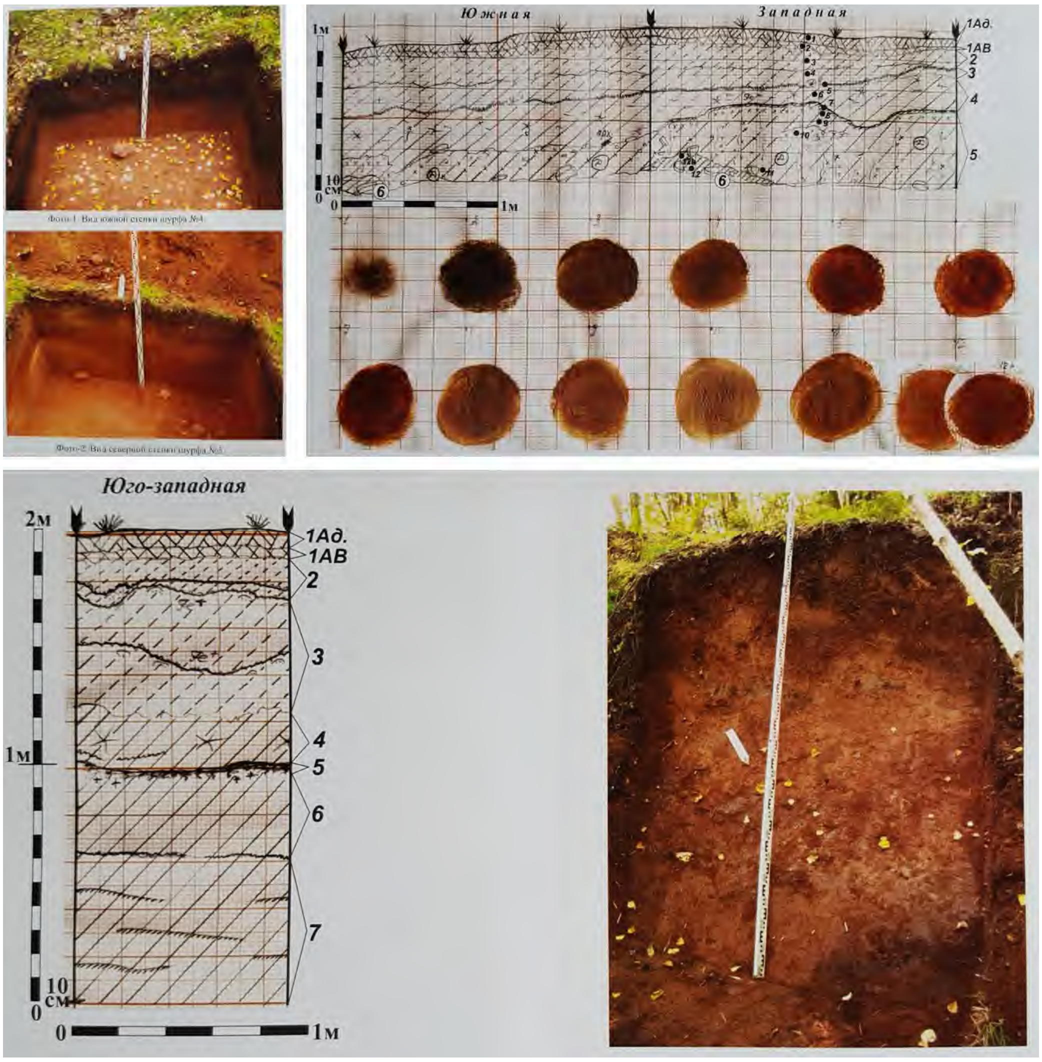


Figure 7.5.3: Stratified soils on the right bank of the Gremyachiy Creek valley with a fertile layer 10 cm to 15 cm thick

(Photo by OOO "Raritet", 2014)

The soils of the bottoms of minor erosion landforms and creek valleys meet the classification criteria for washed-out / deposited gley sod soils (Classification and Diagnostics of Soils of the USSR, 1977) and the criteria for Fluvic Gleysols and associated varieties in the International Classification of WRB-2014. They typically have signs of hydromorphism, i.e. gleyization and new formations of iron hydroxides.

Figure 7.5.4: Stratified soils on the right bank of the Sukhoy Creek with a fertile layer up to 30 cm thick (Photo by OOO "Raritet", 2014)

In the Lena River valley, alluvial soils of the floodplain complex (Fluvisols according to WRB-2014) are represented by combinations of various sub-types and types of alluvial sod and meadow soils, inhomogeneous with regard to the particle size distribution. The overall thickness of organogenic and humus aggradational soils of these soil varieties does not exceed normally 10-15 cm; typical is a high proportion of inclusions of gravel and pebble, as well as considerable areas of poorly developed varieties of alluvial soils over fresh or coarse clastic drifts. In areas subjected to frequent flooding, typical are variations of alluvial laminated primitive pebble-containing thin and truncated soils with variable particle size distribution.

7.5.4 Agrochemical properties and contamination of soils

The described varieties of sod-calcareous, sod-podzol, sod-gley washed-out / deposited and associated soil types have only a thin fertile layer. According to the applicable standards, in most cases they are not subject to topsoil layer stripping and protection:

- According to Item 1.5 of GOST 17.4.3.02-85, a fertile topsoil layer less than 10 cm thick is not subject to stripping in forest areas;
- According to GOST 17.5.1.03-86, the fertile topsoil layer should have the following characteristics: pH value of water suspension from 5.5 to 8.2; humus content of more than 1%; physical clay content from 10% to 75%;
- According to Item 4 of GOST 17.5.3.06-85, a fertile topsoil layer is not subject to stripping if the soil has a high content of gravel and pebbles or has a low, medium or high degree of washed out sod-podzol soil;

- According to Item 2.6 of GOST 17.5.3.05-84, a fertile topsoil layer should be free of radioactive elements, heavy metals, residual quantities of pesticides and other toxic compounds in concentrations exceeding the maximum permissible levels established for soils; it should not be hazardous in the epidemiological respect, should not be polluted or contaminated with industrial wastes, solid objects, stones, gravel, pebble and construction debris.

A low thickness of organogenic and humus-aggradational soils makes them vulnerable to physical and mechanical impacts. Shallow occurrence of carbonate rocks creates an internal alkaline barrier, while dispersed presence of limestone and dolomite fragments throughout the sod-calcareous soil profile provides favorable alkaline-acidic and oxidation-reduction conditions for plant growth. The fertile topsoil of local soil cannot be used for reclamation of the latter, because in case of the mechanized topsoil stripping it would be mixed with the material from the underlying horizons. Under such conditions the biological reclamation should be carried out by adding a peat-sand mixture or similar fertile soil.

It should be taken into consideration that under the conditions of the subject area there is a shortage of not only fertile and potentially fertile soil (i.e. deluvial, deluvial-proluvial and alluvial-deluvial loams meeting the applicable criteria), but also sedimentary rocks weathered to a condition of sandy silts. The main limiting factor of fertility for local substrates are their high stone content and low organic matter content.

The environmental engineering surveys conducted in 2014 for the LPG Facilities construction project[68] in the area adjacent to the project area for the polymer plant included also soil investigations. Interpretation of the results obtained prevents the authors from the use of their own soil classification, which does not correlate with any of the general Russian or international concepts cited above (Figure 7.5.5). Nevertheless, the materials of those investigations confirm the prevalence of sod-calcareous and sod-podzol residual calcareous soils in combination of podzol soils.

The most favorable agrochemical properties have been reported in full-profile varieties of sod-calcareous and sod-podzol residual calcareous soils. On the other hand, sod-gley soils and podzol soils are short of nutrient minerals and have elevated acidity levels.

The soil sampling carried out within the LPG site outlines did not reveal any signs of their chemical contamination: the measured concentrations of elements and compounds specified in the norms GN 2.1.7.2041-06 and GN 2.1.7.2511-09 was found to be lower than the respective MPC and TPC levels. On the other hand, it appears highly probable that surface layers of soil within the IPP site may contain elevated concentrations of biomass burning products from several sources including long-term burning of wood processing wastes at the site adjoining the western side of the waste storage area (refer to Section 7.2 for schematic map of visible smoke plume), and operation of wood-fired boiler houses in Ust-Kut city. The above products always contain polycyclic aromatic hydrocarbons, therefore at least one of them - benz(a)pyrene being a regulated parameter - should be included in the programme of soil survey and monitoring activities at the Project sites and within its area of influence.

Effects due to specific material composition of local soil-forming rock, namely accumulation of certain microelements and bituminous matter, should be also considered. In particular, evidence is available that demonstrates accumulation of lead, zinc and chromiums in ground in the south of Ust-Kut district where hygienic limits for such substances are exceeded by 1.1-1.6 times. High concentrations are also reported for natural bitumoids featuring similar properties as petroleum products (at the total yield of up to 250 mg/kg) and phenols (up to 2 mg/kg)[69]. The above circumstances should be taken into account during interpretation of survey results and environmental monitoring data.

The microbiological analysis of soil samples taken at the LPG RS&O site indicated that there is no hazard related to the sanitary and epidemiological conditions: colibacilli group, enterococci, salmonella, shigella, blue pus bacilli and helminths have not been detected or their quantity was below the maximum permissible level. According to the Veterinary Service of Irkutsk Region (reference is made to the official

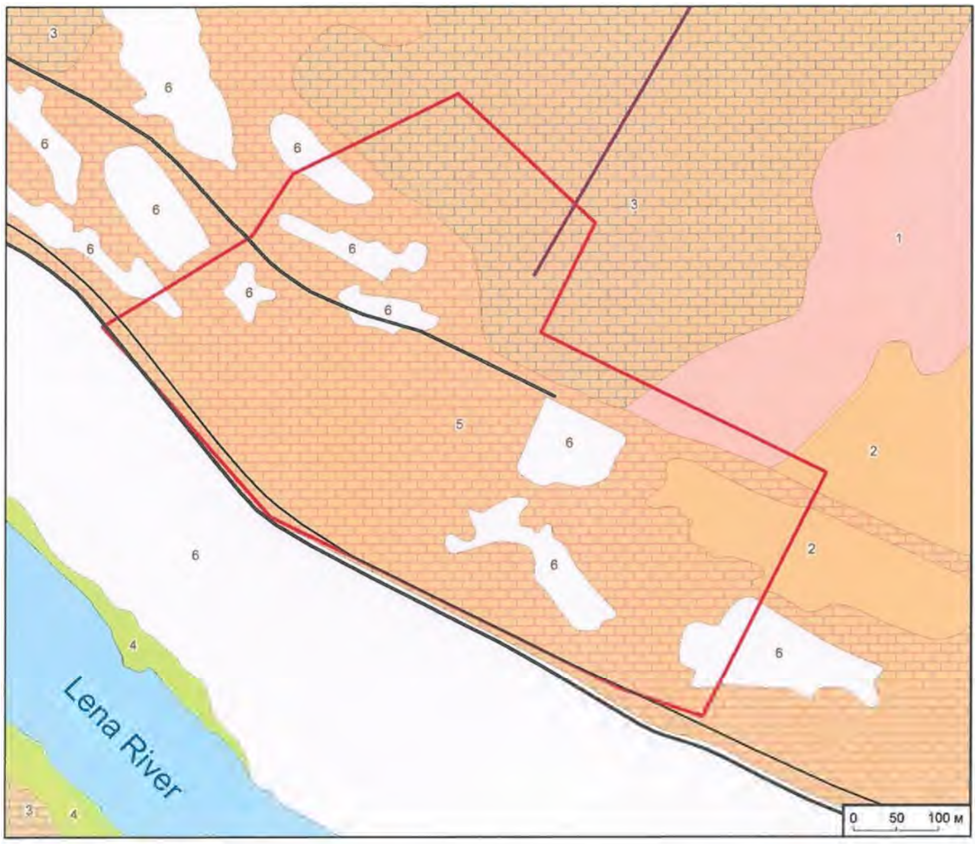
[68] Liquefied petroleum gas reception, storage and offloading terminal. Findings of Engineering Surveys. Technical Report referring to the performed engineering geological surveys. Code 2108/1-1182-13146/1-IGE. - Irkutsk: OOO "INGEO", 2014.

[69] I.A. Belozertseva. Environmental status of soils in the Upper Lena area // Nature of Inland Asia. 2018. No. 3. P. 17-27.

letters attached to the environmental survey reports for LPG RS&O and GFU projects), overall epizootic and sanitary-epidemic situation in the area is fairly good. Soil cover within the Project area does not contain any known animal burial sites, biothermic pits or other biological wastes, and is not considered as a potential source of imported or natural focal infectious diseases. Ust-Kut district is not listed as tick-borne encephalitis endemic area, as of start of year 2019[70]. On the other hand, according to scientific landscape-epidemiological studies, the Project area belongs to Orlingo-Lensky epidemiological area where specific preventive measures are required to address the risk of tick-borne encephalitis. In addition, field surveys of 1990-2007 repeatedly detected high concentrations and high tick infection rates of ixodic ticks in Ust-Kut district in terms of encephalitis and Lyme disease, with an overall trend toward worsening of the situation. Topsoil conditions are critical for expansion of ticks, as they influence ticks survival rate in winter.

The areas barren of any soil cover and areas covered with filled soil with spontaneously growing vegetation are indicated on the map as technogenic soils. According to the 1977 Classification, these areas should be interpreted as re-deposited and artificially accumulated soils of small, medium or high thickness, with different degrees of stone and humus contents (excavations and embankments), and associated with pavement and constructions. Some of them remain frozen for several years after shaping of banks or stripping of surface layers. Currently (May 2017 - June 2019), a major part of construction sites does not have any areas subjected to biological reclamation with remediation of the fertile topsoil and in this connection the Irkutsk Oil Company should consider prospects for soil remediation taking into consideration the information set forth in this Section when preparing a program for environmental engineering surveys for facilities of the planned polymer plant and subsequent planning of environmental and reclamation measures.

[70] Rospotrebnadzor letter of 28.01.2019 No. 01/1180-2019-27



Soil combinations:
1 – (Дл Дл^{о}) + (П - П^{иг}); 2 – Дп + (Дл Дл^{к}) + Дк^{в}; 3 – Дк - Дк^{в}) · Дл^{к}, 4 – ЛгЛдЛбж 5 – ДкН - Дк$^{в}_{н}$, 6 – Т.

Signs of soil combinations:
+ (plus sign) - combinations; – (minus sign) - variations; · (dot) - spottiness; No sign - complexes.

Soil types:
Дл – typical (acidic) forest sod soils of low thickness; Дл^{о} – podzolized forest sod soils; Дл^{к} – forest sod soils, residually calcareous; П – typical podzol soils; П^{иг} – illuvial humus podzol soils; Дк$_{н}$ – calcareous sod soils, normal, highly disturbed; Дк^{в} – calcareous sod soils, leached; Дк$^{в}_{н}$ – calcareous sod soils, leached, highly disturbed; Лг – alluvial meadow soils; Лд – alluvial meadow sod soils; Лб – alluvial meadow bog soils; Т – technogenic soils (soils of man-made origin or soils virtually completely transformed as a result of anthropogenic impact

Figure 7.5.5: Schematic map of the soil cover of the LPG Facilities site and adjacent areas

(Survey data of OOO "INGEO" Company, 2014)

7.5.5 *Ecosystem services and resilience of soil to technogenic impacts*

The methodology that Ramboll adopted for assessment of soil impacts is based on categorization of soils into three groups by their resilience to project impacts:

Soils with *high* sensitivity (vulnerability) are prone to physical transformations under technogenic impacts. Such transformations are often materialized through hazardous exogenous geological processes: erosion-deposition, karst-suffosion, landslide-scree, etc. Other criteria for attribution to this category include susceptibility to chemical contamination and involvement in important economic and ecosystem services, which is in turn dependent on fertility and water regulating capacity. It is generally assumed that restoration of original state of soils with high sensitivity to an impact takes more than 10 years.

Soils with *medium* sensitivity have a higher restoration capacity and can fully recover within 10 years.

Low sensitivity of soils is determined by such properties as resilience to physical impacts, pollution impermeability, low value for ecosystem services, and low water regulating capacity.

Survey results reported by OOO "Raritet" and INGEO indicate that topsoil within the area of IPP and associated facilities is mainly composed of soil with medium and (less frequently) high sensitivity to physical, chemical and pyrogenic impacts. Resilience of local soils is supported by their physical stability, good drainage conditions and absence of permafrost (except for local technogenic frozen areas at construction sites), and substrates rich in calcium carbonate for enhanced accumulation of humus. Therewith, the low integral bonity (due to complex relief and rockiness) is combined medium and sometimes high value of soil for ecosystem services within the subject area (water protection, flow regulation, habitat-forming functions).

The expected main factor of topsoil degradation in relation to the Project is activation of hazardous exogenous geological processes and hydrological phenomena that will have different scope and intensity levels in interfluvial areas, bedrock slopes, floodplain-terrace complex of the Lena River, walls and bottoms of minor erosion landforms, small rivers and creeks.

Due to intensive exogenous geological processes, the Project area is characterized by young raw soils with no environmental or economic value. If destroyed, the soils will rapidly – within few years or decades – restore on sites free from buildings and pavements. On the other hand, formation of soils with established polygenic profile (Figures 7.5.2, 7.5.4) and relatively thick organogenic horizons takes hundreds or even few thousands of years, therefore their restoration after physical disturbance would hardly be practical. Given the above functions of the local soils, the key soil management recommendation is to take the utmost care to maintain soils in an undisturbed state.

Soils in forest areas not affected by hazardous exogenous geological processes and hydrological phenomena are most vulnerable to forest fires that may completely destroy organic matter in litter, dry peat and mulch layers.

7.5.6 Rare and high-value soils

With reference to Art. 62 of the Federal Law "On environmental protection", the Red Books of Soils are maintained at the level of the Russian Federation and of its constituent entities, in order to take stock of and protect rare and endangered soils. In absence of specific regulations for keeping the Red Books of Soils, general methodologies developed by academic community are applied[71].

According to the web-site of the "RF Red Book of Soils" Information System (accessed at https://soil-db.ru), Irkutsk Region is not listed among the Constituent Entities of the RF where the Red Book of Soils is published or has reached final stage of preparation. Therefore, no conservation status has been assigned to soils in the subject area pursuant to applicable legislation on the Red Book of Soils.

The conservation status is most likely to be assigned to soils of certain categories: rare or unique soils, endangered due to erosion or other exogenous processes, displaces with development, exposed to intensive technogenic contamination, having a high value for agriculture and forestry, environmental monitoring, conservation of archaeological sites and paleo-landscape information[72].

The most important function of topsoils within Ust-Kut industrial area is water protection and flow regulation of water bodies, and habitat-forming function for forests and associated phytocoenosis. Other types of soil that may be considered as rare or high-value soils in the future are those associated with archaeological sites and relict attributes. Soils of the two above types are mainly found in the Lena River valley and have not been identified within the designed LPG RS&O and GFU sites.

Conclusion about presence or absence of high-value soils in the designed location site of IPP will be made using the pre-design environmental survey materials.

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[71] The Red Book of Soils of Russia: objects of the Red Book and the High-value Soils Cadastre / ed. G.V. Dobrovolskiy, Y.D. Nikitin M.: "MAKS-Press", 2009. 575 pp.

[72] N.I. Granina. On development of the Red Book of Soils of Irkutsk Region // Soil Science for national food and environmental safety. Papers of VIIth Congress of V.V. Dokuchayev Soil Science Society Part II. Moscow-Belgorod, 2016. pp. 316-317.

7.6 Landscapes

7.6.1 Ust-Kut District Landscapes

The Ust-Kut District area is a part of structural-denudation plateau with absolute elevations up to 800 m. The surface dissection density and depth vary within the range of 300 to 400 m, with greater values in the areas located in higher positions and closer to the Lena River valley. The area is characterized by multiple bedrock outcrops and steep valley slopes (up to 300 m).

The prevailing terrain-forming deposits are Ordovician carbonaceous and terrigenous carbonaceous rock - dolomite, mudstone, siltstone, etc., therefore, the karst processes develop, particularly in the south of the study area. The combination of surface relief and geological structure with the local climate conditions pre-determine extensive gravitational processes - rock slides and falls, subsidence of slopes.

The average annual ambient air temperature reported by the Osetrovo weather monitoring station is below zero (minus 4ºC). Air temperature can drop down to minus 53ºC during the coldest months - December and January. The lowest possible temperature in March and November is minus 44ºC, in April and October - minus 35ºC. The annual total precipitation depth is about 420 mm, with most intensive precipitation during the period from the middle of summer till October.

Cryosolic conditions in the area are typical of the Angara-Lena geocryological region[73]. Permafrost ground is distributed in an irregular manner of island type, mainly in the peat bog areas in topographic lows, river valley floors, and on northern slopes. Permafrost ground occupy up to 25% of the total area of Ust-Kut District.

The Project territory is located in the *Central Siberian Taiga Province, the Lena-Angara Taiga Province of the Baikal-Dzhugdzhur Mountain Taiga Area*. Both Ust-Kut and the designed polymer plant areas belong to the Ilim Larch-Cedar-Spruce Mountain Taiga District[74].

According to the landscape map of the south of the Eastern Siberia[75], the following geosystems are present within the Project area (Figure 7.6.1):

- **Mountainous taiga dark coniferous landscapes of the Altay-Sayany type**
    - *(26) Dark coniferous in intermountain lows and valleys, reduced development conditions;* dark coniferous and lightly-forested (fir-tree/cedar, spruce) bottoms of relief depressions and valleys with dwarf pine dominating the undergrowth;
    - *(27) Dark coniferous with reduced development conditions;* levelled surfaces and slopes, mainly exposed westwards, with cedar-taiga and dwarf shrubs / true moss vegetation;
    - *(33) Low taiga with optimum development conditions***;** mountain-valley mixed-wood/dark-coniferous grass and grass/true-moss landscapes (a part of the optimum development larch-taiga alluvial series);
- **Light/dark coniferous taiga in denudation plateau-plains of the Southern and Central Siberian type**
    - *(36) Larch/dark-coniferous low plateaus and elevations;* ridged elevated plains and plateaus in upland and slope areas, mostly fir trees and spruces with cedar and larch; dwarf shrubs / small grass / true moss, grass-moss and grass ground cover with multiple traps intrusions;
    - *(38) Sub-taiga small-leaved/coniferous on denudation structural plateaus and plains;* piedmont and sub-mountainous landscapes of the ridged plateaus (on terrigenous rocks) covered with small-leaved and light coniferous forests with grass soil cover in the areas of transformed geosystems of the dark coniferous taiga, with optimum development conditions;

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[73] Verkhnechonsk oil and gas condensate field oil transportation system. Environmental Protection. Vol. 7. Book 1. Environmental baseline assessment. - Moscow, FRECOM LLC, 2006. 151 pp.

[74] Atlas: Irkutsk Region. Environmental conditions for development. – Moscow-Irkutsk, 2004, 142 p. Link: http://irkipedia.ru/content/geobotanicheskoe_rayonirovanie_irkutskoy_oblasti_atlas_2004_g

[75] Landscapes of the south of the Eastern Siberia (maps in scale 1:1 500 000) / V.S. Mikheyev , V.A. Ryashyn. - M.: GUGK, 1977

- **South taiga plain**
  - *(58) Dark coniferous taiga in denudation plateau-plains on various rock;* upland plain vegetation of fir-tree/taiga and grass/true-moss type
- **Light coniferous in denudation plateaus and plains, various genesis**
  - *(74) Extensively dissected erosion-structural riverine plateaus (on various rock),* with local karst processes, light coniferous and grass vegetation, partially in the areas of anthropogenically transformed dark coniferous geosystems.

In accordance with the contemporary physical geographic zoning scheme of the Russian Federation, the study area belongs to the Taiga Province where the largest territories are occupied by cryogenic-taiga and taiga complexes with prevailing larch forests [Physical geographic zoning, 2007].

The taiga landscapes are represented by both light coniferous and dark coniferous variants, the latter being most common in high water divide areas and windward slopes. The above are distinguishing feature of the district territory.

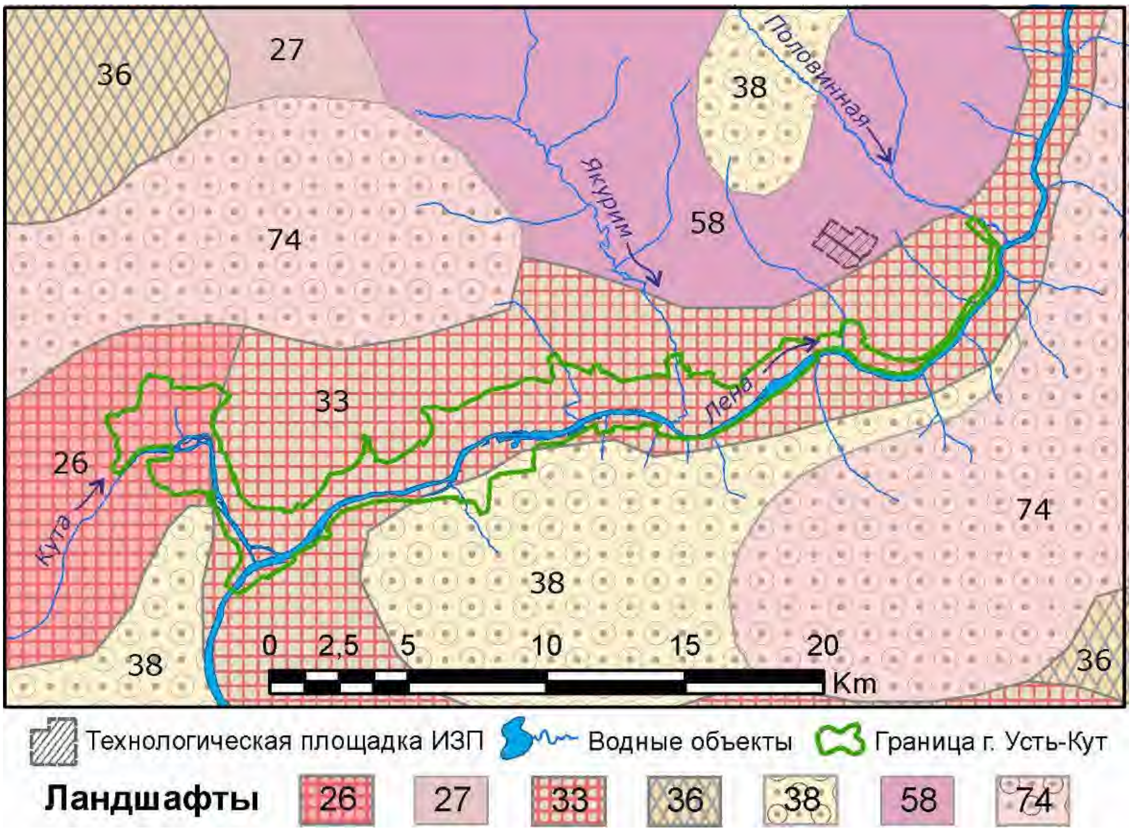

Figure 7.6.1: Landscape map of the Project area

7.6.2 Landscapes in the PPF construction area

The PPF construction site is located near the top of Cape Tolsty. The near-top surfaces are occupied by small-leaved/coniferous sub-taiga forests with small-leaved and light coniferous grass facies in the areas of transformed dark coniferous taiga geosystems. The PPF site is located at the border of small-leaved (aspen-birch) and small-leaved/coniferous (birch, pine) forests.

Figure 7.6.2: Service driveway and small-leaved sub-taiga forests

Photo: Ramboll, May 2017

The upper and steeper parts of the Lena River valley slopes are occupied by mountain taiga forests: pine and pine-larch forests with inclusion of spruce and cedar with typical and illuvial-humus podzol soils, and pine, with duschekia, small grass and true moss ground cover on sod-podzol, sod-calcareous (normal and leached), sod forest (typical and residual calcareous) soils[76].

Gentle slopes of the Lena River valley are covered by larch forests with cedar undergrowth and true moss ground cover over sod-calcareous (normal and leached) and sod residual calcareous forest soils. Slightly gradient slopes are occupied by pine and pine-larch stable derivative forests with Siberian juniper and honeysuckle, small grass and true moss ground cover over sod-calcareous and sod residual calcareous forest soils. Geosystems within the landscape structure are clearly dependent on exposition conditions.

Secondary floodplain meadows with graminoid and forb vegetation, on alluvial meadow-bog, meadow and meadow sod soils, as well as coastal sand beaches and pebble stone areas still partially remain in the Lena River valley.

Planted forests along roads and shrub-graminoid-grass associations with a complex of ruderal species, derivative meadow and ruderal vegetation on heavily impacted sod-calcareous soils are also distinguished as separate geosystems.

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[76] Liquefied petroleum gas reception, storage and offloading terminal. Findings of Engineering Surveys. Technical Report referring to the performed engineering geological surveys. Vol. 4. Code: 2108/1-1182-13146/1-IGE. – Irkutsk, 2014. 282 pp.

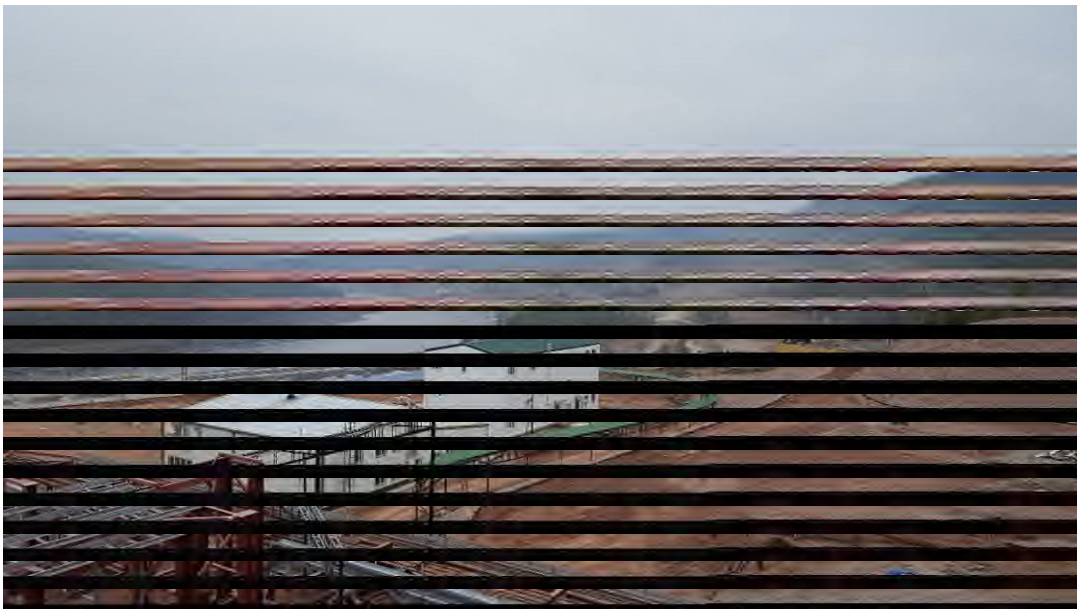

Figure 7.6.3: Anthropogenically disturbed landscape in the area of LPG facilities

Photo: Ramboll, May 2017

Major part of territory in the location area of the existing INK facilities is occupied by technogenic systems - open plant communities in open industrial areas, earth sites with individual plant species and areas without vegetation (built-up areas of operational buildings and utilities) on technogenic soils (made soil or almost totally modified natural soil).

Forest in the PPF construction area are forest land fund areas which are not designated for any protective function. The existing forests in the Project area are secondary forests. The most significant potential uses of the landscapes include picking berries and mushroom, and hunting. In terms of anthropogenic landscape transformation, the main factors are forestry, linear transport facilities, and mining of construction materials.

The nearest farming land areas used as hayland are located within the outlines of the Podymakhinskoye rural settlement in Ust-Kut District around the village of Polovinnaya at a distance of approximately 3 km from the boundaries of the operational Area 1. According to the information requiring clarification, the use of these land areas largely ceased, and the village population consists of only one household.

7.7 Surface Water Bodies and Water Quality

7.7.1 Background

The area of the planned Irkutsk Polymer Plant (IPP) belongs to the Lena watershed district. Its upper section is confined by the location of the town of Ust-Kut (Figure 7.7.1). Priority river use is fishery and municipal water supply. The Lena River is navigable within the Ust-Kut boundaries and downstream of the town. The Lena River is the central watercourse of the district and the largest watercourse in Central Siberia flowing to the Laptev Sea of the Arctic Ocean.

Ust-Kut is situated at one of the sublatitudinal sections of the Lena River valley and stretches along the river for a distance of approximately 40 km mainly on the left river bank. Industrial facilities, including those operated by Irkutsk Oil Company, are concentrated predominantly in the eastern part of the town downstream of its historic and administrative center and most of the residential districts. The IPP project area is located on the left bank section of the Lena valley drained by two creeks: Sukhoy and Gremyachiy.

The main features of hydrography, morphology and regime of water bodies are determined by complex combinations of climate, topography, geological structure, and permafrost. Due to good natural drainage of the area and mountainous terrain, local lakes and swamps chiefly sit within floodplains and, in terms of hydrology, are associated with rivers, which is why the hydrological and hydrochemical characteristics given below refer to the Lena River and its tributaries. Water springs and other underground water occurrences are discussed in Section 7.4.

The following materials were used as a baseline data source for this report: materials of engineering surveys and environmental studies and of hydrometeorological engineering surveys conducted by OOO INGEO (2014, 2018; provided by the Customer); pre-feasibility study relating to the water supply solutions for the Polymer Production Facility (CJSC "Siberian Energy Research and Engineering Center" and Krasnoyarsk GidroProject Institute, 2015; provided by the Customer), scientific publications, and other available sources.

The hydrometeorological study of the surveyed area is carried out by the Federal State Budgetary Institution "Irkutsk Agency for Hydrometeorology and Environmental Monitoring" (hereinafter FSBI Irkutsk AHEM). The nearest hydrologic station of the state monitoring network on the Lena River is sited upstream from the project facilities range (monitoring station code – 30323)[77]. Data used in respective governmental reports[78] refers to two hydrologic stations within the boundaries of Ust-Kut located upstream of the project area: the first station at a distance of 1 km upstream of the Kuta river mouth (the station is called 'Zakutye' in the materials of the hydrometeorological engineering surveys conducted by OOO INGEO) and the second station at a distance of 0.8 km upstream of the Yakurim river mouth.[79]

Table 7.7.1: State of hydrological exploration

Watercourse	Hydrologic station	Authority	Distance from the river head, km	Catchment area, km^2	Period of operation		Zero level of gauge, m in BS (Baltic elevation system)
					Launched	Shutdown	
Lena River	Ust-Kut (Zakutye)	Irkutsk AHEM	826	58900	1973	in operation	282.47
Lena River	Ust-Kut	Irkutsk AHEM	830	71400	1897(1976)	in operation	281.47

[77] List of organizations of the state monitoring network and its monitoring sub-divisions (as of November 01, 2010). – Moscow: RF Ministry of Natural Resources and Ecology, Federal Service for Hydrometeorology and Environmental Monitoring (Roshydromet), 2010. 274 pp.

[78] Governmental Report "On environmental conditions and environment protection in Irkutsk Region in 2015". – Irkutsk: Publishing House "Vremya Stranstviy", 2016. 316 pp.

[79] In this connection, there is an uncertainty about the accurate location of the hydrometric station.

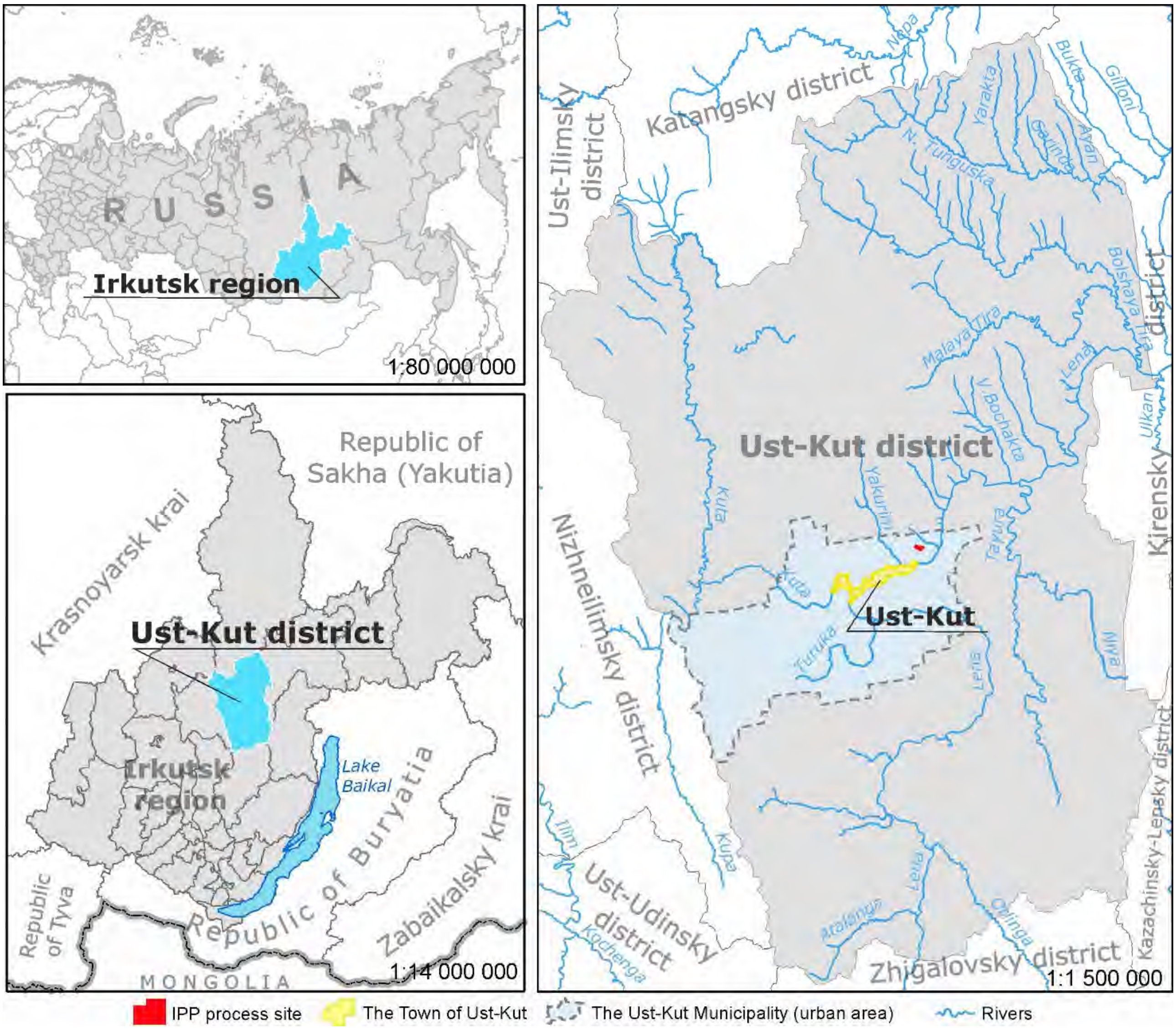

Figure 7.7.1: Surface water bodies located in the Ust-Kut District at the Project area

7.7.2 Lena River

The total length of the Lena River is 4,270 km; Ust-Kut is located in its upper reaches at a distance of approximately 870 km from the river head. The catchment area of the Lena River basin upstream of the IPP project area is estimated at 71,000 km^2.

Hydrographic and hydrometric characteristics

Within the boundaries of Ust-Kut, the Lena River valley cross-section has a trapezoid configuration with an average slope steepness of approximately 15 degrees and average and maximum longitudinal profile slopes of 0.06‰ and 2.7‰, respectively; the streambed width is from 250 m to 300 m and in some areas up to 500 m (Figure 7.7.2). The right-hand river bank is high (7-8 m above the water level in the low-water season) and steep; the left-hand bank is gently sloping and up to 4 m high. The valley walls are covered with grass and forest vegetation; they are moderately dissected by gullies. The lower part of the valley comprises above-floodplain terraces and a complex of low and high floodplains. The average river flow rate is approximately 1 m/s. The bottom is mainly even and stable; it is composed of pebbles in rapids and of sand and pebbles in deeper reaches. Data obtained at the hydrologic station in Ust-Kut (Zakutye) located on the Lena River upstream of the project area is tabulated below.

Figure 7.7.2: The Lena River valley within the Ust-Kut boundaries

Photo: Ramboll 18.05.2017

(Left – view toward east and north-east; there is a plume of smoke from the wooden waste dump site blown toward the valley; the site is operated by OOO TSLK. Right – view toward west and south-west)

Table 7.7.2: Hydrographic and hydrometric parameters of the Lena River from data of the hydrologic station in Ust-Kut (Zakutye) [80]

Parameters	Values
Distance from the river mouth, km	3464
Catchment area (F, km^2)	71400
'0' level of the station, m BS (Baltic elevation system)	282.47
Period of monitoring of the water level (H) and water discharge (Q)	1914-19, 1921-87 rr.
The highest water level (H, cm - m BS / date)	795-290, 42/22.05.79
Maximum water discharge (Q, m^3/s/ date)	3500/24.05.79
Water cross-section area (W, m^2)	2120
Average / maximum water flow velocity (V, m/s)	1.68/2.50
River width at the monitoring station (B, m)	309
Maximum depth (h, m)	5
Elevation of the water edge, m BS	287.47
Maximum (multiannual) water level variation amplitude, cm/year	917/1979 (938)
Frequency of floodplain flooding	Once every 2 or 3 years
Maximum ice thickness, cm/year	129/1953
Water surface slope (J ‰)	$P_{ice\ drift}$ $J_{low\ water}$=0.22-0.39

Hydrologic and water level regime

The Lena River recharge is mixed: snow melting accounts for approximately 40 %, rainwater runoff for 35 % and underground water for 25 %. A high level of atmospheric precipitation (up to 680 mm per year) in combination with significant slope gradients of the terrain and a low evaporation rate (190 mm

[80] Integrated facility for liquefied hydrocarbon gas reception, storage and shipment. Findings of engineering surveys. Technical report on hydrometeorological engineering surveys. Code: 2108/1-1182-13146/1 – IGM. Book 3. – Irkutsk: OOO INGEO, 2014.

per year) generally facilitate the surface runoff drainage, though a ratio of seasonal drainage fields varies depending on specific weather conditions during a particular year.

Among the hydrologic features of the river in the subject area is the unstable water level pattern.

The main phase in the Lena water regime throughout its length is the spring flood (Figure 7.7.3), which is expressed quite clearly in the surveyed area, and maximum spring flood levels in most cases appear to be peak annual.

Summer floods caused not only by heavy rainfall, but also by snow melting begin immediately after the spring flood decline and sometimes even overlap the latter and repeat from 5 to 10 times until the beginning of the cold season.

The winter season in the upper reaches of the Lena is the lowest water period, which is generally typical for the cryolithic zone of Central and Eastern Siberia.

Figure 7.7.3: Late phase of the spring flood period at the Lena River within the Ust-Kut boundaries
Photo: Ramboll 17.05.2017

Figure 7.7.3 (a): Late phase of the winter low water period at the Lena River within the Ust-Kut boundaries Photo: Ramboll 19.03.2019

The annual cycle of the water level in the Lena River in the subject area is characterized by a high rise during the spring flood (25-50 % of the discharge from May to June, Figures 7.7.4-7.7.6), by significant and drastic rises and recessions during the summer-autumn period (30-60 % from June to October) and relatively low and stable level positions during the cold period of the year (10-25 %). The water rise begins between late April and the first decade of May, reaching its maximum during the first days of May. Spring floods end normally in late May – early June. The water level rise height is influenced by large ice jams during spring floods and by high water during the summer-autumn period. The highest intensity of water level rises and recessions in the Lena River at Ust-Kut in the course of spring-autumn floods is 3.2 m/day and 1.2 m/day, respectively. Once the level is high, water intrudes into the floodplain and frequently entails floods (Table 7.7.3). Ust-Kut is one of the Irkutsk Region cities affected by floods at a high frequency of occurrence, i.e. once every 4-5 years; apart from that, the existing difficult water management situation in the upper reaches of the Lena River is due to low water during the low-water period in summer, which affects shipping conditions[81].

Table 7.7.3: Critical water levels in the Lena River

Monitoring point	Elevation of the '0' level of the graph, m BS	Critical water levels (cm) / Duration (days)			Highest water level, cm/year	Lowest water level, cm/year
		Navigation hindering	Floodplain flooding	Flooding of individual buildings and farm land		
Ust-Kut, hydrologic station Zakutye	282.55	10/91	500/8	510/7	795/1979	-143/1969

[81] On approval of the Program for the implementation of the regional hydrometeorological monitoring network". Decree No. 96 of 28.06.1995 of the Irkutsk Region Administration Head.

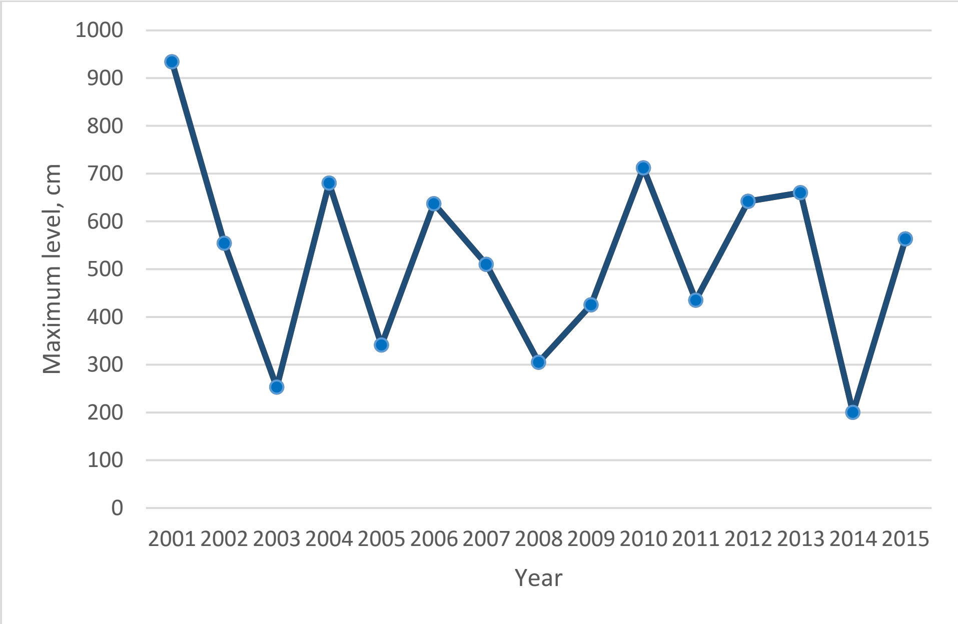

Figure 7.7.4: Multiannual highest water levels in the Lena River at the hydrologic station in Ust-Kut[82]

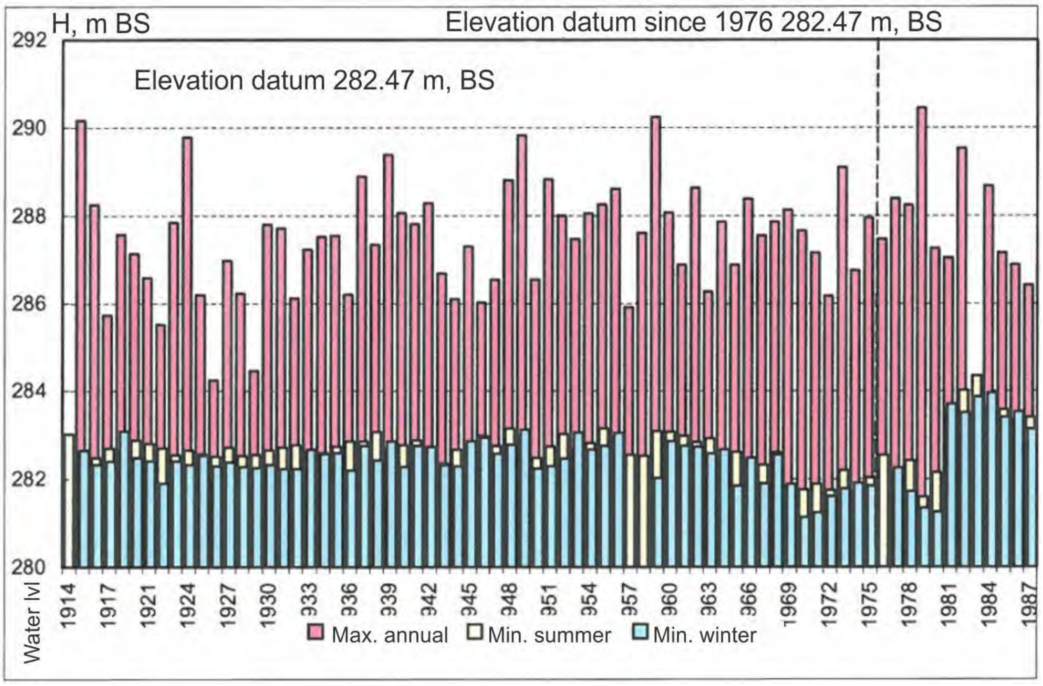

Figure 7.7.5: Chronologic diagrams of variations of annual, average annual and lowest water levels in summer and winter in the Lena River at Ust-Kut (Zakutye) during 1914 – 1987

[82] Analysis of actions undertaken by the Ust-Kut Territorial Subdivision of the Russian Emergency Prevention and Response System to ensure safe conditions during the spring flood of 2015. – Irkutsk Region. Ust-Kut Municipal Administration, 2015.

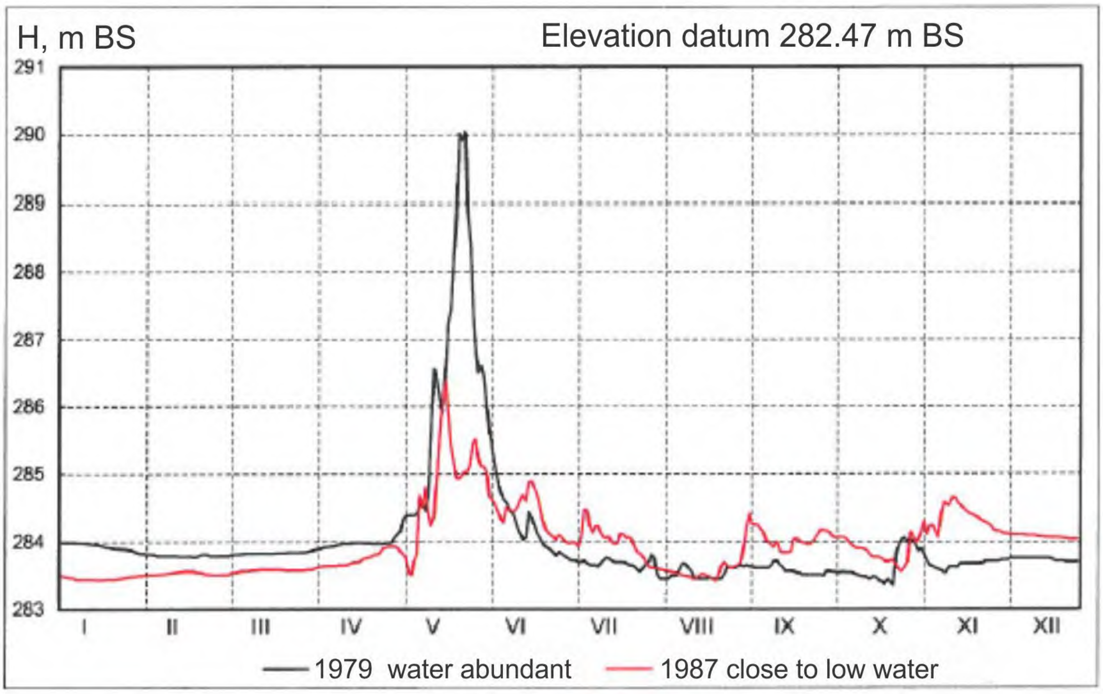

Figure 7.7.6: Water level variations in the Lena River by data of the hydrologic station Zakutye during typical years in terms of water abundance[83]

Figure 7.7.7 shows chronologic graphs of variations of water discharge rates (maximum and average annual, as well as minimum summer and winter discharge rates) for the Lena River, according to data recorded at the hydrologic station Zakutye in Ust-Kut during the 80-year observation period. Years with extreme water abundance have been selected and Figure 7.7.8 shows the water discharge hydrographs for the Lena River at Ust-Kut in 1979 (high water abundance) and 1987 (the year with close to extremely low water discharge). The highest water discharge since 1974 was recorded in the Lena River at Ust-Kut in May 1979 (3,500 m^3/s).

[83] Integrated facility for liquefied hydrocarbon gas reception, storage and shipment. Findings of engineering surveys. Technical report on hydrometeorological engineering surveys. Code: 2108/1-1182-13146/1 – IGM. Book 3. – Irkutsk: OOO INGEO, 2014.

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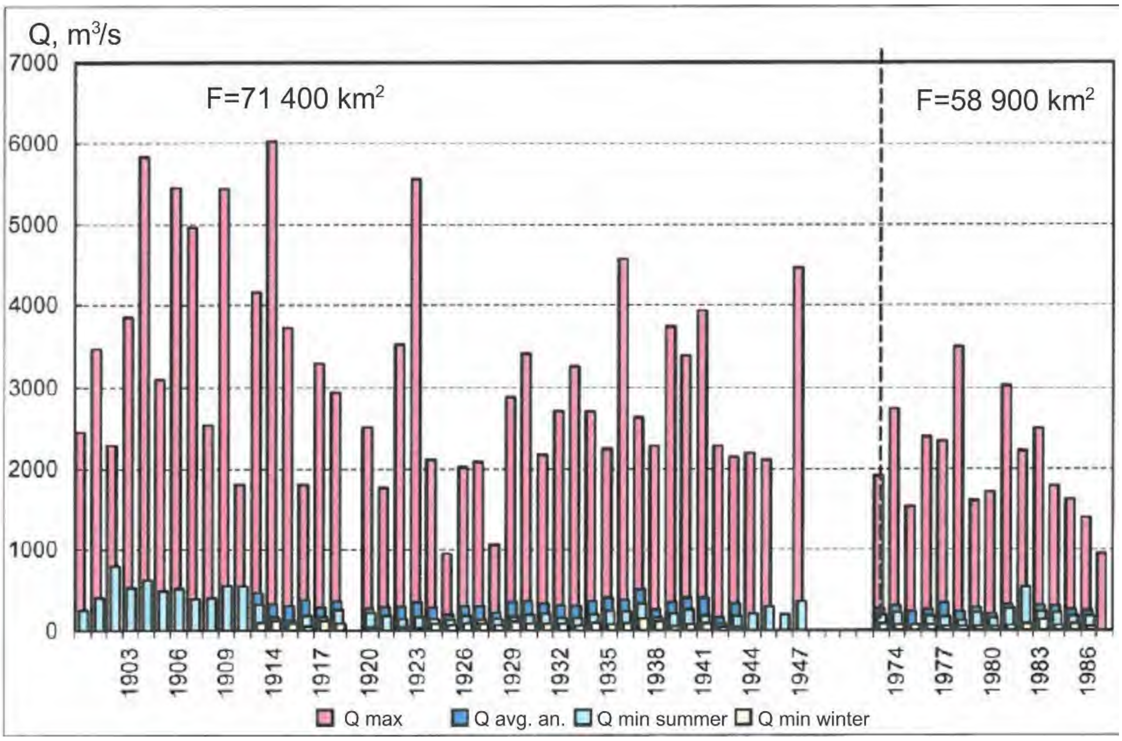

Figure 7.7.7: Chronologic graphs of variations of maximum, average annual, minimum and winter water discharge rates in the Lena River at Ust-Kut (Zakutye) during 1901 - 1987[84]

The hydrologic and morphologic parameters recorded at the monitoring station (Zakutye) on the Lena River within the Ust-Kut boundaries:

- Maximum water discharge with 95 % probability during spring flood 2728 m^3/s
- Maximum water discharge with 95 % probability during rain floods 1519 m^3/s
- Minimum water discharge with 95 % probability in summer 154 m^3/s
- Minimum water discharge with 95 % probability in winter 50.9 m^3/s
- Average flow rate during the low-water period in summer-autumn 0.70 m/s
- Average flow rate during the low-water period in winter 0.24 m/s
- Average river width in case of multiannual average water discharge 220 m
- Average river depth in case of multiannual average water discharge 1.5 m [85]

It is reasonable to assume the value of 332 m^3/s as an average water discharge rate for the Lena River within the Ust-Kut boundaries[86].

[84] Integrated facility for liquefied hydrocarbon gas reception, storage and shipment. Findings of engineering surveys. Technical report on hydrometeorological engineering surveys. Code: 2108/1-1182-13146/1 – IGM. Book 3. – Irkutsk: OOO INGEO, 2014.

[85] Annex B to the document on maximum permissible discharge of substance and microorganisms to the Lena River with rainwater runoff (NDS Document) from the integrated facility for liquefied hydrocarbon gas reception, storage and shipment. Inventory No. 54029. 535-635-NDS. – Irkutsk: AO "SibGiprobum", 2015. 65 pp.

[86] Opekunova M.Yu. Streambed deformation and geomorphologic processes in the upper reaches of the Lena River // Geography and Natural Resources. 2014. No.2. pp. 100-108.

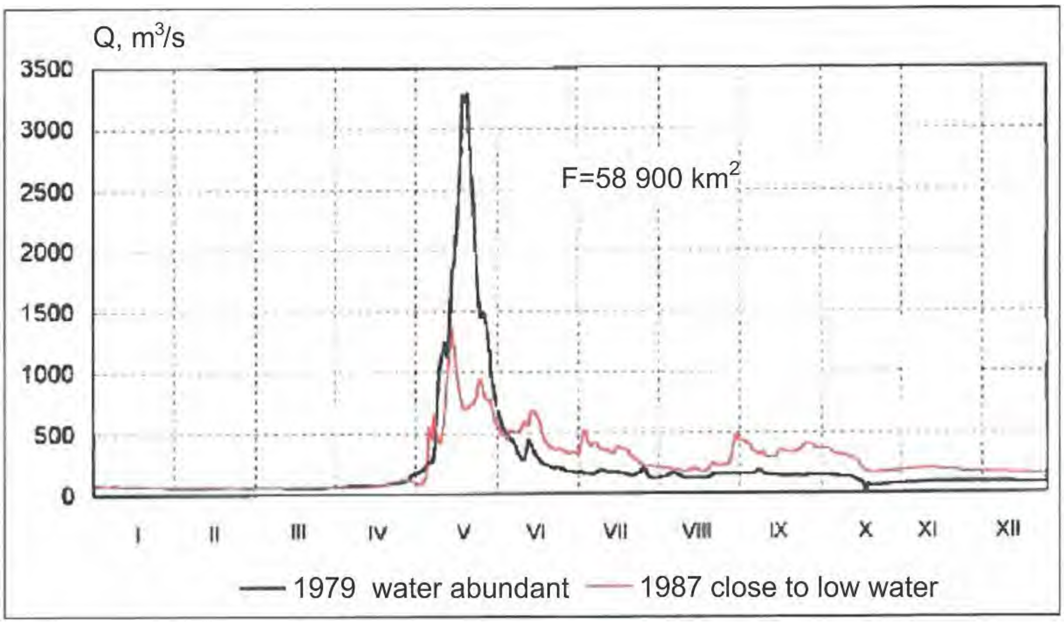

Figure 7.7.8: Water discharge hydrographs for the Lena River at Ust-Kut (Zakutye) recorded during typical years in terms of water abundance[87]

Water discharge

Average annual water discharge at the outlet of the water usage section of the Lena river in Ust-Kut has been assessed at 10.4 km^3 (Table 7.7.4).

Table 7.7.4: Average multiannual water discharge of the Lena River at Ust-Kut (Zakutye)

Catchment area, thou km^2	Discharge modulus, l/s km^2	Water flow rate at the river section outlet, m^3/s	Annual discharge volume, km^3
71,400	4.65	329	10.4

A complexity of natural conditions in the subject area predetermines non-uniform water discharge distribution throughout the year (Table 7.7.5). Water discharge during spring and summer months accounts for 75 % of annual water discharge; the remaining 25 % fall at the autumn-winter period. A decrease in the water abundance of the Lena River recorded during the recent years that affects navigation and other types of water usage might be attributed both to a decrease in the atmospheric precipitation rate in the catchment area and to the occurrence of karst and fissured rocks in the valley predetermining a complex relationship between the surface runoff and water discharge under the streambed.[88] Sporadic nature of the permafrost ground in combination with karst rocks and a significant erosion dissection of the river valleys create favorable conditions for the infiltration of atmospheric precipitates and an active interrelation between underground and surface waters. Another factor influencing the water level pattern in the Lena River at the Ust-Kut range is redistribution of river drifts in the streambed due to the complex dynamics of erosional and accumulative processes (Opekunova, 2014).

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[87] Integrated facility for liquefied hydrocarbon gas reception, storage and shipment. Findings of engineering surveys. Technical report on hydrometeorological engineering surveys. Code: 2108/1-1182-13146/1 – IGM. Book 3. – Irkutsk: OOO INGEO, 2014.

[88] Georgiadi A.G., Kashutina E.A. Multiannual variations of annual and seasonal water discharge of rivers in the Lena River basin // Transactions of the Russian Academy of Sciences. Geographical Series. 2014. No.2. pp. 71-83.

Dzhamalov R.G., Potekhina E.V. Natural climatic and anthropogenic causes of changes in the underground discharge of the Lena River basin // Geological cross-section. Electronic publication in the web at http://georazrez.uni-dubna.ru

Table 7.7.5: Water discharge distribution throughout the year in the Lena River at Ust-Kut (Zakutye)

Station	Month											
	V	VI	VII	VIII	IX	X	XI	XII	I	II	III	IV
Proportion of water discharge, %												
Ust-Kut	28.0	17.1	12.2	10.9	10.0	6.9	3.0	2.7	2.0	1.6	1.8	3.8

Solids discharge

The surveyed watercourse belongs to the zone of low water turbidity (less than 25 g/m^3). Key factors responsible for low water turbidity in the majority of rivers in the subject area are: significant forest density in the catchment area, stability of the rocks that make up the mountainous areas and extensive occurrence of permafrost across the area. A larger proportion of solids discharge (from 70 to 90 %) falls at the spring flood period, which is why the highest water turbidity values and suspended matter concentrations are marked exactly in this period. Suspended matter ingress to the watercourse occurs due to river bed erosion during the ice drift. Ice jam formation in spring is accompanied by fast water level rises and declines, substantial erosion of the river bed and destruction of the river banks. At the same time, the movement of ice facilitates transportation of river drifts alongside with the transfer of ice-bound gravel, pebbles and boulders. Furthermore, weathering products fall onto the ice cover surface from the steep and precipitous river banks before the spring ice drift begins as a result of thawed soil sliding or loose soil falling down along frost fissures.

Ice conditions

Ice conditions in the upper reaches of the Lena are influenced by a sharply continental climate and hydrogeological conditions of the subject area. Ice formation on the river, as a rule, occurs in the conditions of low water content. The river freezes almost ubiquitously during the second half of October. Initially, the river stream carries patches of primary ice for a prolonged period of time (autumn slush ice drift). The following events are typical for the process of ice cover formation: unfrozen patches of water in the icebound river (polynyas), slush ice, freezing to the bottom, ice humps, and an ice thickness buildup. During the spring ice drift, powerful ice jams form causing a water level to rise. The average duration of the ice phenomena is from 190 to 210 days. The maximum ice cover thickness is reported normally in March-April. The ice cover thickness of 1 % probability is 117 cm; the maximum ice cover thickness (129 cm) was recorded in 1953. Ice break in the Lena River in the subject area usually occurs in early May and is accompanied by ice jams and significant water level rises. The ice drift lasts for 6 to 7 days and less frequently for up to 10 days. The river becomes free of ice at the beginning of the second decade of May. On the average, water temperature transits through 0.2 ^oC on May 5-15; by May 20, water temperature rises to 4 ^oC and the water temperature transition through 10 ^oC occurs from June 1 to 20. Average water temperature above 10 ^oC is recorded for the Lena River only in summer months.

Shipping conditions

Regular shipping activities are performed on the Lena River from Ust-Kut downstream (Figure 7.7.9). The main difficulties for shipping operations are the insufficient width of the river, shallow water during the low water season, high water flow speed and slopes in the rapids, as well as a large number of sand bars. According to the information provided by the Lena Basin Inland Waterways Administration as of June 13, 2013, a consistent water level decline was reported throughout the region due to a shortage of precipitation in the Upper Lena basin. The least depth in the Lena River section from Ust-Kut to the Vitim River mouth was 310 cm. Figure 7.7.4, however, clearly indicates that maximum water levels have no annual trend toward lowering.

Figure 7.7.9: Navigable section on the Lena River at the Ust-Kut range: shallow areas and small vegetation-free islands complicate navigation

Photo: Ramboll 19.05.2017

7.7.3 Tributaries of the Lena River

The Kuta River is a left tributary of the Lena River, 408 km long, with a catchment area of 12,500 km^2. It flows across the south-eastern margin of the Central Siberian upland (Lena-Angara plateau) and through the Ust-Kut District. In its mouth section, the river divides into two branches forming an island. The main right-hand river branch has a well-developed streambed. Spring floods influence, to a significant degree, streambed-forming processes within Ust-Kut and in its vicinity, diverting the stream direction toward the right bank. The river is recharged mainly by snow-melting. The average water discharge rate near the river mouth is 62.4 m^3/s. The ice cover is formed in November and it breaks up predominantly in early May. The largest right-hand tributary is the Kupa River.

The watercourses nearest to the project area that flow to the Lena River are its left tributaries: Yakurim River (73 km long, Figure 7.7.10) and Polovinnaya River (38 km long) with water discharge rates in the streambed of about 1.0 to 1.2 m^3/s. With respect to the planned water abstraction facility for the Polymer Production Facility on the Lena River, the Yakurim and Polovinnaya mouths are located at distances of 10 km upstream and 5.5 km downstream respectively.

The Yakurim River is a left tributary of the Lena River, 73 km long; the streambed width is from 25 to 30 m, the depth is from 0.5 to 1.5 m, water flow velocity is around 0.6 m/s. By its physical and chemical composition it belongs to the group of hydrocarbonate magnesium-calcium waters with mineralization of 0,8 g/dm^3.

The Polovinnaya River is a left tributary of the Lena River, 38 km long, with a catchment area of 175 km^2, the streambed width is from 12 to 18 m the depth is from 0.2 to 1.5 m, water flow velocity is 0.5 - 0.7 m/s. The river does not have permanent tributaries. During the summer time river is recharged by precipitation and groundwater, in winter the recharge is by groundwater inflow. The valley has a V-shaped profile in the upper and middle reaches and a trapezoid- shaped profile in the lower reaches. The slopes of the valley are steep, symmetrical. The width of the river valley is 150 – 260 m. The terrace above flood-plain and flood plain (flooded by spring flood) are well traced here. The average annual runoff of the Polovinnaya River varies from 0.60 to 1.73 m^3/s. The average monthly minimum water discharge is 0.21 m^3/s and maximum 9.57 m^3/s. By its physical and chemical composition it belongs to the group of hydrocarbonate with a mixed cationic complex waters with mineralization from 0,1 g/dm^3 to

0.7 g/dm^3 .Catchment areas of both rivers are separated from the designed IPP area by valleys of lower order watercourses: Sukhoy Creek (approximately 9.5 km long, catchment area 17 km^2) and Gremyachiy Creek (approximately 4 km long, Figure 7.7.11). Both creeks are left tributaries of the Lena River and drain the project area directly.

The hydrologic regime of the creeks is extremely unstable, with periods of drying in the summertime during some years and complete freezing, which reduces drastically the value of these watercourses for fishery and virtually rules out their use for water supply and for other practical needs. Higher water discharge rates and levels are observed during rainfall high water.

Table 7.7.6: Minimum width of the water protection zone and riverside protection belt

Watercourse	Catchment area, km^2	Slope angle, °	L from the head to the range, km	Minimum width	
				Water protection zone, m	Riverside protection belt, m
Lena River	81,000	above 3	1,040	200	100
Polivinnaya	175		38	100	50
Sukhoy Creek	17	above 3	9,5	50	50
Gremyachiy Creek		above 3	4	50	50

Figure 7.7.10: Left tributaries of the Lena River:

top left - Yakurim at the crossing with the Baikal-Amur Railway; bottom left and right - Gremyachiy Creek at the crossing with the Federal Highway A-331 Vilyui. Photo: Ramboll 19.05.2017

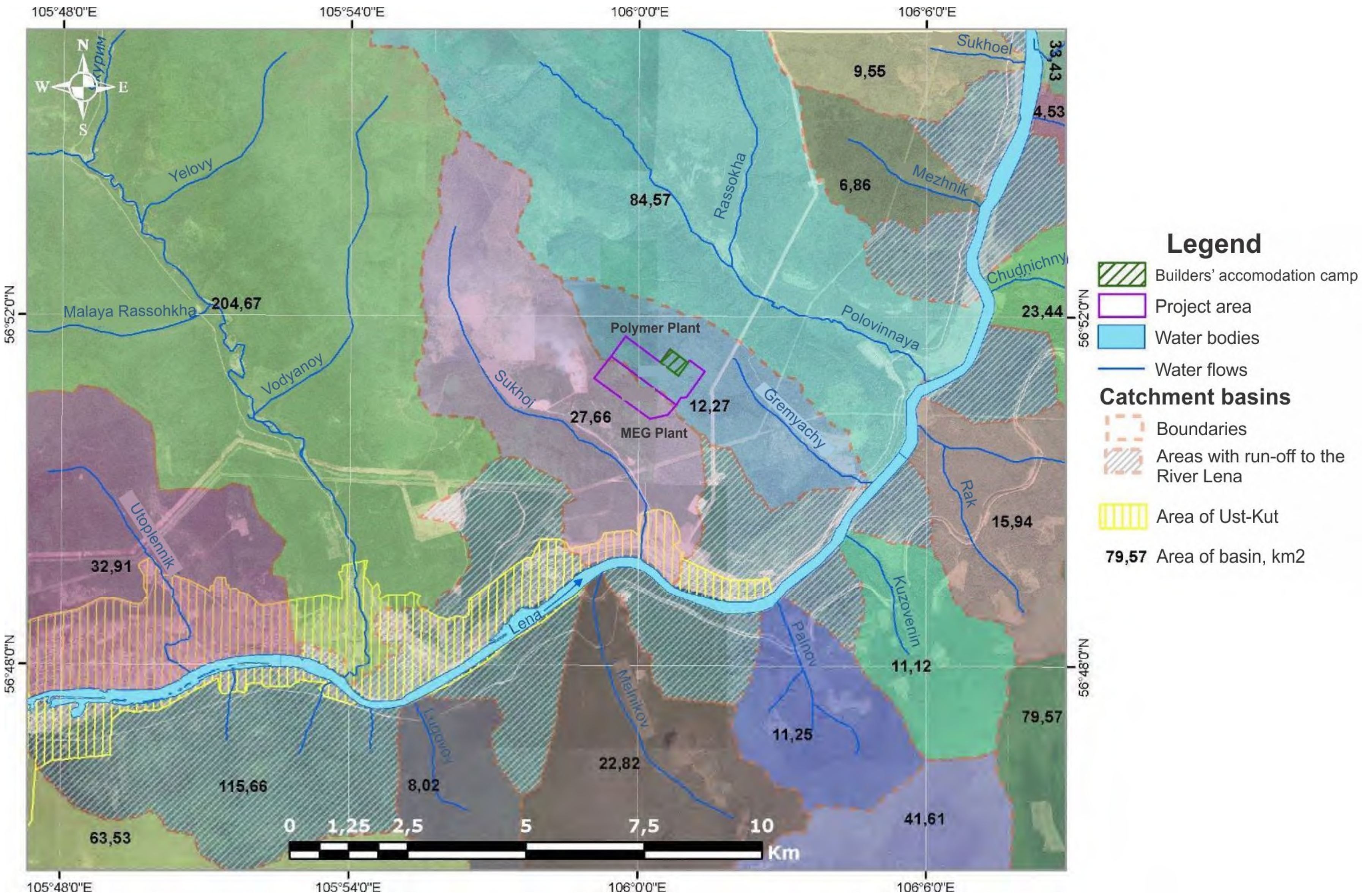

Figure 7.7.11: Watercourse basins in the area of the proposed Project

7.7.4 Limitations of Land Use Associated with Surface Water Bodies

In order to prevent pollution, contamination and siltation of surface water bodies and depletion of their water resources, as well as to preserve habitats of aquatic biological resources and other wildlife and flora resources, water protection zones are established along coastal lines (water body boundaries) of rivers, canals, lakes, and water reservoirs in conformity to Article 65 of the RF Water Code[89]. Special rules and conditions are applied to any commercial and other types of activities within water protection zones.

Within water protection zones, a riverside (riparian) protection belts are established with some additional limitations relating to any commercial and other types of activities. A width of a riverside protection belt is dependent on the slope angle of the river bank and is 30 m for a negative or zero slope angle, 40 m for a slope of up to 3 degrees, and 50 m for a slope angle of 3 degrees and more.

Outside of towns and other residential localities, a width of water protection zones of rivers, creeks, canals, lakes and water reservoirs and of their riverside protection belts is established from the boundary of the respective water body.

According to Item 3, Part 4, Article 65 of the RF Water Code, the water protection zones width within the project area shall be as follows:

- Lena River 200 m
- Sukhoy Creek 50 m
- Gremyachiy Creek 50 m

For any watercourse less than 10 km long from the watercourse head to the mouth, the water protection zone coincides with the riverside protection belt (50 m for the Sukhoy and Gremyachiy Creeks); the riverside protection belt for the Lena River is 50 m wide.

Within water protection zones, it is permitted to plan, construct, refurbish, commission and operate commercial and other property provided it is equipped with facilities ensuring protection of water bodies against pollution, contamination, siltation and depletion of water resources. Water protection facilities shall be selected with due consideration of compliance with the applicable water and environmental protection legislation and regulations on permissible discharges/emissions of pollutants and other substances and microorganisms.

The following activities are prohibited within water protection zones/belts:

1) use of wastewater to fertilize soils;
2) cemeteries, burial grounds, waste disposal, disposal of chemical, explosive, toxic, poisonous substances, disposal of radioactive waste;
3) aerial spraying for pest control;
4) vehicular traffic and parking (except for special transport vehicles) with an exception of traffic on paved roads and parking in special paved areas);
5) filling stations, storage facilities for fuel and lubricants (unless filling stations and storage facilities are located within port sites, ship-building and ship repair yards, infrastructure facilities of inland waterways provided that they comply with the applicable environmental legislation and the RF Water Code), technical maintenance facilities for technical inspection and repairs of transport vehicles and for washing of transport vehicles;
6) specialized storage facilities for pesticides and agrochemicals, as well as use of pesticides and agrochemicals;
7) release of wastewater, including drainage water;
8) exploration and production of common construction-grade minerals (with an exception of cases when exploration and production of such minerals is carried out by the subsoil resources users within the boundaries of the land allocated for this purpose in conformity with the RF legislation regulating subsoil resources usage and on the basis of an approved technical project design in accordance with Federal Law No.2395-1 of 21.02.1992 "On Subsoil Resources".

The following activities are also prohibited within the riverside protection belts:

[89] RF Water Code, No.74-FZ of 03.06.2006 (with amendments and supplements, in effect since 01.01.2016)

1) plowing of land;
2) disposal of dredge spoils.

According to the information provided by the territorial Angara-Baikal RosRybolovstvo Department (Fishery), the Lena River is categorized as a water body of the highest fishery category due to the fact that it provides habitats and spawning grounds to especially valuable and important commercial fish species. No fishery zones have been established for the Lena River section within the subject area.[90]

Especially hazardous hydrologic phenomena

The most common hazardous hydrologic phenomena reported in the subject area are spring floods and rainfall high water. These are most often observed in certain sections of the rivers characterized by a complex configuration of the streambed (the presence of islands, sharp turns, bends and narrowings), where ice jams are most frequent.

According to the multiannual observations, the subject area is one of the most hazardous in the Irkutsk Region in terms of floods. By statistical data for 2010-2015, the water level rise in the rivers in the Ust-Kut District above critical elevations caused flooding of the following settlements: Ust-Kut and Kaimanovo in 2010 and 2013; Orlinga village in 2010; Zvyozdny in 2015.

The subject area is characterized by a harsh continental climate, which causes deep freezing of soil in winter and freezing of rivers in shallow water areas. These factors contribute to the development of icy phenomena determining the ice size and thickness that varies from a few centimeters to 5 m.

7.7.5 Surface Water Quality

The chemical composition of water in the Lena River and its basin is influenced both by natural factors (extremely harsh climatic conditions, presence of the cryolithologic zone, low self-recovery and self-purification ability of the biota in case of technogenic impact, low thickness and thermal instability of the topsoil cover, and existence of persistent geochemical anomalies and karst rocks in the streambeds) and by technogenic / anthropogenic factors (exploitation of gold, coal, diamond and oil deposits; leaching of waste rock dumps generated in the process of exploration and exploitation of ore deposits containing copper, iron and zinc; impact of river transport, discharge of industrial effluents, logging operations, discharge of sanitary wastewater, etc.).

Main sources of water pollution in the rivers of the Lena River basin are human activities of local communities in towns and settlements, river fleet, river ports, shipyards, and wastewater from industrial enterprises. During periods of intensive navigation, water pollution with petroleum hydrocarbons, phenols and organic matter is reported within the area of Ust-Kut's influence (up to 1.5-5.0 MPC).

One of the recharge sources for the Lena River is surface water that normally has low salinity (in most cases not exceeding 50-100 mg/l) and prevalence of HCO_3^- and Ca^{2+} in the ionic composition. Another recharge source is underground water, but its contribution is somewhat less significant; however, it plays an important role in predetermining the chemical composition of river water.

In terms of the chemical composition, water in the Lena River is fresh with sodium hydrocarbonate facies. During the winter low-water period, water salinity rises up to 0.7 g/l due to the effect of subaquatic discharge of saline underground water.

The chemical composition of water in the Lena tributaries in the surveyed range varies from river to river. Water in the Kuta river is marked with a rather high relative content of sodium chlorides, which tells on the chemical composition of water in the Lena in the section downstream of Ust-Kut.

Lena River

Materials used to assess the surface water quality in the Lena River in the project area characterize different river sections (upstream and downstream, as well as in the immediate vicinity of the survey objects), these are namely:

[90] Water supply system for the Ust-Kut Polymer Plant. Pre-feasibility documentation. General Explanatory Note 889-PZ. – Krasnoyarsk: CJSC Siberian Energy Research and Engineering Center, Krasnoyarsk Gidroproject Institute, 2015. 112 pp.

- materials of the environmental engineering surveys[91], including the results of analyses of water samples collected at a distance of a few km from the planned facilities, as well as 2 water samples collected downstream in the vicinity of the Verkhnemarkovo settlement;
- multiannual data recorded at the hydrologic stations (in Ust-Kut) of the Irkutsk Department of State Hydrometeorological Service located downstream of the planned facilities. One of them is sited at a distance of 1 km upstream of the Kuta mouth (Zakutye) and the other at a distance of 0.8 km upstream of the Yakurim mouth.

Water samples were collected from the Lena River in the process of the environmental engineering surveys in the vicinity of the integrated facility for LHG reception, storage and shipment. The hydrochemical analysis results are providsented below (Table 7.7.7). The water samples were collected at depths of 0.7 m and 1.5 m.

The hydrochemical analysis of the water samples has indicated that surface water in the Lena River in the vicinity of Ust-Kut complies, with regard to virtually all chemical indicators, with the applicable MPC values for water bodies for general, sanitary, drinking and recreational uses, as well as with the MPC values for fishery water bodies. The only exception is the iron concentration of 0.3-0.5 mg/l, which exceeds respective MPC levels.

Table 7.7.7: Results of the chemical analysis of the water samples collected in the Lena River at the LHG site

Water sampling depth, m		0.7	1.5	$MPC_{sanit.}$ [92].	$MPC_{fishery}$ [93]
Unit of measurement		mg/l	mg/l	mg/l	mg/l
Cations					
NH^{4+}		0.34	0.37	1.5	0.5
$Na^{+}+K^{+}$		2.04	6.23		
Mg^{2+}		16.54	29.18	50	40
Ca^{2+}		77.0	40.1	-	180
Fe_{total}		**0.30**	**0.50**	0.3 (1)	0.1
Anions					
Cl^{-}		76.6	79.4	350	300
SO_4^{2-}		46.2	37.5	500	100
NO_3^{-}		12.6	10.5	45	40
HCO_3^{-}		122.0	92.8	-	-
Other parameters					
Hardness mmol/dm equiv.	Total	5.74	4.83	-	-
	Carbonate	2.00	1.52	-	-
	Non-carbonate	3.74	3.31	-	-
pH		7.1	7.7	-	6.5-8.5
CO_2 agr., mg/l		3.5	0.3	-	-
Salinity, mg/l		365	306	-	-

Two water samples were collected in the Lena River downstream of the planned facilities during the surveys conducted in the vicinity of the Verkhnemarkovo settlement by the V.B. Sochava Institute of Geography of the Russian Academy of Sciences.

The results of the chemical and physical analysis (Table 7.7.8) indicate that the water samples, by all specified parameters, comply with the MPC values for water bodies for general, sanitary, drinking and recreational uses, as well as for fishery water bodies.

[91] Integrated facility for liquefied hydrocarbon gas reception, storage and shipment. Findings of engineering surveys. Technical report on environmental engineering surveys. Code: 2108/1-1182-13146/1–IGE. Book 4. – Irkutsk: OOO INGEO, 2014.

[92] Hygienic Norms GN-2.1.5.1315-03, GN 2.1.5.2280-07, GN 1.2.3111-13

[93] Order of the RF Ministry of Agriculture "On approval of regulatory requirements to water quality in fishery water bodies", No.552 of 13.12.2016.

Table 7.7.8: Physical and chemical parameters of surface water in the Lena River in August 2011

Parameters	Water sampling locations		$MPC_{sanit.}$[94]	$MPC_{fishery}$[95]
	2 km upstream of Verkhnemarkovo	2 km downstream of Zayarnovo		
K^+, mg/l	0.51	0.77	-	50 (10 for water bodies up to 100 mg/l)
Na^+, mg/l	10.9	12.5	200	120
Ca^{2+}, mg/l	31.60	39.5	-	180
Mg^{2+}, mg/l	12.4	14.4	50	40
HCO_3^-, mg/l	142	170	-	-
Cl^-, mg/l	15.9	19.2	350	300
SO_4^{2-}, mg/l	14.7	10.5	500	100
Salinity, mg/l	288	267	-	-
Suspended matter, mg/l	5.0	5.5	-	10 (or 0.25 mg/l to the baseline content for water bodies of the highest and first fishery category, 0.75 mg/l for water bodies of second fishery category)
NO_2^-, mg/l	0.04	0.05	3.3	0.08
NO_3^-, mg/l	0.3	0.5	45	40
F^-, mg/l	0.42	0.51	-	0.05 (in addition to the baseline fluoride content, but the total content may not exceed 0.75 mg/l)
O_2, mg/l	8.1	7.8		-
CO_2, mg/l	3.8	3.4		-
Temperature, °C	17	16	-	The water temperature may not increase as a result of human activities (including wastewater discharge) as compared to the natural temperature of the water body by more than 5°C, with a total increase up to 20°C in summer and 5 °C in winter in water bodies inhabited by cold water fish species (salmon and cisco species) and not more than up to 28°C in summer and 8 °C in winter in other cases. It is prohibited to increase the water temperature in burbot spawning grounds by more than 2°C in winter.
Color, degrees	<10	<10	-	-
Transparency, cm	150	160		
Odor, points	0	0	-	-
pH	7.9	8.1	-	6.5-8.5

The surface water under study (the water sample collected at a distance of 2 km downstream of Zayarnovo) generally meets applicable MPCs for water bodies used for sanitary and fishery needs (Table 7.7.9). Above- $MPC_{fishery}$ values were detected for ammonium (1.4 $MPC_{fishery}$) and petroleum hydrocarbons (1.4 $MPC_{fishery}$). Assumingly, this exceedance should be attributabled to natural origin of these pollutants because water in rivers in the taiga zone is rich in organic matter and some of its components are similar to petroleum derivatives with regard to their physicochemical properties.

[94] Hygienic Norms GN-2.1.5.1315-03, GN 2.1.5.2280-07, GN 1.2.3111-13

[95] Order of the RF Ministry of Agriculture "On approval of regulatory requirements to water quality in fishery water bodies " (No.552 of 13.12.2016)

Table 7.7.9: Pollutant concentrations in the surface water samples collected in the Lena River in August 2011[96]

Parameters	Sampling point location		$MPC_{sanit.}$[97]	$MPC_{fishery}$[98]
	2 km upstream of Verkhnemarkovo	2 km downstream of Zayarnovo		
Petroleum hydrocarbons	0.03	**0.07**	0.1	0.05
Synthetic surfactants	0.074	0.090	0.5	0.1
Phenols	0.005	0.004	0.001	0.001
NH_4^+, mg/l	0.4	**0.7**	2	0.5
PO_4^{3-}, mg/l	<0.05	<0.05	3.5	0.2
BOD_5	1.1	1.8	3.0	6.0
COD	13.8	12.7	15	-

The contents of iron and heavy metals in surface water in the Lena River comply with MPC for water used for general, sanitary and drinking needs and for fishery water bodies. Elevated aluminum concentrations from 0.05 to 0.06 mg/l were detected, which exceed the regulatory limits established for fishery water bodies (Table 7.7.10).

Table 7.7.10: Concentrations of iron, aluminum and heavy metals in surface water in the Lena River [99]

Chemical elements, mg/l	Sampling point location		$MPC_{sanit.}$[100]	$MPC_{fishery}$[101]
	2 km upstream of Verkhnemarkovo	2 km downstream of Zayarnovo		
Fe	0.014	0.013	0.3	0.1
Zn	0.005	0.008	1	0.01
Cu	0.002	0.003	1	0.005
Cr	0.004	0.004	0.05	0.02
Pb	<0.001	<0.001	0.01	0.006
Cd	<0.001	<0.001	0.001	0.005
Ni	0.004	0.006	0.02	0.01
Co	0.001	0.001	0.1	0.01
Al	**0.05**	**0.06**	0.2	0.04

Also, hydrochemical monitoring of the Lena River and its tributaries was performed at three stations, at six cross-sections, by the Irkutsk Department of State Hydrometeorological Service over the period of 2008-2017:

1. at the cross-section 0.05 km upstream of the river port Kachug;
2. 0.1 km downstream of the river port Kachug;
3. 1.6 km upstream of the town of Ust-Kut (1 km upstream of the Kuta River mouth, Zakutye);
4. in the town of Ust-Kut (0.8 km upstream of the Yakurim river);
5. 2 km upstream of the town of Kirensk (5 km upstream of the Kirenga River mouth);
6. 1 km downstream of the town of Kirensk (1 km downstream of the Kerenga River mouth).

Sampling points No.3 and No.4 are the nearest to the project area; they are located at a distance of approximately 1 km from the water edge of the Lena River.

[96] Integrated facility for liquefied hydrocarbon gas reception, storage and shipment. Findings of engineering surveys. Technical report on environmental engineering surveys. Code: 2108/1-1182-13146/1 – IGE. Book 4. – Irkutsk: OOO INGEO, 2014.

[97] GN 2.1.5.1315-03, GN 2.1.5.2280-07, GN 1.2.3111-13.

[98] Order of the RF Ministry of Agriculture "On approval of regulatory requirements to water quality in fishery water bodies" (No.552 of 13.12.2016).

[99] Integrated facility for liquefied hydrocarbon gas reception, storage and shipment. Findings of engineering surveys. Technical report on environmental engineering surveys. Code: 2108/1-1182-13146/1 – IGE. Book 4. – Irkutsk: OOO INGEO, 2014.

[100] GN 2.1.5.1315-03, GN 2.1.5.2280-07, GN 1.2.3111-13.

[101] Order of the RF Ministry of Agriculture "On approval of regulatory requirements to water quality in fishery water bodies" (No.552 of 13.12.2016).

The environmental situation in the Lena River basin at the above river cross-sections was assessed basing on monitoring data of the Irkutsk Department of State Hydrometeorological Service against the criteria characterizing the water contamination level.

The most informative indicators for integrated water quality assessment are the specific combinatorial index of water contamination (SCIWC) and the water quality class (the level of water quality determined within an interval of numerical values of water properties and composition characterizing its suitability for a particular water user).

SCIWC is determined from a frequency and MPC exceedance degree by several contaminants and it can vary in waters of different contamination degrees from 1 to 16 (0 for pure water). A higher index indicates a lower water quality[102]. The SCIWC–based water quality classification allows categorizing surface water by 5 water quality classes:

- Class 1 conditionally clean;
- Class 2 slightly contaminated;
- Class 3 contaminated;
- Class 4 dirty;
- Class 5 extremely dirty.

At the baseline cross-section located at a distance of 1.6 km upstream of Ust-Kut, the average annual organic matter concentration 1.2- 3 times exceeded the regulatory limit by COD, from 1.1 to 1.4 times by BOD_5; copper concentrations exceeded MPC 1.3 and 1.1 times. In 2014 and 2015, the recorded average annual phenol concentrations exceeded MPC 2.5 and 1.8 times, respectively. Maximum COD values, in some years, as much as 5 times exceeded the regulatory limit; the BOD_5 value exceeded MPC 2.4 times; the iron content reached a level of 3.4 MPC, the nitrite nitrogen content was as high as 4.4 MPC, and the manganese content was up to 2 MPC (Table 7.7.11).

On the basis of the integrated set of indicators, the water quality in the Lena River section upstream of Ust-Kut was categorized as 'slightly contaminated' in 2017. In the previous years, it had been categorized as 'slightly contaminated' or 'contaminated'.

Table 7.7.11: Concentrations of pollutants and water quality assessment at the baseline monitoring station located 1.6 km upstream of Ust-Kut

Pollutant concentrations, year	Copper avr./max.	Total iron avr./max.	Phenols avr./max.	COD avr./max.	BOD_5 avr./max.	Water quality class
2017						2 (slightly contaminated)
2016						3, a (contaminated)
2015			1.8	1.9	1.4	2 (slightly contaminated)
2014			2.5	3	>1	2 (slightly contaminated)
2013			>1	>1	>1	2 (slightly contaminated)
2012	1.1/1.8	-/3.2		2/5.4	1.2/1.9	3, a (contaminated)
2011	-/1.4	1/3.4		2/4	1.1	2 (slightly contaminated)
2010	1.3/3.3	-/1.4	-/2	1.9/5	1/2.1	3, a (contaminated)
2009	1/2	1/3.4		1.7/4.2	1/2.4	3, a (contaminated)
2008	-/2	-/1.3		1.2/2.2	-/1.4	3, a (contaminated)

Within the boundaries of Ust-Kut, average annual organic matter concentrations (BOD_5 and phenols) during the period of 2008-2012 did not exceed the applicable MPC levels. However, in 2014 and 2015, they reached 1.6 MPC for BOD_5 and 2.5 MPC for phenols. Elevated average annual values of COD up to 2.8 MPC and maximum concentrations up to 4.6 MPC were recorded annually. Above-limit average

[102] RD 52.24.643-2002 'Methodological Guidelines. Method for assessing the surface water contamination with regard to hydrochemical indicators.

annual copper (2.2 MPC), total iron (1.8 MPC) and manganese (1.1 MPC) concentrations were detected in individual years. (Table 7.7.12).

River water in Ust-Kut was categorized as 'slightly contaminated' (Class 2) throughout the year of 2017, whereas in the previous years its quality had varied between 'slightly contaminated' (Class 2) and 'contaminated' (Class 3, a).

Table 7.7.12: Concentrations of pollutants and water quality assessment in the Lena River within Ust-Kut (0.8 km upstream of the Yakurim river mouth)

Pollutant concentrations, year	Copper avr./max.	Total iron avr./max.	Phenols avr./max.	COD avr./max.	BOD_5 avr./max.	Water quality class
2017						2 (slightly contaminated)
2016						2 (slightly contaminated)
2015			2	1.6	1.6	2 (slightly contaminated)
2014			2.5	2.8	>1	3, a (contaminated)
2013			>1	>1	>1	2 (slightly contaminated)
2012	2.2/5.1	-/2.3	1/3	1.7/4	1/1.9	3, a (contaminated)
2011	-/2	-/2.8		2.3/4.4	1/1.8	3, a (contaminated)
2010	1.1/2.1	-/2.1	1/2	1.7/4.6	1/1.5	3, a (contaminated)
2009	-/2	1.8	1	1.6/3.6	1/2.3	2 (slightly contaminated)
2008	1.3/5	-/2.8	1	1.2/1.9	1/1.7	3, a (contaminated)

According to the letter No.CMC763 of 16.10.14 of the Irkutsk Department of State Hydrometeorological Service addressed to Irkutsk Oil Company, the following baseline concentrations of pollutants were recorded in water of the Lena River at the monitoring point located in Ust-Kut 0.8 km upstream of the Yakurim river mouth (Table 7.7.13):[103]

Table 7.7.13: Baseline pollutant concentrations in the Lena River at Ust-Kut (0.8 km upstream of the Yakurim river mouth)

Ser. Nos.	Substance or indicator of the chemical composition of river water	Baseline value, mg/l
1	Suspended matter, total concentration	6.16
2	COD	47.1
3	BOD_5	2.73
4	Sum of ions, concentration	383.6
5	Petroleum hydrocarbons, total concentration	0.01

Kuta River

The Kuta River throughout its length flows across the territory of the Ust-Kut District of the Irkutsk Region. The river passes through Ust-Kut in the lower reaches (8 km from the river mouth). At this river section, a number of mineral water sources flow into the Kuta River on its right bank; Solyonoye Lake is located on the left river bank.

Hydrochemical monitoring was conducted by the Irkutsk Department of State Hydrometeorological Service only at one point sited in the range of the Ruchey settlement. Over the period of 2008-2017, MPC exceedances were recorded for a number of indicators (COD, BOD_5, copper, total iron, and phenols).

Average annual copper and total iron concentrations were shown to exceed MPC 1.3-1.7 and 1.3-2 times, respectively. However, in some years, average annual copper and iron concentrations were in conformity to the applicable MPCs. A trend toward elevated average annual concentrations of COD was traced over the monitoring period (1.2-2.5 MPC). Also, in 2014 and 2015, average annual concentrations of phenols

[103] Annex G to the Document (NDS Document) specifying maximum permissible discharge of substances and microorganisms to the Lena River with industrial and rain runoff from the integrated LHG reception, storage and shipment facility. Inv.No. 54029. 535-635-NDS. – Irkutsk: AO SibGiprobum, 2015. 65 pp.

exceeded MPC 2.3 and 2 times, respectively. On the other hand, average annual BOD_5 concentrations decreased and have not exceeded the applicable limits since 2010 (Table 7.7.14).

River water at the monitoring point in this river range was categorized as 'slightly contaminated' (Class 2) throughout 2017. During the previous years, it had been assigned to Class 2 'slightly contaminated' or Class 3, a 'contaminated'. However, in 2013, the water quality deteriorated to Class 3, b 'highly contaminated'.

Table 7.7.14: Pollutant concentrations and water quality assessment in the Kuta River at the Ruchey settlement

Pollutant concentrations, year	Copper avr./max.	Total iron avr./max.	Phenols avr./max.	COD avr./max.	BOD_5 avr./max.	Water quality class
2017						2 (slightly contaminated)
2016						3, a (contaminated)
2015			2	1.9		2 (slightly contaminated)
2014			2.3	2.1		2 (slightly contaminated)
2013	>1	-/>1	>1	>1	>1	3, a (contaminated)
2012	1.5/3	-/3.2	1	1.5/2.5	-/1.9	2 (slightly contaminated)
2011	1.3/1.7	1.3/4.8		2.5/3.8	-/1.9	2 (slightly contaminated)
2010	1.7/2.6	1.2/4.1		2.1/5	-/1.5	3, a (contaminated)
2009	<1/1.9	2/6.6	1/3	1.2/2.2	1.2/1.9	3, a (contaminated)
2008	1.6/2.4	-/2.5	1	1.5/1.9	1.4/2.2	3, a (contaminated)

The surface water quality was assessed on the basis of multiannual observation data reported by the Irkutsk Department of State Hydrometeorological Service (hydrologic monitoring station on the Kuta River and two hydrologic stations on the Lena River – Zakutye and a station located at a distance of 0.8 km upstream of the Yakurin river), as well as from data of the environmental engineering surveys carried out for construction of the LHG Complex Project (2 water samples collected at the LHG site and 2 water samples collected upstream of the site in the vicinity of the Verkhnemarkovo settlement). The following conclusions can be made on the basis of the above materials:

- In the water samples collected in the Lena River at a distance of a few km from the planned Polymer Production Facility, iron concentrations exceeded regulatory MPC for water used for general, sanitary and drinking needs and for fishery water bodies.
- The analyzed surface water (the samples collected 2 km upstream of Verkhnemarkovo and 2 km downstream of Zayarnovo) does not comply with the regulatory concentration levels for petroleum hydrocarbons (probably bituminous substances of natural origin), ammonium and aluminum.
- The baseline monitoring station Zakutye on the Lena River during the period of 2008-2017 recorded MPC exceedances by copper, COD, BOD_5, and phenols (probably substances of natural origin).
- Surface water in the Lena River at Ust-Kut is characterized by maximum exceedance of MPC levels as compared to other river ranges. Above-MPC concentrations were detected for the following pollutants: copper, total iron, COD, BOD_5, and phenols.
- The water samples collected in the Kuta River within the Ruchey settlement during 2008-2017 exhibited elevated concentrations of the following pollutants: copper, total iron, COD, BOD_5, and phenols.

7.7.6 Groundwater Quality

The groundwater quality was assessed on the basis of chemical analyses and results of radiological studies of water samples provided in the report generated by OOO GGL Razdolye: "Geological statement relating to the results of drilling of the hydrogeological well No. SUG-1G at the site of the integrated facility for LHG reception, storage and shipment in Ust-Kut", as well as of the laboratory testing data on water samples from water abstraction facilities provided by the Irkutsk Region Center of Hygiene and Epidemiology.

Groundwater in the studied water-bearing formation of the Upper Lena rock series of the Middle-Upper Cambrian system ($Є_{2-3}$vl) is freshwater, the chemical composition is of magnesium-calcium sulfate - hydrocarbonate facies, with a salinity level of 0.55 g/l. No significant variations in the chemical composition of the groundwater were detected in the process of three-day test pumping.

The content of radioactive elements complies with the requirements set forth in SanPiN 2.1.4.1074-01: total volumetric alpha-activity is 0.096 Bq/l (MPC 0.2 Bq/l); total volumetric beta-activity is 0.121 Bq/l (MPC 1.0 Bq/l).

In terms of physical properties, the tested water is odorless, without sediments, and transparent. The underground water temperature is from 2.0°C to 2.5°C.

With regard to the level of natural protection, underground waters in the investigated aquifer are rated as reliably protected, because they are overlain by clayey deposits of a considerable thickness (approximately 70 m).

According to the classification of operational water reserves and inferred water resources, water occurrence of the well No. SUG-1G at the LHG reception, storage and shipment facility site is rated as Group 1.

In March 2016, the groundwater quality in water wells Nos. SUG-1G and SUG-2G was assessed in the course of laboratory tests conducted by the East-Siberian Railroad Division of the Center of Hygiene and Epidemiology for Railroad Transport and the Center of Hygiene and Epidemiology in the Republic of Buryatia. Chemical composition data for water from water wells Nos. SUG-1G and SUG-2G are tabulated below (Table 7.7.15).

As follows from the Table, the iron content in water from well No. SUG-1G (0.78 mg/l) exceeds the applicable MPC level. The other chemical water quality parameters meet the regulatory requirements.

Water from the water well No. SUG-2G exceeds the MPC values for water bodies used for general and sanitary needs and fishery water bodies by iron (0.63 mg/l) and manganese (0.07 mg/l); also, higher chromaticity was marked (33.3 degrees).

The laboratory studies revealed a violation of hygienic water quality standards set forth in SanPiN 2.1.4.1175-02. Total coliform bacteria (TCB) and thermotolerant coliform bacteria (TtCB) were detected in water from the well No. SUG-2G (Table 7.7.15).

Water from the wells is compliant with the radiological safety standards specified SanPiN 2.1.4.1074-01.

Table 7.7.15: Chemical composition of water from hydrogeological wells Nos. SUG-1G and SUG-2G

Indicators	Sampling points		Control levels[104]	$MPC_{sanit.}$[105]	$MPC_{fishery}$[106]
	SUG-1G	SUG-2G			
Organoleptic indicators					
Odor at 20°C, points		2.0	2-3	-	-
Odor at 60°C, points		2.0	2 -3	-	-
Taste, points		3.0	2	-	-
Aftertaste, points		3.0	2- 3	-	-
Color, degrees		**33.3**	30	-	-
Turbidity, ЕМФ		2.44	2.6	-	-
Chemical indicators					
Total iron	**0.78**	**0.63**	-	0.3(1)	0.1
Total hardness, mg-equiv./ l	5.9	5.52	7-10	-	-
pH	6.91	6.65	6-9	-	6.5-8.5

[104] SanPiN 2.1.4.1175-02.

[105] GN-2.1.5.1315-03, GN 2.1.5.2280-07, GN 1.2.3111-13.

[106] Order of the RF Ministry of Agriculture "On approval of regulatory requirements to water quality in fishery water bodies" (No.552 of 13.12.2016).

Indicators	Sampling points		Control levels[104]	MPC$_{sanit.}$[105]	MPC$_{fishery}$[106]
	SUG-1G	SUG-2G			
Permanganate oxidizability, mg/l	0.4	0.3	5-7	-	-
Dry residue, mg/l	320	300	1000-1500	-	-
NH_4^+, mg/l	<0.1	<0.1	-	1.5	0.5
NO_2^-, mg/l	<0.002	<0.01	-	3.3	0.08
NO_3^-, mg/l	<0.5	<0.5	45	45	40
SO_4^{2-}, mg/l	53.0	51.7	500	500	100
F^-, mg/l	0.38	0.46		-	0.05 (in addition to baseline fluoride content, but not higher than total content 0.75 mg/l)
Cl-, mg/l	27.6	27.4	350	350	300
HCO_3^-, mg/l	342	340	-	-	-
Ni, mg/l	<0.003			0.02	0.01
Si, mg/l	4.4			10	-
B, mg/l	<0.05			?	0.1
Cu, mg/l	<0.001			1	0.001
Total alkalinity, mg/l	2.7		-	-	-
Petroleum hydrocarbons, mg/l	0.03			0.3	0.05
Co, mg/l	<0.015			0.1	0.01
Ca, mg/l	60.1	59.4		-	180
Mg, mg/l	34.3	38.9		50	40
Na, mg/l	25.7	25.7		200	120
K, mg/l	5.28	5.28		-	50 (10 for water bodies up to 100 mg/l)
CO_2, mg/l	39			?	-
Mn, mg/l		**0.07**		0.1	0.01
Microbiological investigations					
Total microbial number, number of colony-forming microbes per 1 ml	-	**Detected**	100	-	-
Total coliform bacteria	-	**Detected**	Not detected	-	-
Thermotolerant coliform bacteria	-	**Detected**	Not detected	-	-
Radiological studies					
Indicators	**Borehole SPBT-1G**	**SUG-1G**	**Maximum permissible level[107]**	**MPC$_{sanit.}$[108]**	**MPC$_{fishery}$[109]**
Specific total alpha-radioactivity, Bq/kg	0.026	0.096	0.2	-	-
Specific total beta-radioactivity, Bq/kg	0.37	0.121	1.0	-	-

Drinking water supply of Ust-Kut is performed from the underground water abstraction facilities 'Slopeshny' and 'Lena-East'. According to the results of laboratory tests conducted by the Irkutsk Region Center of Hygiene and Epidemiology, the underground water quality from the municipal water abstraction facilities meets the applicable hygienic and radiological standards.

Data obtained from drilling of water wells SUG-1G and SUG-2G alongside with data from the test reports of the Irkutsk Region Center of Hygiene and Epidemiology were used for underground water quality assessment (Table 7.7.16). The following conclusions can be made on the basis of the above data:

- In water samples from the well SUG-1G, iron content does not exceed regulatory levels for water bodies used for general and sanitary water supply and for fishery water bodies.
- In water samples from the well SUG-2G, manganese and iron contents exceed the regulatory standards for water bodies used for general and sanitary water supply and for fishery water

[107] SanPiN 2.6.1.2523-09, SanPiN 2.1.4.1074-01.

[108] GN-2.1.5.1315-03, GN 2.1.5.2280-07, GN 1.2.3111-13.

[109] Order of the RF Ministry of Agriculture "On approval of regulatory requirements to water quality in fishery water bodies" (No.552 of 13.12.2016).

bodies. Also, the microbiological tests indicated non-compliance with the hygienic standards specified in SanPiN 2.1.4.1175-02.

- The quality of underground water supplied from the water abstraction facilities 'Slopeshny' and 'Lena-East' comply with the applicable hygienic and radiological regulations[110].

Table 7.7.16: Chemical composition of water from hydrogeological wells Nos. SUG-1G and SUG-2G

Indicators	Sampling points		Control levels[111]	$MPC_{sanit.}$[112]	$MPC_{fishery}$[113]
	№SUG1-1G	№SUG2-2G			
pH	6.85	6.65	6-9	-	6.5-8.5
Dry residue, mg/l	512.43	300	1000-1500	-	-
Permanganate oxidizability, mg/l		0.3	5-7	-	-
Total hardness, mg-equiv./ l	5.34	5.52	7-10	-	-
NH_4^+		<0.1	-	1.5	0.5
NO_2^-, mg/l		<0.01	-	3.3	0.08
NO_3^-, mg/l		<0.5	45	45	40
Fe общ.		**0.63**	-	0.3(1)	0.1
Cl^-, mg/l	25.33	27.4	350	350	300
SO_4^{2-}, mg/l	51.15	51.7	500	500	100
F^-, mg/l		0.46	-	-	0.05 (in addition to baseline fluoride content, but not higher than total content 0.75 mg/l)
HCO_3^-, mg/l	311.10	340	-	-	-
Ca^{2+}, mg/l	58.32	59.4	-	-	180
Mg^{2+}, mg/l	30.62	38.9	-	50	40
$Na^+ + K^+$, mg/l	31.59		-		
Na^+, mg/l		25.7	-	200	120
K^+, mg/l		5.28	-	-	50 (10 for water bodies up to 100 mg/l)
Mn^{2+}, mg/l		**0.07**	-	0.1	0.01

According to the results of laboratory tests conducted by FBUZ "Center for Hygiene and Epidemiology in the Irkutsk Region", the quality of underground water supplied from the water abstraction facilities 'Slopeshny' and 'Lena-East' comply with the applicable hygienic and radiological regulations.

Data obtained from drilling of water wells №1G and №2G (Polovinnskogo UN, near Polovinnaya River) alongside with the data from the test reports of the Irkutsk Region Center of Hygiene and Epidemiology were used for underground water quality assessment.

The following conclusions can be made on the basis of the laboratory tests (Table 7.7.17):

The laboratory studies revealed a violation of hygienic water quality standards set forth in SanPiN 2.1.4.1175-02, GN 2.1.5.1315-03:

- In water samples from the well №2G, Permanganate oxidizability content is 5.1 time more than MPC, which indicates the presence of readily oxidizable organic and inorganic impurities.
- In water samples from the wells №1G and №2G, iron content exceeds (2.6 MPC и 8.7 MPC) the regulatory standards for water bodies used for general and sanitary water supply and for fishery water bodies.

110 SanPiN 2.1.4.1074-01, SanPiN 2.6.1.2523-09, GN 2.1.5.1315-03.

111 SanPiN 2.1.4.1175-02.

112 GN-2.1.5.1315-03, GN 2.1.5.2280-07, GN 1.2.3111-13.

113 Order of the RF Ministry of Agriculture "On approval of regulatory requirements to water quality in fishery water bodies" (No.552 of 13.12.2016).

Table 7.7.17: Chemical composition of water from hydrogeological wells Nos.1G and 2G

Indicators	Sampling points №1-G	Sampling points №2-G	Control levels[114]	$MPC_{sanit.}$[115]	$MPC_{fishery}$[116]
Chemical indicators					
HCO_3^-, mg/l	195±23	196±24	-	-	-
F^-, mg/l	< 0.15	< 0.15		1.5	0.05 (in addition to baseline fluoride content, but not higher than total content 0.75 mg/l)
Total alkalinity, mg/l	3.2±0.4	3.2±0.4	-	-	-
pH	7.6±0.2	6.2±0.2	6-9	-	6.5-8.5
Dry residue, mg/l	500±60	499±60	≤ 1500	1000-1500	-
Total hardness, mg-equiv./ l	5.9±0.9	6.7±1.0	≤ 10	7-10	-
Permanganate oxidizability, mg/l	0.88±0.18	35.7±3.6	≤ 7	5-7	-
Petroleum hydrocarbons, mg/l	0.030± 0.012	0.92±0.23	-	0.1	0.05
NH_4^+, mg/l	0.12±0.04	0.44±0.09	-	1.5	0.5
NO_2^-, mg/l	0.0050±0.0025	0.0040± 0.0020	-	3.3	0.08
NO_3^-, mg/l	1.8±0.4	0.77±0.15	-	45	40
SO_4^{2-}, mg/l	129±14	172±26	≤ 500	500	100
Cl-, mg/l	5.8±0.5	7.4±0.5	≤ 350	350	300
Si, mg/l	3.3±0.8	1.6±0.4	-	10	-
B, mg/l	< 0.05	0.078± 0.023	-	0.5	0.1
Total iron	0.78±0.18	2.6±0.4	-	0.3(1)	0.1
Co, mg/l	0.0067± 0.0023	< 0.002	-	0.1	0.01
Ni, mg/l	< 0.004	0.0045± 0.0022	-	0.02	0.01
Cu, mg/l	0.0014±0.0007	< 0.001	-	1	0.001
Na, mg/l	7.3+1.2	6.7±1.1	-	200	120
Ca, mg/l	61.3±1.2	81±12	-	-	180
Mg, mg/l	34.3±0.7	32.0±4.8	-	50	40
K, mg/l	2.1±0.4	<1	-	-	50 (10 for water bodies up to 100 mg/l)
Microbiological investigations					
Coliforming bacteria	Not detected	Not detected	Not detected	-	-
Total bacterial count	0	0	100	-	-
Total coliform bacteria	Not detected	Not detected	Not detected	-	-
Thermotolerant coliform bacteria	Not detected	Not detected	Not detected	-	-
Radiological studies					
Specific Rn-22 radioactivity, Bq/kg	-	1.7±0.8			
Specific total alpha-radioactivity, Bq/kg	-	0.13±0.05			
Specific total beta-radioactivity, Bq/kg	-	0.11±0.04			

[114] SanPiN 2.1.4.1175-02.

[115] GN-2.1.5.1315-03, GN 2.1.5.2280-07, GN 1.2.3111-13.

[116] Order of the RF Ministry of Agriculture "On approval of regulatory requirements to water quality in fishery water bodies" (No.552 of 13.12.2016).

7.8 Biodiversity

The vegetation and wildlife characterization of the project area for the planned Polymer Production Facility is presented based on the materials of the engineering surveys conducted by OOO "INGEO" and some other surveyors in 2014-2019 for the adjacent site for construction of the LNG Facilities and the gas fractioning unit (GFU), the forest management information and documents relating to the designated forest land plots leased by INK, the reference data provided by the competent governmental agencies (RF Ministry of Natural Resources, the Ministry of Natural Resources and Environment of Irkutsk Region, the Wildlife Management Service of Irkutsk Region, Fish Resources Management Department "BaikalRybvod"), publications and other information sources available in the public domain.

7.8.1 General characterization of vegetation

The vegetation in Ust-Kut District is represented by complexes of mountainous and boreal forest (taiga) plant species typical of the Central Siberian formation. According to the regional schemes of geobotanical zoning[117] the subject area belongs to the Ilim mountainous taiga district of larch-Siberian pine-spruce vegetation of the Lena-Angara mountainous taiga province.

The floristic richness of a major part of this territory corresponds to the zone of boreal forests (taiga) and specifically to the southern taiga sub-zone. Tree stands consist of Siberian larch (*Larix sibirica*), Siberian pine (*Pinus sibirica*), common pine (*Pinus silvestris*), Siberian spruce (*Picea obovate*), Siberian fir (*Abies sibirica*), flat-leaved birch (*Betula platyphylla*), and aspen (*Populus treumula*). The undergrowth comprises rowan (*Sórbus sp.*) and shinleaf willow (*Sálix pyrolifólia*). The shrub layer consists of a few species: honeysuckle (*Lonicera edulis*), spiny rose (*Rosa acicularis*), juniper (*Juniperus sibirica*). Dwarf shrub cover is recorded virtually in all types of phytocoenosis. Most common are lingon-berry (*Vaccinium vitis-ideae*) and bog bilberry (*Vaccínium uliginósum*).

The proportion of the area covered with forests in Ust-Kut District is estimated as high as 95.9 %[118], which indicates high level of availability of forest and associated resources in the Project area. The Ust-Kut Forestry Department manages 4,535,060 ha of designated forest land which is divided into several forestry divisions.

The Ust-Kut industrial area of INK immediately affects the land of Osetrovskaya Lesnaya Dacha (193,675 ha) being a part of the eponymous forestry division (421,005 ha), and causes indirect impact on urban forest areas in the east of Ust-Kut city (693 ha) controlled by Ust-Kut City Municipal Administration[119].

According to the forestry plan of Irkutsk Region[120] and the Forestry Management Regulations, the total area of the Ust-Kut Forestry Department includes 4,422,399 ha of forest which represents the taiga forest zone comprising the Upper Lena taiga district and the Kirensky forest-protection district. Here the main forest-forming species are coniferous trees - pine, spruce, larch, fir, and Siberian pine. The urban forests in Ust-Kut are composed of the same species - pine (48 % of the tree layer), larch (29 %), spruce (14 %), birch (9 %) and aspen (16 %), with willow thickets in creek valleys and the Lena River floodplain.

The dominating variant in the coniferous forest areas is true moss (56%), while forbs vegetation and dwarf-shrubs/moss variants are less common (24% and 13%, respectively). Most of them are secondary, as virgin forests have been destroyed due to many-years' logging and frequent forest fires (Figure 7.8.1).

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[117] Atlas. Irkutsk Region: Environmental conditions for development. Edited by V.V. Vorobyov, Academy Member. Moscow-Irkutsk, 2004

[118] Forest Management Regulation for Ust-Kut Forestry Department of Irkutsk Region. - Irkutsk: PribaikalLesProject Branch of FGBU RosLesInfOrg, 2018. 452 pp.

Forest land field survey Act of 21.11.2018, approved by Deputy Forest Resource Minister of Irkutsk Region A.Y. Stupin

[119] Forest Management Regulation for Urban Forests of Ust-Kut City Municipality - Irkutsk: PribaikalLesProject Branch of FGBU RosLesInfOrg, 2013. 129 pp.

[120] Irkutsk Region Forest Plan. 2013 г. <http://irkobl.ru/sites/alh/documents/lesplan/lesplan1.pdf>

According to the statistical reports, fires damaged 13,932 ha (0.3%) of forests controlled by the Ust-Kut Forestry Department over past 15 years. Reforestation activities covered only 13% of the areas affected by forest fires. Sanitary state of the completely burnt areas is poor, due to high extent of littering.

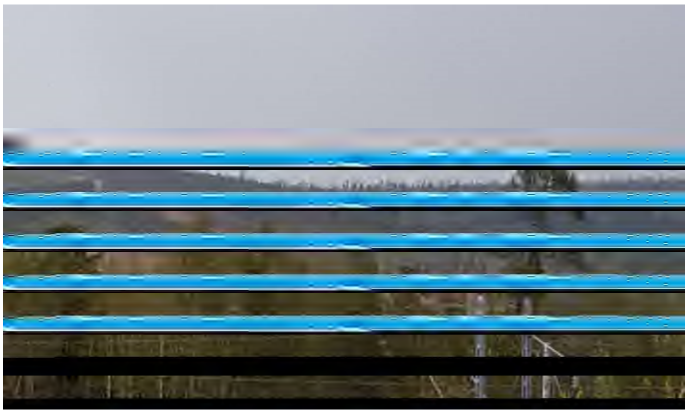


Figure 7.8.1: General view of forest within the Project area

(Photo: Ramboll 19.05.2017 and 20.03.2019): mixed secondary coniferous and small-leaved forest disturbed by areal and linear clearcutting with reservation of seed trees (stand out against general background due to larger crowns)

Forests within the Ust-Kut Forestry Department are most disturbed in the areas near settlements, cooperative gardens, MSW landfills, motor roads and railway lines. The most common factors of forest degradation in the above areas are man-caused fires, illegal logging, machinery movements outside the designated routes, littering with solid waste, impact of emissions from vehicles traffic, and settlement of road dust. The nearest development area is the "Kedr-2" Gardening Association in the Gremyachiy Creek valley (Figure 7.8.2).

Figure 7.8.2: Small development areas within "Kedr-2" Gardening Association, north-east of the Project site

(Photo: Ramboll 19.05.2017 and 20.03.2019)

The nearest agricultural areas are associated with Polovinka village and include hayland, pastureland, and minor crop farms with varying species composition of the farmed ecosystems (vegetable crops, leaf vegetables, grain crops). Their locations are shown in the map in Appendix 4.

The meadow and swamp-shrub communities have various series of factor-dynamic ties with forests (including anthropogenic) and are most common in the river valleys (Figure 7.8.3) and forest areas disturbed by felling, fires and construction activities.

Figure 7.8.3: Shrub-graminoid communities in the Lena River floodplain: willow thickets with individual small-leaved trees and forb-graminoid meadows with presence of ruderal plants

(Photo: Ramboll 19.05.2017 and 20.03.2019)

7.8.2 Vegetation within the Project site

The Project will immediately affect the area of the Osetrovskaya Lesnaya Dacha controlled by the Ust-Kut Forestry Department. This forest area represents the taiga forest zone comprising the Upper Lena taiga district and the Kirensky forest-protection district. Here the main forest-forming species are coniferous trees - pine, spruce, Siberian larch, fir, and Siberian pine.

In terms of forest protection and exploitation, the Osetrovskaya forestry division comprises a belt of designated spawning protection forest on the erosion slopes and terrace along the Lena River, and nut production forest areas, the nearest of which is located at a distance of 14 km from the designed boundary of IPP site (Figure 7.8.4).

The boundary of the spawning protection forest belt has no floristic importance and is set at the edge of the river valley: conservation of forest vegetation on the Lena River valley slopes and terrace is assumed as a measure to prevent development of adverse exogenous processes, make the snow-melting period more gentle and extended in time, for better conservation of the near-shore spawning areas of valuable and rare fish species.

Due to the restrictions on use of spawning protection forests that were first imposed in the USSR back in 1958, the forests acquired a vital role in conservation of biodiversity and the ecological framework that supports local terrestrial and fresh-water ecosystems.

Boundaries of the spawning protection forests are shown in the supporting maps herein. Originally (in 2017) the Company considered construction of the main PPF facilities within the spawning protection forests, whereas site location in merchantable forests was considered as alternative solution. Later on the alternative option was adopted as the main one, for environmental and process reasons. Therefore, the PPF process area will be located in the area of designated merchantable forest land. Since site locations of certain designed facilities are dependent on the transport corridors of Ust-Kut city and configuration of the Lena River valley, disturbance of spawning protection forests cannot be fully avoided: certain forest areas will be fragmented by technical corridors of linear facilities.

Figure 7.8.4 illustrates morphological features of forests within the Ust-Kut industrial area of INK. Most part of the forest areas within the Project land is covered with pine/small-leaved and pine-larch shrub/true-moss and grass/true-moss, aspen-birch and birch-aspen grass/true-moss series communities, with prevalence of secondary associations, short-timed or permanent. The forest density is within the range of 0.5 to 0.7, average bonity grade is three, timber yield is 220 - 285 m^3/ha.

Figure 7.8.4: Story structure variants of the forest and meadow-shrub communities within the Project area during vegetative season

(Photo: OOO "INGEO", 2014). From left to right, top to bottom: Birch-larch forest with inclusions of pine trees duschekia and small grass - true moss ground cover in the interfluvial area; spruce horsetail small grass - true moss forest in near-valley positions; shrubby forbs meadow surrounded by mixed coniferous/small-leaved forest; larch with spruce and cedar dwarf-shrub/true-moss forest on northern slope

Disturbance of the tree layer is partially compensated by more intensive development of other elements of vegetation. The undergrowth commonly comprises rowan (*Sorbus sibirica*) and in the stream valleys it may also include shinleaf willow (*Salix pyrolifolia*). The shrub layer consists of few species and has the cover density of 0.1-0.3. Its typical elements are honeysuckle (*Lonicera edulis*), spiny rose (*Rosa acicularis*), juniper (*Juniperus sibirica*), and in water-logged areas also meadowsweet (*Spiraea media*) and dwarf birch (*Betula humilis, B. exilis*).

Dwarf shrub cover is recorded virtually in all types of phytocoenosis, with a projective cover varying within the range of 10 to 60 per cent. The most common species here is lingon-berry (*Vaccinium vitis-ideae*). In wet forests, on northern mountain slopes and in marsh land common are bog bilberry (*Vaccinium uliginosum*) and ledum (*Ledum palustre*). The survey reports of OOO "INGEO" recognise the rich floristic composition of the examined phytocoenosis, particularly the herb layer. More specifically, the identified herb species include several horsetail species (*Equisetum arvense, E. palustre, E. fluviatile, E. hyemale, E. scirpoides, E. sylvaticum*), multiple graminoids (C*alamagrostis epigeios, C. obtusata, C. purpurea, Meica nutans, Alopecurus pretense, Poa pratensis, P. palustris, P. sibirica, Bromopsis inervis; Phleum pretense*), four pyrola species (*Pyrola asarifolia, P. chlorantha, P. rotundifolia, P. minor*), other small forest grass species (*Maianthemum bifolium, Mitella nuda, Trientalis europaea*), and tall grasses (*Trollius asiaticus, Cimicifuga foetida, Aquilegia sibirica, Delphinium elatum*).

Moss ground cover is also present throughout the territory and includes *Pleurozium schreberi, Hylocomium splendens, Rhytidiadelphus triquestrus, Aulacomnium palustre, Dicranum polysetum, Ptilidium ciliare, Ptilium crista-castrensis, Climacium dendroides* with average projective cover of 40 to 80 % (in the forest associations affected by fires moss cover is often fragmentary).

Secondary forests in the clearcut or burnt areas are sometimes very homogeneous - they may consist of one or two tree species with coniferous undergrowth (Figure 7.8.5). Forest regeneration takes less time in the areas where seed trees are left (photo on the right).


Figure 7.8.5: Mixed secondary small-leaved forests in clearcut areas

Photo: Ramboll 19.05.2017, at the crossing of the INK's gas pipeline and 220 kV power transmission line NW of the Polymer Plant (on the left), and 20.03.2019, access road of the main PPF process site

Areas affected by forest fires are reported throughout the study area including the forest land plots leased by INK. Characteristic signs of fire damage in the forest areas are black colour of tree trunks and typical damage of moss cover (in case of ground fire, refer to Figure 7.8.6).


Figure 7.8.6: Secondary coniferous/small-leaved forest damaged by fire within the forest area leased by INK

View from the service road and INK gas pipeline; background in the right-hand photo - LPG Terminal and the Lena River valley (Photo: Ramboll, 19.05.2017)

The geobotanical description of the site where the Plant is planned to be located was carried out in 2019 as a part of the engineering and environmental surveys performed for the Production Facility for Storage of Equipment and Materials for Construction of INK LLC facilities. The surveys were carried out prior to clearing and planning of the industrial site and mapping of plant communities (Figure 7.8.7.-1) The presented chart shows that in the vegetation cover of the industrial site of the IPP is dominated by low-value secondary forests (about 78% of the area in the land abandonment contour), represented by restoration communities (in place of cedars and clearcuts) and forest plantations, while semi-indigenous forests (cedar-fir forests and pine larch forests with admixture of cedar) occupy about 22% of the Project footprint.

Cadastral land plots of

IPP process zone — Other facilities in INK's Ust-Kut industrial area

0 250 500 1 000 1 500 2 000 m

BOREAL CONIFEROUS FORESTS

Mountain taiga forest (*Abies sibirica, Pinus sibirica, Picea obovata, Larix sibirica, Pinus sylvestris*)

1 Cedar-fir forests with suffruticose (*Vaccinium vitis-idaea, V. myrtilus*), small grasses (*Trientalis europaea, Maianthemum bifolium, Aegopodium alpestre, Goodyera repens, Orthilia secunda*) and green mosses (*Pleurozium schreberi, Hylocomium splendens, Ptilidium ciliare*) on flat divides, including succession plant communities:

- 1а Aspen-birch grass-green moss
- 1б Pine-birch-larch with spruce, cedar, aspen shrub-small grass-green moss
- 1в Birch-larch-pine shrub-small grass-green moss
- 1г Birch-aspen grass-green moss
- 1д Man-made plantations of pine with cedar and fir undergrowth

2 Cedar-fir forests with suffruticose (*Ledum palustre, Vaccinium vitis-idaea*), small grasses and green mosses on gentle slopes, including succession plant communities:

- 2а Birch grass-green moss
- 2б Pine-larch shrub - small grass - green moss
- 2в Larch-pine shrub - small grass - green moss
- 2г Aspen grass-green moss
- 2д Grass communities on the burnt and deforested areas
- 2е Man-made plantations of pine with cedar and fir undergrowth

3 Cedar-pine forests with larch forests on the gentle slopes of light exposures, including:

- 3а Aspen succession community
- 3б Grass communities on the burnt and deforested areas

4 Pine and larch with lingonberry cedar (Vaccinium vitis-idaea), small grasses (Trientalis europaea, Maianthemum bifolium, Aegopodium alpestre, Goodyera repens) and green mosses (Pleurozium schreberi, Ptilidium ciliare) sustainable productive forests on the slopes of shadow expositions, including succession plant communities:

- 4а Birch-aspen grass - green moss
- 4б Aspen-birch grass - green moss
- 4в Grass communities on the burnt and deforested areas
- 4г Man-made plantations of pine with cedar and fir undergrowth

5 Larch, pine-larch shrub (Spiraea media, Rosa acicularis) -Lingonberry grass (Lathyrus humilis, Iris ruthenica, Pulsatilla patens) with sparse with a cover of Rhytidium rugosum, Aulacomium turgidum forests, stable productive forests on the sloping slopes of light exposures, including succession plant communities:

- 5а Larch young-growth stands
- 5б Larch-spruce young-growth stands
- 5в Larch-fir young-growth stands
- 5г Man-made plantations of pine with cedar and fir undergrowth

6 Pine lingonberry-grass forests on the steep slopes of light exposures, including:

- 6а Birch-aspen grass - green moss succession plant community

7 Larch with spruce and cedar, blueberry-rosemary green-moss, sometimes sphagnum stably-derivative forests of wide drainage hollows, including:

- 7а Fir young-growth stands
- 7б Birch succession plant community
- 7в Grass communities on the burnt and deforested areas
- 7г Man-made plantations of pine with cedar and fir undergrowth

8 Larch-spruce and spruce-larch valley forests, including:

- 8а Shrubs (*Salix sp., Padus avium, Spiraea salicifolia*, willow, red currant) - large grass (*Filipendula ulmaria, Viola uniflora, Veratrum lobelianum*) communities

9 Larch-cedar and pine forests of dry valleys with temporary seasonal watercourses, including:

- 9а Birch succession community

Antropogenically changed communities

10 Shrub and grass communities clearings of high-voltage lines and pipelines

11 Roadside communities along the roads (*Bromopsis inermis, Poa pratensis, Melilotus albus Medicus, Melilotus suaveolens Lebed, Arctium tomentosum Mill*)

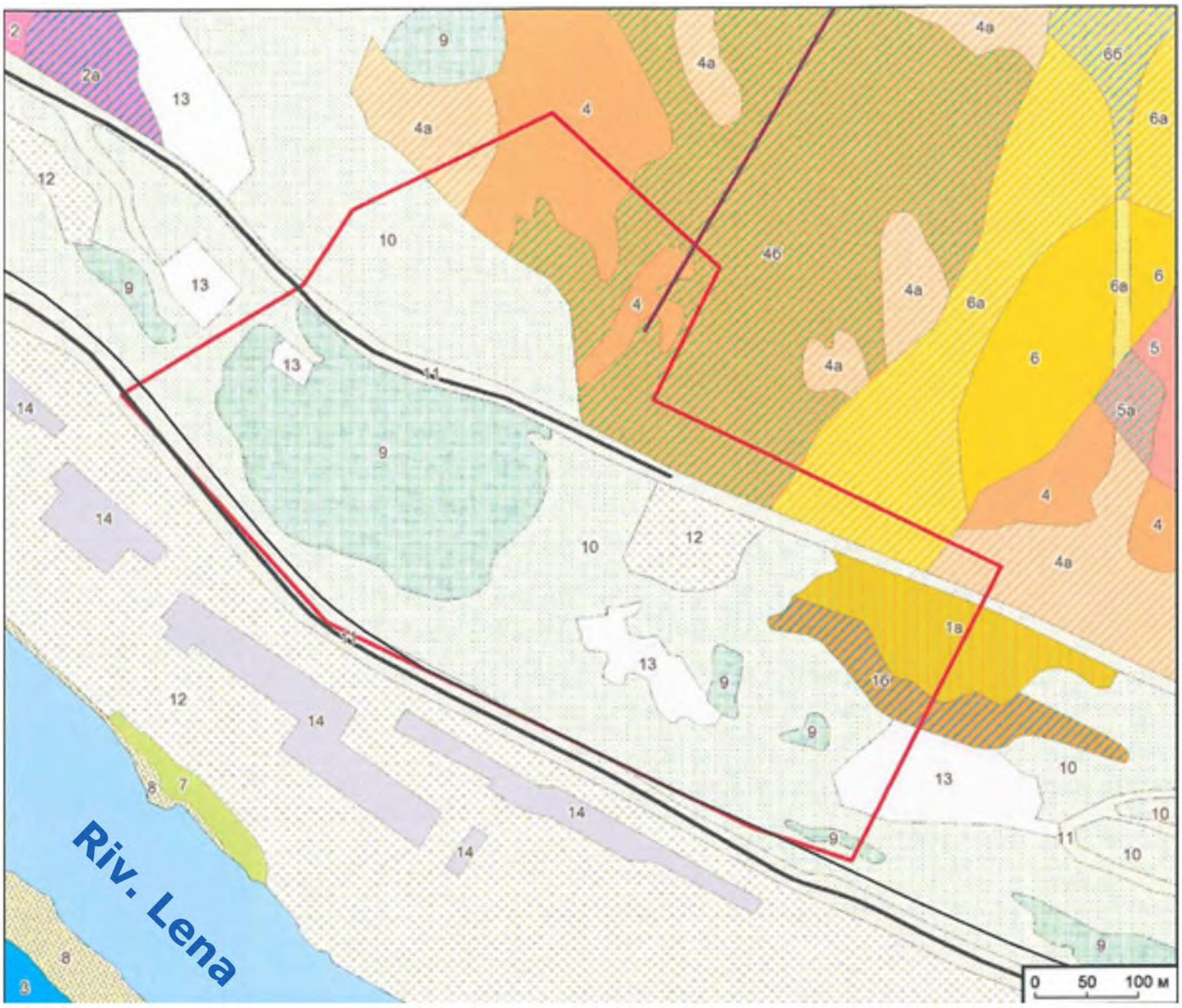
12 Communities of open space industrial areas (*Polygonum avculare, Achillea millefolium, Taraxacum ceratophorum, Trifolium repens, Trifolium pratense, Plantago media*)

13 Open plant groups (Achillea millefolium L, Taraxacum ceratophorum, Trifolium repens) on technogenic sites with freshly disturbed substrate

14 Shrub-grass communities of secondary meadow and ruderal vegetation, sometimes with sparse groups of woody vegetation

Figure 7.8.7-1: Vegetation of the area to be occupied by the Irkust polymer plant and associated facilitie s (OOO "INGEO", 2019)

In addition, the mapping undertaken within the framework of the environmental engineering surveys for the liquefied petroleum gas reception, storage and offloading terminal in 2014 covered also a part of the land allocated for the Project (Figure 7.8.7-2). More specifically, the contour line in the picture shows the area where the PPF offloading terminal and linear facilities (access roads, water, treated wastewater and process water pipelines) will be constructed. According to the schematic map, most of the area was covered by derivative heavily disturbed open shrubbery and graminoid/forb meadows with abundant presence of ruderal plants, before construction of INK facilities commenced. In some places the above low-value communities have been fragmented or completely displaced with earth roads and buildings.



1*. Larch forests with undergrowth comprising Siberian pine, with dwarf shrub (*Vaccinium vitis-idaea, Vaccinium uliginosum*) and true moss groundcover, stable derivative forests on gentle slopes
- 1a. Birch-larch forests with dwarf shrub (*Vaccinium vitis-idaea, Vaccinium uliginosum*) and true moss ground cover, forest recovery series of plant associations
- 1b. Birch forests with grass and true moss ground cover, forest recovery series of plant associations

2. Pine and pine-larch forests with Siberian juniper and honeysuckle, small-grass and true moss ground cover, stable derivative forests on gently sloping slopes
- 2a. Birch forests recovery series of plant associations

3. Larch forests with occasional Siberian pine and spruce trees and duschekia in the undergrowth, with dwarf shrub (*Ledum palustre*, *Vaccinium uliginosum*) and true moss ground cover, on gentle northern slopes.
4. Pine and larch-pine forests with thin shrub (*Spiraea media, Rosa acicularis*) - lingon-berry and grass (*Lathyrus humilis, Iris ruthenica, Pulsatilla patens*) ground cover with *Rhytidium rugosum, Aulacomius turgidum*, stable derivative forests on gentle well-lighted slopes
- 4a. Birch-pine forests of recovery series
- 4b. Aspen and birch forests of recovery associations series

5. Pine forests with duschekia and small-grass/true moss ground cover on steep slopes with hard rock outcrops
- 5a. Aspen-birch forest recovery series of plant associations
- 5b. Secondary shrub and grass associations

6. Pine and pine-larch derivative forests with inclusion of spruce and Siberian pine trees, shrub and grass (*Filipendula ulmaria, Viola uniflora, Verabatum lobelianum*) ground cover, on steep water-collecting gully slopes
- 6a. Birch forests with inclusion of larch trees, with shrub and grass (Filipendula ulmara, *Viola uniflora, Verabatum lobelianum*) ground cover, series of recovery forest plant associations
- 6b. Birch and grass series of initial recovery stages
- 6c. Grass series of initial recovery stages

7. Secondary floodplain meadows with graminoid and forbs vegetation
8. Open plant association of coastal sandy and pebble stone beches
9. Shrub (*Salix sp., Padus avium, Spiraea salicofolia*) - graminoid (*Calamagrostis sp., Bromopsis inermis, Poa pratensis*) - grass (*Tanacetum vulgare, Achillea millefolium, Taraxacum ceratophorum, Trifolium repens, Trifolium pretense, Melilotus albus, Melilotus suaveolens, Medicago sativa, Chamaenerion angustifolium*) ground cover with a complex of ruderal plant species (*Artemisia vulgaris, Urtica cannabina, Urtica dioica, Urtica urens*), derivative associations of meadow and ruderal vegetation, sometimes with thin groups of woody plants
10. Shrub (*Salix sp., Padis avium, Spiraea salicifolia*) - graminoid (*Calamagrostis sp., Bromopsis inermis, Poa pratensis) - grass (Tanacetum vulgare, Achillea millefolium, Taraxatum ceratophorum, Trifolium repens, Trifolium pretense, Melilotus albus, Melilotus suaveolens, Medicago sativa, Chamaenerion angustifolium*) ground cover with a complex of ruderal plant species (*Artemisia vulgaris, Urtica cannabina, Urtica dioica, Urtica urens*), derivative associations of meadow and ruderal vegetation
11. Associations of roadside vegetation (*Bromopsis inermis, Poa pratensis*, *Melilotus albus, Melilotus suaveolens, Arctium tomentosum*)
12. Plant communities of open industrial sites (*Polygonium avculare, Achillea millefolium, Taraxacum ceratophorum, Trifolium repens, Trifolium pretense, Plantago media*)
13. Unpaved areas with individual plant species (*, Achillea millefolium, Taraxacum ceratophorum, Trifolium repens*)
14. Areas without any vegetation: inudstiral buildings, engineering installations and facility.

*– Native plant associations not indicated on the map, currently completely transformed as a result of human activities.

Figure 7.8.8-2: Vegetation in the Ust-Kut industrial area occupied by LPG/SGC RS&O, GFU and IPP offloading facilities (OOO "INGEO", 2014)

Before re-categorisation into industrial land category for construction of the PPF process area, respective forest areas controlled by Ust-Kut Forestry Department of Irkutsk Region were inspected by Task Force which assessed the actual state of the forest land against the forest management records. Along with representatives of Irkutsk Oil Company, the Task Force team included S.V. Govorukhin - acting Head of the Division for Ust-Kut Forestry Department at the Forest Resource Ministry of Irkutsk Region, and O. A. Bezlik - Unit Head in the same Division.

According to the Field Survey Act of the concerned areas (dated 21.11.2018), 99.7 % of the area (where 100% is 430.49 ha) is actually forest land (i.e. forests), and the rest are clearing areas and roads (0.6758 ha or 0.16 %) or other types of land (0.6708 ha, 0.16 %).

The forests are identified as highly fire-prone (average level of fire risk for the whole area is 3, however in few elements it is assessed as high as 4). The highest risks of fire outbreak are associated with sorrel and bilberry pinery, cowberry larch forests, all types of cedar forests except for riverine and sphagnous, cowberry and sorrel spruce forests. The highest risk of ground and crown fires within the Project sites is expected during the summer maximum fire risk period, and in relation to cedar forests - also during the maximum fire risk periods in spring and particularly in autumn. The natural causes of forest fires in the study area are related to the high occurrence rate of windy weather in vast old-growth forests heavily littered with combustible materials. Within the forest areas leased by INK, the risk of fire outbreaks is significantly enhanced due to presence of wood processing waste dumps with regularly reported spontaneous ignition events.

7.8.3 Rare and endangered plant species

The forest development project documents for the leased forest areas designated for construction of PPF process facilities provide a list of plant, fungi and lichen species recorded in the Red Data Book of Irkutsk Region (Table 7.8.1). Two of them - Pennsylvanian lily and peony 'Maria's root' - are verifiably present within the designed area, and other may be identified during the pre-design environmental survey.

Table 7.8.1: Plant, fungi and lichen species listed in the Red Data Book of Irkutsk Region which are reportedly present or potentially present within the designed PPF process area

Living organisms group	Designation in English	International designation in Latin	Presence within leased forest areas
Lichen	Laurer's nephromopsis	Nephromopsis laureri	Probable
Fungi	White birch bolete	Leccinum percandidum	

Living organisms group	Designation in English	International designation in Latin	Presence within leased forest areas
Vascular plants	Pennsylvanian lily	Lilium pensylvanicum Ker-Gawl	Confirmed
	Dwarf lily	Lilium pumilum	Probable
	Calypso orchid	Calypso bulbosa (L.) Oakes	
	Calcareous lady's slipper	Cypripedium calceolus	
	Large flowered cypripedium	Cypripedium macranthon	
	Peony 'Maria's root'	Paeonia anomala	Confirmed
	Mezereon	*Daphne mezereum*	Probable

According to the findings of the engineering survey by OOO “INGEO”[121], no rare and endangered plant species have been found within the neighbour LPG RS&O and GFU sites. However, a tentative list of species which are typical for the Project area in general and may be encountered during the pre-design environmental survey activities has been prepared using the published data (Red Data Book of the USSR, 1984; Red Data Book of the RSFSR, 1988; Red Data Book of Irkutsk Region, 2001; Malyshev, Peshkova, 1979; Central Siberian Flora, 1979; Rare and Endangered…, 1980). The list includes 9 protected vascular plant species Table 7.8.2) - all species from Table 7.8.1 plus Lady's slipper (this species is present in Irkutsk Region and is listed in the CITES Convention Annex II) and Siberian adonis (Red Data Book of Irkutsk Region).

Two species listed in Table 7.8.2 are protected at the national level (calcareous lady's slipper *Cypripedium calceolus L.* and large flowered cypripedium *Cypripedium macranthon*); both species are classified as species with “constantly decreasing numbers” which may be moved to the “endangered” category in the near future, if the negative factors reducing the number continue. Conservation status of seven other species largely matches category 3 - rare species with naturally low numbers inhabiting limited territory or sporadically distributed over an extensive territory, requiring specific conservation measures.

[121] Liquefied petroleum gas reception, storage and offloading terminal. Findings of Engineering Surveys. Technical Report referring to the performed engineering geological surveys. Code 2108/1-1182-13146/1-IGE. - Irkutsk: OOO "INGEO", 2014.

Ust-Kut gas fractioning unit. Phase 1. Environmental Survey Technical Report. Code: 2826-1426-1783/2-ИЭИ. Vol. 4. - Irkutsk: OOO "INGEO", 2018. 326 pp.

Table 7.8.2: Rare and endangered vascular plant species in the Project area

Description	Brief description	Conservation status		Typical habitats	Geographic area of presence
		RF	IUCN		
Pennsylvanian lily (*Lilium pensylvanicum Ker-Gawl*)	Perennial herbaceous bulbous plant, height 40-120 cm, Lilaceae family	Category 3 (R). Rare species	Not ranked	Wet floodplain meadows, forest open spaces and margins, sparce bush thickets, pebble stone areas	In the Russian Federation the species is present in Siberia (Krasnoyarsk Krai, Buryatia, Zabailaksky Krai) and in the Far East. Outside Russia - in the north-east of Mongolia and China, and in Korea
Dwarf lily (*Lilium pumilum*)	Perennial herbaceous bulbous plant, height 20-50 cm, Lilaceae family	Category 3 (R). Rare species	Not ranked	Steppe-like slopes, forest margins, and rock cliffs	In the Russian Federation the species is also encountered in the south of the Western and Eastern Siberia, and in the Far East. Outside Russia - in Central (Mongolia) and Eastern (China, Korea) Asia
Calypso orchid (*Calypso bulbosa (L.) Oakes*)	Perennial herbaceous plant, height 8-20 cm, with short cord-like roots and above-ground bulb-like body, Orchidaceae family	Category 3 (R). Rare species. Listed in the Red Data Book of the Russian Federation.	NT (near-threatened)	Shady mossy coniferous forests, including windfelled areas, water-logged areas	In the Russian Federation the species is present in the north of European territories, in the Western and Eastern Siberia, and in the Far East. Outside Russia - in the Northern Europe, Central (Mongolia) and Eastern (north-east of China, Japan, Korea) Asia, North America
Calcareous lady's slipper (*Cypripedum calceolus*)	Long-rooted perennial herbaceous plant, Orchidaceae family	Category 2 (V). Vulnerable species. Listed in the Red Data Book of the Russian Federation	LC (least concern)	Sparce leaf and mixed forests, open spaces in forests and brushwood; mesophyte distinctly linked to calcareous soil	In the Russian Federation the species is present in the forest zone of European territories, in Caucasus, Western and Eastern Siberia, and in the Far East. Outside Russia - in Europe, Minor, Middle, Central and Eastern Asia, and North America
Large flowered cypripedium (*Cypripedium macranthon*)	Perennial herbaceous plant with long and tender creeping root, Orchidaceae family	Category 2 (V). Vulnerable species. Listed in the Red Data Book of the Russian Federation	LC (least concern)	Open leaf and mixed forests, open spaces in forests and brushwood	In the Russian Federation the species is present in the European territories (Volga region), south of Siberia, and in the Far East. Outside Russia - in the Eastern Europe (Ukraine), Middle, Central and Eastern Asia
Lady's slipper (*Cypripedium guttatum Sw*)	Perennial herbaceous plant with long and tender creeping root, Orchidaceae family	Listed in the Red Data Books of 38 Constituent Entities of the Russian Federation. Not listed in the Red Data Book of Irkutsk Region	LC (least concern) Listed in CITES Annex II	Leaf, mixed and coniferous forests, forest margins, limestone cliffs, sandy rock slides	Common in the mild zone of Eurasia and in the north-west of North America. In Asia, its area of presence includes Siberia, Far East, Mongolia, China, Korea, Bhutan

Description	Brief description	Conservation status		Typical habitats	Geographic area of presence
		RF	IUCN		
Peony 'Maria's root (*Paeonia anomala*)	Perennial herbaceous plant with thick tuberous root, Paeoniaceae family	Category 3 (R). Rare species	Not ranked	Birch, pine, mixed forests, forest margins and open spaces in forests, dry meadows. The plant is present in medium-moisture habitats, in sufficiently warm and light areas	Mainly Siberian species which is also present further in the northern areas of European Russia and in the south-east of Kola peninsula. The utmost eastern part of its range is in the catchment area of the Dzhida river on the branches of Khamar-Daban ridge. Outside Russia - in Mongolia and north of China
Mezereon (*Daphne mezereum*)	Deciduary subramose shrub, 0.5-1.5 m tall, with yellowish-grey and grey bark, Thymelaeaceae family	Category 3 (R). Rare species. Tertiary nemoral relict	Not ranked	Mixed and dark coniferous forests	Encountered in most parts of Europe, in Transcaucasia (Armenia, Azerbaijan, north of Iran) Present throughout forest zone of Russia
Siberian adonis (*Adonis sibirica Patrin ex Ledeb.*)	Perennial herbaceous plant with thick and short root, Ranunculaceae family	Category 3 (R). Rare species	Not ranked	Light forests, forest margins, open spaces in forests, bush thickets	Widely spread in Siberia up to Baikal, mostly in forest steppe and forest areas. Very rare in the areas to the east of Baikal. Also present in European Russia. Outside Russia - in Middle and Central (Mongolia) Asia

7.8.4 Food and medicinal plants

The subject area has a significant resource of medicinal and food plants resources (Atlas of occurrence ranges …, 1976; Forest Management Regulation for Ust-Kut ..., 2018), most significant of which are listed in Table 7.8.3. Commercial gathering activities in the area of Ust-Kut Forestry Department are focussed on two food resources - currant and bog bilberry. Other species are picked by local communities for own consumption.

Table 7.8.3: Characteristics of medicinal and food plants reported in the Project area

Species	Type of resources	Usage
Lingon-berry (*Vaccínium vítis-idaéa*)	Leaves, fruit	Food and medicinal plant
Bog bilberry (*Vaccínium uliginósum*)	Fruit	Food and medicinal plant
Horsetail (*Equisétum sp.*)	Green sprouts	Medicinal plant
Marsh tea (*Lédum palústre*)	Leaves, young shoots	Medicinal plant
Meadow rue (*Thalictrum simplex*)	Grass	Medicinal plant
Costmary (*Tanacétum vulgáre*)	Flowers	Medicinal plant
Milfoil (*Achilléa millefólium*)	Above-ground herbage, flowers	Medicinal plant
Bean trefoil (Menyanthes trifoliata)	Leaves	Medicinal plant
Melilot (*Melilótus officinális*)	Above-ground herbage	Medicinal plant
Burnet (*Sanguisórba officinális*)	Roots and rhizome	Medicinal plant
Common juniper (*Juniperus communis L*)	Fruit	Medicinal plant
Current (*Ribes sp.*)	Fruit	Food and medicinal plant
Stinging nettle (*Urtíca dióica*)	Leaves	Medicinal plant
Spiny dog rose (*Rósa aciculáris*)	Fruit	Medicinal and food plant
Mongolian sagebrush (*Artemisia mongolica*)	Tops of blooming plant	Medicinal plant
Common bilberry (*Vaccínium myrtíllus*)	Fruit	Food and medicinal plant
Common cranberry (*Vaccinium oxycoccos*)	Fruit	Food and medicinal plant
Flat-leaved birch (*Bétula platyphýlla*)	Leaf buds, fungus	Food and medicinal plant
Valerian (*Valeriána officinális*)	Roots and rhizome	Medicinal plant
Green alder (*Alnus fruticosa*)	Fruit (catkins)	Medicinal plant
St. John's wort (*Chamaenérion angustifolium*)	Above-ground herbage, flowers	Medicinal plant
Common dandelion (*Taráxacum officinále*)	Roots	Medicinal plant
Wheatgrass (*Elytrígia répens*)	Roots	Medicinal plant
Siberian rowan (*Sorbus sibirica*)	Fruit	Medicinal plant

The average annual yield of berries gathered in the Ust-Kut forestry is as follows: 143 kg/ha of lingonberry; 55 kg/ha of cranberry, 195 kg/ha of bog bilberry; 51 kg/ha of raspberry; 42 kg/ha of current; and 136 kg/ha of bilberry.

The planned harvests have not been reached by the forestry department during the past years; the yields are unstable due to the inadequate management of the operations. However, according to publications in printed and social media, gathering of wild berries is a significant source of income for local communities.

The yields of pine nuts in the Ust-Kut forestry area are in general low (less than 70 kg/ha), therefore, commercial nut gathering is limited. The nearest official nut gathering area is located 14 km to the north-north-west of the PPF process area. In the rest of area controlled by the forestry department local communities gather nuts only for own consumption.

Local forests dominated by coniferous species can be considered as a potential source of tar (crude turpentine) for production of colophonium and other products. At present, production of wood tar is not practiced in the study area.

7.8.5 *Terrestrial vertebrate fauna*

The natural habitats of terrestrial vertebrates in the subject area have been significantly impacted by human activities and the current species composition is scarce. Prevailing are individual species of the Eastern Palearctic fauna and common are environmentally flexible species of the Holarctic Arctoboreal fauna.

The review of the Project area fauna population is based on the environmental survey materials prepared in 2014-2019 for the Project footprint area and LPG facilities, and on publicly available information and project documents. Grading works are in progress at the IPP construction site, and the top soil has been stripped.

Reptiles

Common lizard (*Lacerta vivipara L.*) is the only reptile species that may be potentially present in the Project area. Its main habitats are river valleys and well warmed southern slopes. The species' population is limited, apparently due to the area location in the periphery of its occurrence range. Also, common viper (*Vipera berus L.*) may be occasionally encountered here, as the Project area is located within this species habitat in Irkutsk Region.

Amphibians

Amphibian variety is limited too and includes only three species: Siberian salamander (*Salamandrella keyserlingii Dybovski*), Siberian (*Rana amurensis Boul.*) and moor (*Rana arvalis Nilsson*) frogs. These species' habitats are associated with well warmed lakes and meanders on the floodplains and terraces of the N. Tunguska and Lena rivers.

Mammals

Local mammals' fauna is composed of three fauna environment systems: taiga, meadow-swamp-dwarf birch, and near-water associations. In terms of habitats' area size, the dominating fauna association is **taiga** with a relatively limited species variety (about 20 species), due to the geographic position and the extent of man-caused disturbance of local environment. Most abundant small mammals are medium and common shrew, red, red-backed, field vole, and root vole. Commercial mammal species are squirrel, sable, mountain hare, elk, and reindeer.

Mammal populations of the **meadow-swamp-dwarf birch complexes** in dwarf-birch thickets, water-logged meadows, bogs, as well as burnt forest areas at early stage of restoration are absolutely dominated by shrews (tundra and big-tooth), voles (tundra and water), and ermine; Siberian weasel, fox and elk are encountered much less frequently.

The **near-water mammal complex** on the shores of streams, lakes and meanders are populated with semi-aquatic species - water vole, water shrew, and musk rat. The chance of encounter with river otter - object of commercial hunting - is very small.

Birds

A review of the literature data (Gagina, 1962a) suggests a conclusion that approximately 40 bird species have been reported within the project area, including nesting, migrating, visiting and wintering bird species. It is typical that the bird species composition varies significantly from season to season due to migrations. The bird species composition and the sizes of their populations in winter are much less abundant (by 4 to 5 times) than in summer. Similarly to mammals, local bird fauna is composed of three fauna environment systems: taiga, meadow-swamp-dwarf birch, and near-water.

Taiga complex is dominated by Species of Siberian origin: willow tit, warbler (Pallas' and greenish, yellow-browed and Pallas'), Indian tree pipit, brambling, yellow-browed bunting, Siberian rosefinch, great spotted woodpecker, bullfinch. Populations of thrushes (fieldfare, Naumann's thrush, dusky thrush), nutcracker, Siberian jay, waxwing, eastern turtle dove, sparrow-hawk, goshawk, hawk owl, raven are much smaller. Common gaming species are hazel grouse, blackcock, common and rock capercaillie. Dominating bird species in dark coniferous taiga are nutcracker, Pallas's warbler, willow tit, gray wagtail, Siberian thrush, and yellow-browed bunting. In light coniferous larch-pine forests, dominating species are Pallas's warbler, Indian tree pipit, lanceolated warbler, and pine bunting. Dominating bird species in coniferous/small-leaved forest with dwarf birches are brown shrike, dusky and greenish warbler, Pallas' grasshopper warbler, willow tit; sub-dominants are Pallas's warbler and bullfinch.

Prevailing species in the **meadow-swamp-dwarf birch complexes** are: golden bunting, yellow-headed wagtail, red-backed shrike, Arctic warbler, millerbird, dusky warbler, snipes, great snipe, lapwing, marsh harrier, and short-eared owl. Upland game is represented by blackcock and willow grouse.

Dominating species in shrub thickets, pine-birch and spruce forests **near floodplains** are golden bunting, dusky and greenish warbler; sub-dominants are marsh snipe, brown shrike, Siberian rubythroat, long-tailed tit, and willow tit.

The **water and near-water complexes** include gulls, terns, ducks and waders. The most abundant among them are white wagtail and common sandpiper. Most common anseriformes are teals, wigeon and mallard. Much smaller populations are reported for northern pintail, common shoveler, gadwall, bullhead, common pochard and bluebill (Tkachenko 1938; Melnikova et al. 1984; Vodopyanov 1988; Report of IG SO RAN 2005).

7.8.6 Migrating animals and birds

Migration routes of waders and anseriformes, including the main one (Toreya-Kirenga-Tunguska) and secondary, passes through the area of Ust-Kut district, which also provides autumn migration corridor for falcons. The main birds' migration routes in Eastern Siberia are shown in Figure 7.8.8. Birds dependent on valley-based habitats tend to migrate along rivers. Migration of smaller passerine birds is diffuse, without formation of large flocks.

No migration of wild hoofed animals is reported within the Project area (Forest Development Project document, 2018). Seasonal migrations of hoofed mammals (Manchurian deer, elk, reindeer and roe deer) are associated mainly with formation of snow cover preventing access to food. Animals migrate both individually and in groups, predominantly along river valleys. Seasonal movements of animals (elk, reindeer) in Ust-Kut district take place outside the planned construction sites. In addition, the migration routes of local hoofed mammals have already been affected by the existing LPG pipeline along which the new DSG pipeline will be constructed. Therefore, construction of the new pipeline will have no impact on the baseline situation in terms of seasonal migration of ungulates. Sable and squirrel do not undertake any regular migrations. Mass migrations of these species are caused by natural disasters (forest fires) or take place in case of food shortage. Migrations of small mammals are not so evident and are associated predominantly with migrations of young animals in late summer in search of vacant habitats.

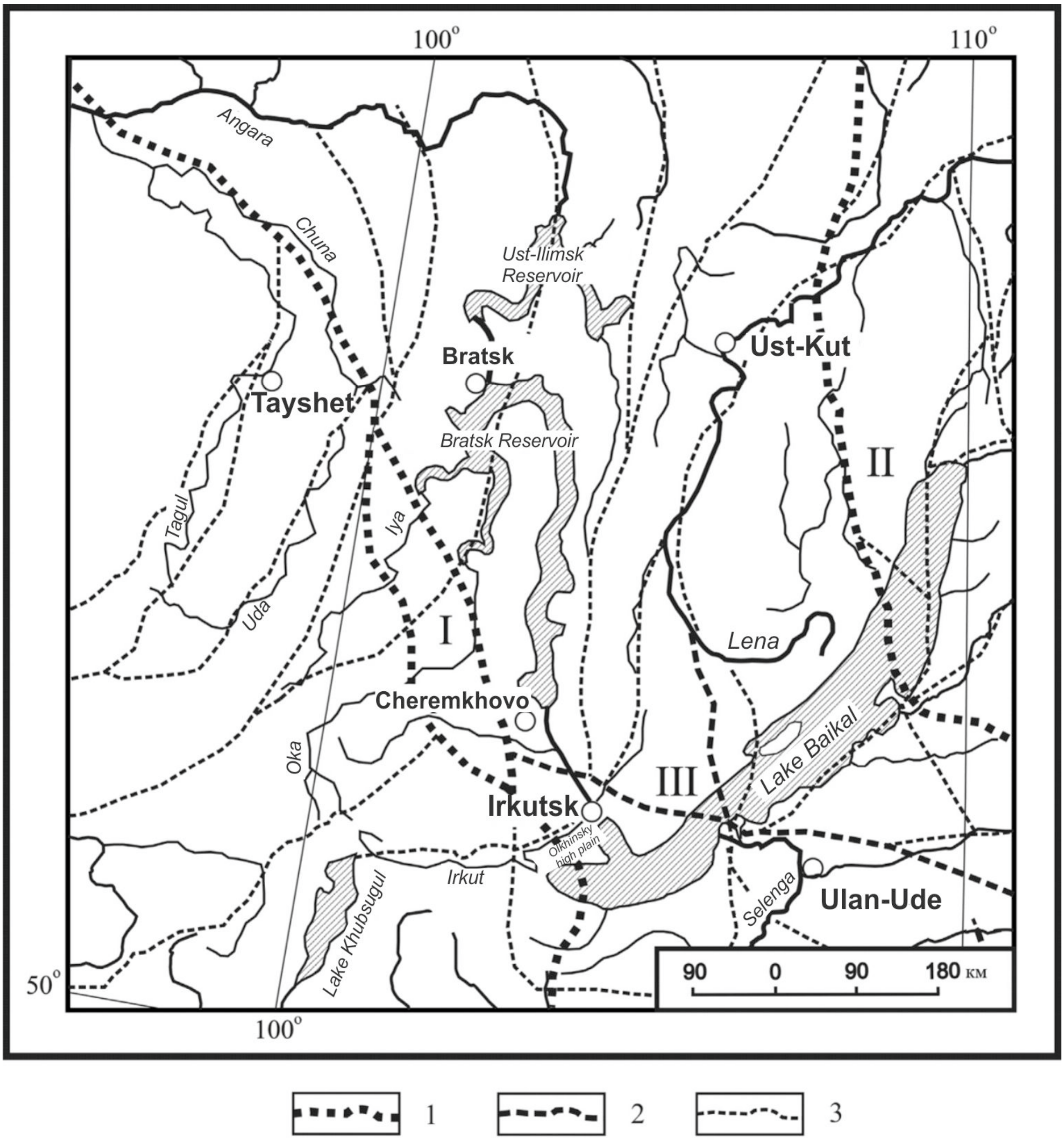


Figure 7.8.9: Autumn migration routes of common crane *Grus gus* in Southern Cisbaikalia

Migration routes significance: 1 - mass migration route; 2 - low rate but distinct migration; 3 - secondary migration routes. Main directions of migration flows: I - Baikal-Angara-Yenisei; II - Toreya-Kirenga-Tunguska; III - Toreya-Baikal-Angara. (Source: Y.I. Melnikov, 2009)

7.8.7 *Rare and endangered terrestrial vertebrates*

No rare or endangered animal species were identified during the survey activities conducted at the site of the Project associated facilities (the "lower site") in 2018-2019. Based on the habitats information in the Red Data Book of Irkutsk Region, river otter (*Lutra lutra Linnaerus*) and Ikonnikov's bat (*Myotis ikonnikovi*) are tentatively identified in Ust Kut District. However, given the specific habitat requirements of these species (Table 7.8.4), the probability of their occurrence in the Project area is extremely low.

Table 7.8.4: Rare and endangered animal species in Ust-Kut District (Red Data Book of Irkutsk Region, 2010)

No.	Species	Status	Conservation status (Irkutsk Region RDB)	IUCN Red List
Carnivores (Carnivera)				
1	River otter (*Lutra lutra Linnaerus*)	The presence of nonfreezing parts of rivers is an obligatory condition for this animal. There are no suitable water bodies in the Project footprint area. The otter may inhabit the Lena River valley, but the limiting factor is the presence of human beings.	Category 3 - rare species	NT – near threatened
Chiropterians (Chiroptera)				
2	Ikonnikov's bat (*Myotis ikonnikovi*)	Optimal habitats or the bat are parts of the mountain taiga with a developed river valleys. Summer refuges can be found in rock cracks, in hollows or under the bark of old trees. There are no suitable habitats in the Project area.	Category 3 - rare species	LC – least concern

No rare or endangered bird species were identified during the environmental survey activities conducted at the Project lower site in 2018-2019. Around 20 rare and endangered bird species can inhabit or be found on the territory of the Ust-Kut district, including 14 nesting birds - the list of bird species having the conservation status has been compiled according to the information from reports on engineering and ecological surveys (2019), the Forest Development Project (2018), official memorandums of the Wildlife Protection and Use Service of the Irkutsk Region (2013), the Red Data Book of the Irkutsk Region, as well as literary and tourist sources (Table 7.8.5).

According to the Survey Report[122], it is unlikely that any rare bird species may be encountered in the concerned area, as such birds are very sensitive to quality of habitat. Vast majority of bird species need ample open spaces like broad meadows, marshlands, lakes, steppes, large river valleys for their normal life activities. Such habitat types are not available in the subject area. Taking into account the ecology of these species in other parts of their habitat ranges, the nearest suitable habitats exist downstream the Lena River. During seasonal migrations and migrations after their nesting periods, the following bird species might appear in the subject area: golden eagle (*Aquila chrysaetos L.*), gyrfalcon (*Falco rusticolus*), peregrine falcon (*Falco peregrinus Tunst.*), merlin (*Falco columbarius L.*), red-footed falcon (*Falco vespertinus L.*) and Eurasian eagle owl (*Bubo bubo L.*). According to the Governmental Report "On Environmental Conditions and Environmental Protection in Irkutsk Region in 2017", roody shelduck (*Tadorna ferruginea*) may also be encountered in Ust-Kut District. Table 9.6.3, Section 9.6 provides further detail on the habitat requirements for these species and the probability of their occurrence in the Project area.

Table 7.8.5: Protected bird species

Species	Conservation status
Baikal teal (*Anas formosa*)	Irkutsk Region Red Data Book - Category 1. Rare nesting and migrating bird species. Endangered species. IUCN: VU – vulnerable
Booted eagle (*Hieraaetus pennatus*)	Irkutsk Region Red Data Book - Category 5. Rare nesting and migrating species. Population is currently restoring. IUCN: LC – least concern

[122] Ust-Kut GFU. Environmental Survey Technical Report. Vol. 4. INGEO. 2018.
Irkutsk polymer plant. IEI materials for the public hearing of the second stage. Vol.4.1. INGEO, 2019.
Production base for storage of equipment and materials for construction of OOO "INK" facilities. Tom. 4.1. INGEO, 2019

Species	Conservation status
Pigeon hawk (*Falco columbarius L*)	Irkutsk Region Red Data Book – Category 3. Rare nesting, migrating and partially wintering species IUCN: LC – least concern
Bean goose (*Anser fabalis*)	Irkutsk Region Red Data Book – Category 1. Rare nesting and migrating bird species. Endangered species. IUCN: LC – least concern
Whooper swan (*Cygnus cygnus*)	Irkutsk Region Red Data Book – Category 3. Nesting and migrating species IUCN: LC – least concern
Marsh harrier (*Circus aeruginosus spilonotus*)	Irkutsk Region Red Data Book – Category 3. The population has been decreasing IUCN: LC – least concern
Greater spotted eagle (*Aquila clanga*)	Irkutsk Region Red Data Book – Category 3. Decreasing population size IUCN: VU – vulnerable
Golden eagle (*Aquila chrysaetos*)	RF Red Data Book – Rare species. Irkutsk Region Red Data Book – Category 3. The population has been decreasing IUCN: LC – least concern
Osprey (*Pandion haliaetus*)	Irkutsk Region Red Data Book – Category 3. Rare nesting species. IUCN: LC – least concern
Peregrine falcon (*Falco peregrinus*)	Irkutsk Region Red Data Book – Category 3. Rare nesting species. IUCN: LC – least concern
Gyrfalcon (*Falco rusticolus*)	RF Red Data Book – The population has been decreasing. Irkutsk Region Red Data Book – Category 3. Very rare, probably nesting, rare wintering species with a decreasing population. IUCN: LC – least concern
Corncrake (*Crex crex)*	Irkutsk Region Red Data Book – Category 3. Nesting and migrating species. IUCN: LC – least concern
Curlew (*Numenius arquata*)	Irkutsk Region Red Data Book – Category 3. Nesting and migrating species. IUCN: VU – vulnerable
Common crane (*Grus grus*)	Irkutsk Region Red Data Book – Category 3. Nesting and migrating species. IUCN: LC – least concern
Black stork (*Ciconia nigra*)*	RF Red Data Book – Rare species. Irkutsk Region Red Data Book – Category 3. Rare nesting and migrating species. IUCN: LC – least concern
Eurasian eagle owl (*Bubo bubo*)	RF Red Data Book – The population has been decreasing. Irkutsk Region Red Data Book – Category 3. Rare non-migratory species. IUCN: LC – least concern
Scops owl (*Otus scops*)	Irkutsk Region Red Data Book – Category 3. Rare nesting and migrating species, eastern periphery of the occurrence range. IUCN: LC – least concern
Roody shelduck (*Tadorna ferruginea*)	Irkutsk Region Red Data Book – Category 5. Nesting migrating species. IUCN: LC – least concern

* Encountered in the Project site area during the route surveys in 2016 (V.V. Popov, Notes on Ust-Kut District ornithofauna. Russian Ornithological Journal 2018, Vol. 27, Express issue 1613.)

7.8.8 Game animals

Over 25 game species of animals and birds are present in the Project area. In spring and autumn their numbers significantly increase due to seasonal transit migration of birds. The hunting areas within the forestry planning compartments (Forest Development Project document, 2018) feature a high level of bonity for multiple animal and bird species (Manchurian deer, reindeer, elk, European red deer, sable, mountain hare, capercaillie, black grouse, hazel grouse).

Sable is encountered in all taiga habitats. However, in the areas mainly occupied by young forests overgrown with sheds and clearcuts, which prevailed in the area of the Project footprint, the sable population density is low. The highest population density is found in dark coniferous forests with cedar, as well as in light coniferous forests bordering on cedars; the lowest density is found in marshes, marshy spruce forests, fresh cedars and young cedars. **Squirrel** is, like sable, an important commercial gaming species. This animal is present in all taiga habitats and is the object of extensive production by local hunters. Population size of this species is prone to significant variations between years.

Musk rat occupies almost all suitable habitats - river arms, meanders, river sections with convenient conditions for burrowing and feed resources. Its main habitat are lakes with abundant aquatic vegetation on the floodplains and terraces of the Chona, Nizhnyaya Tunguska, Nelpa, Gazhenka, Pravaya Poymyga, and Gulmok rivers.

Ermine is present in all types of habitats, with highest population density reported in river floodplains. At present, this animal is seen as associated game, rather than main object of hunting activities.

Mountain hare is encountered throughout the area and keeps to sparce forests, overgrowing clearcut and burnt areas with well developed shrubs or herbaceous vegetation. Similarly to squirrel, its population size varies significantly between years. Hare is not a focus object of hunting. In most cases its carcass is only used as bait.

Siberian weasel. Population of this animal is very small, apparently due to the competition with sable. It is not an object of commercial hunting.

Wolverine is very rare throughout the occurrence range including the study area.

Lynx. Similarly to the above species, lynx is very rare. It tends to use same habitats as its prey - mountain hare and hoofed animals.

Brown bear is the largest carnivore among the gaming species reported in the district. It is occasionally encountered during movements in search for food. Bear is not permanently present in the study area.

Elk has permanent habitats in the floodplains of the Chona, Ichera, Piliuda, Gazhenka, Poymyga, Gulmak rivers and their tributaries, and on dwarf birch bogs. In winter, distribution of elk and other hoofed animals is highly dependent on thickness of snow cover. In Ust-Kut District, winter concentrations of elk are reported in the interfluvial area of Nizhnyaya Tunguska and Bolshaya Tira. During dry winters elks evenly distribute throughout the area instead of concentrating at the wintering sites.

Manchurian deer. In 20th century the occurrence area of this species within Irkutsk Region increased by more than two times (Lyamkin, 1998). In Ust-Kut District its population density is as high as 0.7 per sq.km. It is one of the few species that extend their presence range due to man-caused impacts on natural habitats (forest felling, fires, etc.). This hoofed animal is a significant object of hunting.

Reindeer. Population size of this animal is smaller than that of elk. It is encountered most frequently at upper reaches of rivers. The preferred habitats, particularly in winter, are those with abundant lichen sward. Reindeer are most commonly encountered in the right-bank area of the Chona river. The nearest wintering areas are at the water divide of Chona, Ichera and Priliuda rivers (to the north-east of Ust-Kut city), which is outside the Project area of influence.

European red deer. Population density of European red deer in Ust-Kut District is 0.72 per 1000 ha. Its winter concentrations are reported in the water divide area between sources of the Kuta, Maoaya Tira, Yakurim rivers, i.e. in the direct vicinity of the Project area.

Musk deer has a relatively low population density in Ust-Kut District. The main factors affecting its population are poaching, fires and felling of dark coniferous forests preferred by the species.

Upland game. The main objects for this type of hunting are four species - hazel grouse, capercaillie (common and rock), blackcock, and willow grouse. For a number of reasons, their significance as objects of commercial hunting is limited.

Among gallinaceous birds, hazel grouse is most abundant. It is encountered in virtually all types of forest communities. The main determining factors of its population numbers include precipitation quantity and air temperature in June, and man-caused disturbance of life activities. Situation concerning common capercaillie and blackcock is similar. The upland game populations are most severely damaged by fires that destroy eggs and brood, and by felling of forests in the bird mating areas.

Water fowl. The area size of potential nesting areas affected by pipeline crossings on rivers is relatively small (Tkachenko, 1937; Melnikov et al., 1984). The baseline number of water fowl population in river drainage areas within the pipeline area of influence is low. Therefore, water fowl hunting is normally practiced only during the autumn migration period. Common game would include teals, mallard, wigeon and bluebill.

Detailed data on hunting resources and respective species population densities in Ust-Kut District of Irkutsk Region over the period 2013-2017 is provided in the table below (based on information from Ust-Kut city branch of Irkutsk Region Association of Hunters and Fishermen).

Table 7.8.6: Species composition and population densities of hunting resources in Ust-Kut District of Irkutsk Region, 2013-2017

Information from winter route census and other special counting techniques (Source: Forest Development Project document, 2018)

No.	Gaming species	Average density of gaming species population (units per 1000 ha)				
		2013	2014	2015	2016	2017
1	Elk	0.31	0.37	0.31	0.32	0.6
2	European red deer	0.44	0.56	0.52	0.52	0.72
3	Wild reindeer	0.21	0.11	0.13	0.13	0.27
4	Musk deer	0.19	0.27	0.29	0.29	0.68
5	Sable	4.25	4.95	4.8	4,	4.78
6	Squirrel	16.65	15.3	16.88	16.88	19.86
7	Grey wolf	0.01	-	0.01	0.01	0.02
8	Ermine	0.5	0.11	0.19	0.19	0.44
9	Mountain hare	3.84	3.55	3.32	3.32	3.59
10	Siberian weasel	-	-	-	-	-
11	Wolverine	0.04	0.02	0.01	0.01	0.01
12	Lynx	0.02	0.01	0.01	0.01	0.03
13	Red fox	0.22	0.22	0.21	0.21	0.27
14	Capercaillie	7.38	2.58	3.07	3.07	4.1
15	Hazel grouse	43.96	19.57	23.93	23.93	16.65
16	Black grouse	7.42	8.87	6.0	6.0	6.29
17	Brown bear	-	0.43	0.29	0.29	0.34
18	Mink	-	0.92	0.92	0.92	0.93
19	River otter	-	0.11	0.11	0.11	0.11
20	Musk rat	-	1.39	1.38	1.37	1.42

- data is not available

The main focus objects of terrestrial vertebrates hunting are the commercially gainful species - sable, squirrel, elk and reindeer, as well as upland and water fowl. Some species (wolverine, lynx, mink, ermine, etc.) serve as secondary game animals in the course of the main hunting season. The most important game bird species are gallinaceous birds (capercaillie, hazel grouse and black grouse). Animals exposed to the heaviest pressure of unregulated hunting are hoofed mammals, and to a lesser extent - fur game.

7.8.9 Invertebrates

No dedicated studies of invertebrates have been conducted in the area. Information available in the Red Data Book of Irkutsk Region and public sources suggests that presence of rare and vulnerable invertebrate species in the Project area is unlikely. Mourning-cloak butterfly (*Vanessa antiopa*) - one of the largest and most beautiful butterflies - is present in the concerned area, but it is not extremely rare.

Presence of insects should be considered at the time of planning of activities in taiga areas. Multiple small streams and bogs provide a very good habitat for blood-sucking dipteran insects which are commonly referred to as ‘gnat’ (Cisbaikalia and Transbaikalia. Natural environment and resources of the USSR. Institute of Geography of the USSR Academy of Sciences, Institute of Geography of Siberia and Far East of the USSR Academy of Sciences, Moscow, Nauka, 1965). Those include horse-flies (Tabanidae), mosquitoes (Culicidae), blackflies (Melusinidae) and biting midges (Heleidae). Attacks of insects deteriorate labour productivity and may cause diseases as many blood-sucking dipterans are vectors of malaria, tularemia and anthrax.

The numbers of blackflies reach peak levels in late June - early July and in the second half of August. The largest numbers of biting midges are reported in early July and start of August, i.e. during the warm and wet period. Attacks of blackflies and biting midges cease only in steady frost conditions without thaws. The largest numbers of attacking mosquitoes are reported in early June and mid-July, i.e. during the warmest period in summer. Horse-flies are most active in late June, during July and in early August. The Company shall provide personnel working in taiga with adequate personal protection equipment against gnat (protective clothes, repellents, veils, etc.). Consideration should be given to insecticide treatment of territory, to destroy mosquito and fly larvae.

When snow cover disappears, in April and May, abundant ixodic ticks (*Ixodes persulcatus Sch.*) appear in taiga. These insects are vectors of dangerous viral disease – encephalitis, therefore, specific preventive measures must be taken to protect personnel working in the sites of the disease: provision of special protective clothes, application of repellents, mandatory vaccination.

7.8.10 Freshwater ecosystems of the Lena River and tributaries

7.8.10.1 Overview

The natural conditions of the upper reaches of the Lena River are not sufficiently favourable for the ichthyofauna, which is the central element of any freshwater ecosystem and one of the most valuable natural resources of the subject region. The insufficiently dissected river banks, a small number of backwater areas, wide pools and floodplain water bodies, low water temperature (max. 14-15°C), lack of soft ground and macrophytes, low contents of minerals and nutrients; this prevents development of stable food resources for aquatic fauna, especially zooplankton as food for young fish.

The adverse combination of abiotic and biotic factors predetermined development of specific ichthyocoenosis in the upper reaches of the Lena River, consisting mainly of psychrophilic and oxyphilous fish species breeding on hard ground (lithophilic fish species) and eating both autochthonous and allochthonic food[123]. Presence of salmonids (ciscos, lenok, grayling) imparts a high commercial value to ichthyocoenosis of the Upper Lena which, on the other hand, is extremely vulnerable to anthropogenic impacts - water contamination, transformation of river bed, extensive fishing and navigation.

The Lena tributaries draining the designed location area of the PPF facilities are small creeks with seasonal variations of flow rates that may dry out in summer or completely freeze in winter. Therefore, these streams are of little value as fish habitats but they perform an important function in the Upper Lena ichthyocoenosis by carrying forage organisms, nutrients and silt into the river.

7.8.10.2 Fish food resource

The basic food resource for ichthyocoenosis in the upper reaches of the Lena River are zooplankton and zoobenthos which is briefly characterized below with reference to studies of T.V. Potyomkina[124], survey by OOO “INGEO”[125] and reference information from FSBSI “Gosrybtsentr” and FSUE “Vostsibrybtsentr”[126]. Hydrobiological description of the left-hand tributaries of the Lena River that drain the area of the Project (the Sukhoy and Gremyachiy creeks and the Polovinnaya River) is based on data from similar streams - tertiary tributaries of the Lena River.

The zooplankton is represented by 76 species, including 37 rotifer species, 29 Cladocera species and 10 copepod species. Based on the taxonomic structure of the zooplankton and its quantitative indicators, the trophic status of water bodies in the upper section of the Lena River varies from oligotrophic to α-mesotrophic type. The biomass parameters of the Upper Lena section are comparable to those in the middle reaches of the river, which amount on average to 0.39 mg/m^3 in the right-hand bank zone with a maximum of 7.35 mg/m^3. In the left-hand bank zone it is almost 4 times as high. The lower reaches of the river between its upper and middle sections differs by higher productivity characteristics of zooplankton, the population of which is as high as 31,500 organisms/m^3 and the zooplankton biomass reaches 299.5 mg/m3 (Guidelines …, 1983).

Zoobenthos. Nineteen groups of benthic invertebrates have been recorded in the upper reaches of the Lena River; regardless of the time of sampling, prevailing are larvae of mayflies, dragonflies and caddis flies with regard to their biomass, and chironomids and mayflies with regard to the number of organisms. The zoobenthos biomass in the streambed section varied from 0 to 23.9 g/m^2 averaging 0-13.7 g/m^2. The minimum and maximum population size was 96 and 6,656 organisms per square meter, respectively. The highest productivity is reported for the biotopes with high flow velocity (rifts), with pebble or rocky bottom. The low values of biomass and zoobenthos numbers are attributable to reaches with silt-sand bottom. In creeks and small rivers discharging to the Lena River, zoobenthos numbers and biomass are smaller and vary within a broad range - 483-1,410 org./m^2 and 2.2-27.8 g/m^2. The most common stone-

[123] A.I. Demin Ecological characteristics of the Upper Lena River and its specific features // Proceedings of international conference “Biodiversity and environmental issues of Altai Mountains and neighbour territories: present, past, future”. Information and education research resource of Gorno-Altaisk State University. E-publication at http://e-lib.gasu.ru/konf/biodiversity/2008/2/86.pdf

[124] T.V. Potyomkina. Ecological-biological fish characteristic of upper reaches of the Lena River. Author’s abstract of dissertation in support of candidature for biological science degree. – Irkutsk, 2013. 20 pp.

[125] Ust-Kut gas fractioning unit. Phase 1. Environmental Survey Technical Report. Vol. 4. – Document code: 2826-1426-1783/2-ИЭИ. - OOO "INGEO", Irkutsk, 2018. 326 pp.

[126] Fishery characteristic of the Lena River and the Sukhoy creek, Ust-Kut District, Irkutsk Region. Letter No.OB-133 of 22.11.2017 from FGBU “State Fishery Research and Production Centre”

pebble bottom material supports so called litoreophil benthic system comprising mayflies, stone flies, caddis, and chironomids. In terms of numbers and mass, the dominants are mayflies representing the families of *Heptageniidae*, *Baetidae*, *Ephemerellidae*, etc. Other common elements of benthos are larvae of two-winged flies, midges, beetles and other insects. The sand-silt biotopes are dominated by larvae of two-winged flies from *Chironomidae* and *Limoniidae* families, with presence of oligochaetes and leeches.

7.8.10.3 Ichthyofauna

Fish population of the Upper Lena comprises three faunistic systems: boreal-plain, boreal-piedmont, and Arctic fresh-water. Among all species (with reference to T.V. Potyomkina, 2013: 24 taxons belonging to 21 genera, 12 families, 8 orders and 2 classes), about a half (more precisely - 40-45%) belong to the boreal-plain system, by their origin. At the level of orders, the leading are carps (3 families, 8 genera and 9 species) and salmon species (3 families, 6 genera and 7 species).

In terms of *nutritional adaptation*, ichthyocoenosis of the Upper Lena can be divided into *predatory* (taimen, pike, burbot), *benthos eaters* (sturgeon, pidschian, pilot fish, Siberian stone loach), *detritus eaters* (lamprey, Siberian loach), *euryphages* (lenok, grayling, sculpins, dace, perch, ruffe, roach, gudgeon, monnows, crucian), and plankton eaters (tugun). Siberian and spotted sculpins, dace, roach, gudgeon, Chinese minnow and grayling demonstrate seasonal variations of diet - in spring their food spectrum is much wider than in autumn.

The section of the Lena River that will be used for abstraction of technical water for the plant, for discharge of treated wastewater, and for goods transportation by river (the temporary berth facility) is located downstream of the railway bridge on the Baikal-Amur Railroad (within the Ust-Kut city) represents a water body of varying width of 250-300 m, sometimes up to 500 m, with flow velocity of 0.75-1 m/s and depth of 5 m during low-water period (transverse profile mean depth 1.5 m).

The concerned water course section is characterized by scarce meandering, uniform bottom surface[127], absence of branches and islands, lack of large and medium tributaries (the nearest large tributary downstream of the Kuta River discharge point is the Tayura River, some 50 km from the sections belonging to the Ust-Kut industrial area of INK), therefore, diversity of aquatic fauna habitats is limited, and the environment is generally unfavourable for large fish populations. The omnipresent and most abundant species are perch, ruffe, pike, dace, gudgeon, Siberian stone loach, monnows, and loaches. Lamprey, taimen, ciscos (pidschian and tugun), lenok and pilot fish are widely spread, tough in small numbers. Four of them - taimen (*Hucho taimen*), lenok (*Brachymystax lenok*), tugun (*Coregonus tugun*) and pilot fish (*Prosopium cylindraceum*) are recorded in the Red Data Book of Irkutsk Region[128]: pilot fish, tugun and lenok are assigned with category 2 (decreasing population size), and taimen is category 1 (endangered species).

Reportedly, the main contributing factors of decline of the above fish populations are poaching and water pollution with effluents from industrial sites and river transport. Few identified species are also assigned with IUCN conservation status: taimen and pidschian (*Coregonus lavaretus*) - as vulnerable species (VU), Arctic grayling (*Thymallus arcticus*), common dace (*Leuciscus leuciscus*), Siberian loach (*Cobitis taenia*), common minnow (*Phoxinus phoxinus*) and Siberian bullhead (*Cottus poecilopus*) - as species of least concern (LC).

Special attention should be given to Siberian sturgeon (*Acipenser baerii*) with its population in the Lena River commonly known as Yakut sharp-nosed sterlet sturgeon or Hatys sturgeon and being an important part of the global population the species recognised by IUCN as endangered (EN). The most important sturgeon habitats are located in the Yakut section of the Lena River. According to the Fishery characteristic of the Lena River prepared by the Baikal Section of FSBSI “Gosrybtsentr”, sturgeon is

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[127] In particular, *document “Fishery characteristic of the Lena River” prepared by the Baikal Section of FSBSI “Gosrybtsentr” mentions that no wintering holes exist in the studied section of the river*

[128] According to *the Fishery characteristic of the Lena River prepared by the Baikal Section of FSBSI “Gosrybtsentr”, Siberian brook lamprey (Lampetra japonika kessleri or Lethenteron kessleri) is also listed in the Red Data Book of Irkutsk Region. According to information that was made available to the Consultant, Category 2 (decreasing population size) has been assigned in Irkutsk Region to a different lamprey species - Asiatic brook lamprey (Lethenteron reissneri) which is also present in the Lena River downstream of the village of Zhygalovo. Conservation status of this species in accordance with the international classification is LC - least concerned.*

extremely rare in the upper reaches of the river and is never encountered upstream of Ust-Kut[129]. The Red Data Book of Irkutsk Region sets the upstream boundary of sturgeon occurrence area in the Lena River catchment at the Zhygalovo settlement (340 km upstream of Ust-Kut), and assigns Category 1 (endangered) to the species. In any case, the part of the Lena River affected by the Project is clearly not a preferred habitat for sturgeon. It does not perform the functions of permanent habitat, feeding, breeding or wintering grounds, and mainly serves as a migration corridor.

Many other fish species also use the Lena River within the area of Ust-Kut on their migration routes covering major part of the river basin. In particular, due to the lack of forage organisms (especially zooplankton) in the river, almost all valuable commercial species - Siberian whitefish, pilot fish, lenok - adopt semi-migratory mode of life. Migration behaviour of grayling is also distinct but to a lesser extent. According to the established ecological relationships between the above salmon species, whitefishes (pidschian, pilot fish) use spawning grounds in autumn, and their larvae hatch out and migrate downstream at the beginning of high water period in early spring; grayling and lenok spawn roe in spring, therefore, their larvae hatch out and migrate to lower reaches in the beginning of summer (only a small part of fry remains in the upper reaches and stays there for a relatively long time). In the lower reaches of the Lena River, the larvae fatten and reach maturity before returning to the places of reproduction (Demin, 2008).

The Lena River and tributaries in the area of Ust-Kut provide sufficient food resource to support stable population of few relatively permanent non-migratory species (gudgeon, perch, pike, sculpins, ruffe, lamprey, roach, loach, etc.), and is also partially used by migrating salmonids. Burbots migrate to shorter distances (compared to those of whitefish) for spawning, and smaller cyprinids (minnow and dace) migrate in search of food.

Spawning grounds in the Upper Lena are used in all seasons: spring is the season for spawning of dace, roach, pike, grayling, lenok, taimen, Siberian stone loach, Siberian and spotted sculpins, perch, ruffe, gudgeon; lamprey, sturgeon, minnows, gudgeon, loach and crucian spawn roe in summer; autumn season is for pidschian, tugun, pilot fish, and Arctic char; and burbots use the spawning grounds during winter low-water period.

Species diversity in small rivers and creeks discharging to the Lena River is limited, and their ichthyocoenosis follows a distinct seasonal pattern, due to complete freezing in winter and partial drying out in summer. Aquatic fauna of reference small streams includes common minnow, Siberian bullhead and Siberian stone loach. Fish from the Lena River (grayling, roach, perch, dace) may use the lowest reaches of small streams, near debouchment as fattening and spawning grounds.

7.8.10.4 Fishery

With reference to the above description of ichthyocoenosis of the Lena River and tributaries, the river being the main water course in the Eastern Siberia is categorized as the top grade fishery water body providing habitat and spawning grounds for the top and high value fish species. The small tributary streams are classified as 2nd fishery category (for their function as seasonal habitats for few species and contribution to food resources for the main river ichthyocoenosis).

Before 1990-s fishery was an important of economy in the Upper Lena area. According to the historical data provided in the referenced publication of T.V. Potyomkina (2013), reported catches were about 700-800 tons per year in the middle of 20th century and dropped to 40 tpa in 1980s, including about 13 tons of fish produced in Ust-Kut District. After 1990 fishery was practices sporadically. Long-time average catch in the Lena River section between Zhygalovo and Ust-Kut over the period 1990-2005 was 4.1 ton, with the following content of various species (%): taimen – 0.2, lenok – 0.4, grayling – 42.4, perch – 3.7, burbot – 2.3, roach – 31.4, pike – 18.9, dace – 0.7. In 2005 catch in the same area increased to 6.5 tons including 5.6 tons of grayling (about 85 %). No commercial fishery activity was reported over the period 2006-2014 in the section between Zhygalovo and Ust-Kut. In 2014 fishery activities were partially relocated to the relatively large tributary streams - Vitim (within the boundaries of Irkutsk Region, 1 user, total catch - 0.23 tons of grayling, pidschian and lenok) and Kirenga (3 users, 3.71 tons of grayling,

[129] The same conclusion is made by T.V. Potyomkina (Ecological-biological fish characteristic of upper reaches of the Lena River. Author's abstract of dissertation in support of candidature for biological science degree. – Irkutsk, 2013. 20 pp.)

whitefishes, lenok, taimen, small ordinary fish, pike); one user practiced fishery in the Lena River - near Zhygalovo (total catch of 1.85 tons of grayling, lenok, taimen, small and big ordinary fish).

The quotas for production of grayling and whitefish that were issued on the basis of recommendations of authorities subordinated to the Federal Agency for Fishery[130] (in year 2013 - 10 tons and 1 ton, respectively) have not been taken up during several years, due to relatively low economic efficiency of commercial fishery in the Lena River compared to the regional water reservoirs (particularly the Bratsk reservoir) that demonstrate higher yield fish. Commercial fishery was suspended during 2015-2016 for the purpose reasonable use and conservation of fresh water ecosystems.

The total commercial fish reserves in the Lena River within the boundaries of Irkutsk Region are tentatively assessed as 1000 tons of fish including 14% of grayling, 59% of roach and perch, 27% of big ordinary fish (pike, burbot). At present, commercial fishery activities are mainly focused on tributaries of the Lena River - Kirenga and Khanda (Kazachinsko-Lensky District) and have almost ceased in the Upper Lena and other rivers, due to low economic efficiency.

According to the Irkutsk Region Ministry of Agriculture (Order No.76-мпр of 14.06.2016), no new commercial fishery areas have been established on the Lena River or other water bodies within Ust-Kut District[131]. However, recreational fishing is quite common in the area, with the main catch including grayling, perch, pike, roach and other small cyprinids; lenok is less common, and taimen or whitefish are extremely rare. Reportedly, the quantity of grayling caught by non-commercial fishermen in the Lena River within the boundaries of Irkutsk Region is by 14 times more than commercial catch of this fish.

The widely-spread poaching has reportedly resulted in significant juvenation of populations of taimen, lenok, pidschian and pilot fish, against the background of overall decline of size of these populations. In this situation, academic community has good reasons to advocate revision of salmon species' conservation status in the Upper Lena, to prevent their vanishing (Potyomkina, 2013). It is expected that the most significant man-caused impact on ichthyocoenosis of the Lena River downstream of Ust-Kut city will be related to the fairway dredging and navigation activities, including the illegal practice of discharging liquid and solid wastes from vessels straight to the river.

7.8.11 *Designated conservation areas*

The system of designated conservation areas (DCA) in Irkutsk Region is currently represented by several DCAs of the federal and regional significance that occupy all together 3% of the total region's territory. Given the Russia's average percentage of DCA (12%), this indicates scarcity of natural reserves in the region[132]. At present, Irkutsk Region includes the following DCAs:

- 6 DCAs at the federal level: 2 nature reserves, 1 national park, 2 game reserves and 1 botanic garden;
- 137 regional and local DCAs including 13 game reserves, 81 land marks, 32 medicinal and recreational areas and resorts.

There are no designated conservation areas of federal, regional or local significance within the project sites and in their immediate vicinity. The nearest DCAs are located at a distance of 14-30 km (Table 7.8.7, Figure 7.8.9); their designation was mainly dictated by the aesthetic value of local landscapes due to their geological features (e.g. the Mir Rock Cliff), or by the availability of balneal resources (thermal springs of Ust-Kut and Kazarki village)[133][134][135]. The nearest integrated landscape reserve - Tayursky

[130] Assessment of aquatic biological resources, recommendations for their management, forecast of total allowable catch (TAC) and potential catch in 2013 in the inland waters controlled by FSUE "Gosrybtsentr". Stage 2/ Book 1. Supporting materials for TAC 2013 for the aquatic biological resources in fresh waters of Irkutsk Region. - Ulan-Ude: Baikal branch of FSUE "Gosrybtsentr", 2012. 36 pp.

[131] The Irkutsk Region Ministry of Agriculture is developing schematic maps of region's fish-breeding and fish-production areas.

[132] G.D. Rusetskaya, Y.A. Dmyterko. Designated conservation areas as a tool for sustainable nature management // Baikal State University. 2017. No. 4. P. 478-487.

[133] Summary list of designated conservation areas in the Russian Federation (Reference Book). Part II. Potapova N.A. Nazyrova R.I., Zabelina N.M., Isayeva-Petrova L.S., Korotkov V.N., Ochagov D.M. - Moscow, VNIIprirody, 2006. 364 pp.

[134] Atlas of designated conservation areas of the Siberian Federal District / Kalikhman T.P., Bogdanov V.N., Ogorodnikova L.Yu. - Irkutsk: Publishing House 'Ottisk', 2012. 384 pp.

[135] Lyamkin V.F., Kalikhman T.P., Bogdanov V.N., Sokolova L.A. Report 'Development and positioning scheme of designated conservation areas in Irkutsk Region'. - Irkutsk: V.B. Sochava Institute of Geography, Siberian Division of the Russian Academy of Sciences, 2006.

Reserve with the total area of about 50 thousand ha is intended for comprehensive protection of landscapes, vegetation, terrestrial vertebrates, and ichthyofauna of a relatively large tributary of the Lena River.

Table 7.8.7: Designated conservation areas nearest to the Polymer Plant

Name	Distance from project site boundary	Status	Category	Significance	Profile
DCAs nearest to the design boundaries					
Tayursky reserve	33 km to the south-east	Existing	State nature reserve	Regional*	Integrated landscape reserve
Ust-Kut resort	24 km to the west	Prospective	Natural park	Regional*	TBD
Ust-Kut water spring	23 km to the west	Existing	Land mark	Regional*	Geological (hydrogeological)
Mir Rock Cliff	14 km to the west	Existing	Land mark	Regional*	Geo-morphological
Turuksky mineral water springs	24 km to the south-west	Prospective	Land mark	Regional*	Geological (hydrogeological)
Mineral water springs in Kazarki village	17 km to the north-east	Prospective	Land mark	Regional*	Hydrological
DCAs in downstream areas of the Lena River valley (nearest to the design boundaries)					
Pilka	Over 500 km downstream the Lena River	Existing	State nature reserve	Regional**	Biological
Cherendey	Over 1,000 km downstream the Lena River	Existing	Resource reserve	Local**	Integrated reserve

* Managed by the to the Irkutsk Region Ministry of Natural Resources and Environment

** Managed by the Republic of Sakha (Yakutia) Ministry of Nature Protection

Considering the position of few facilities of the MEG Plant on the river bank, DCAs located downstream the Lena River have also been identified: distance to the nearest of them - the Pilka Reserve - is 500 km (refer to Table 7.8.7).

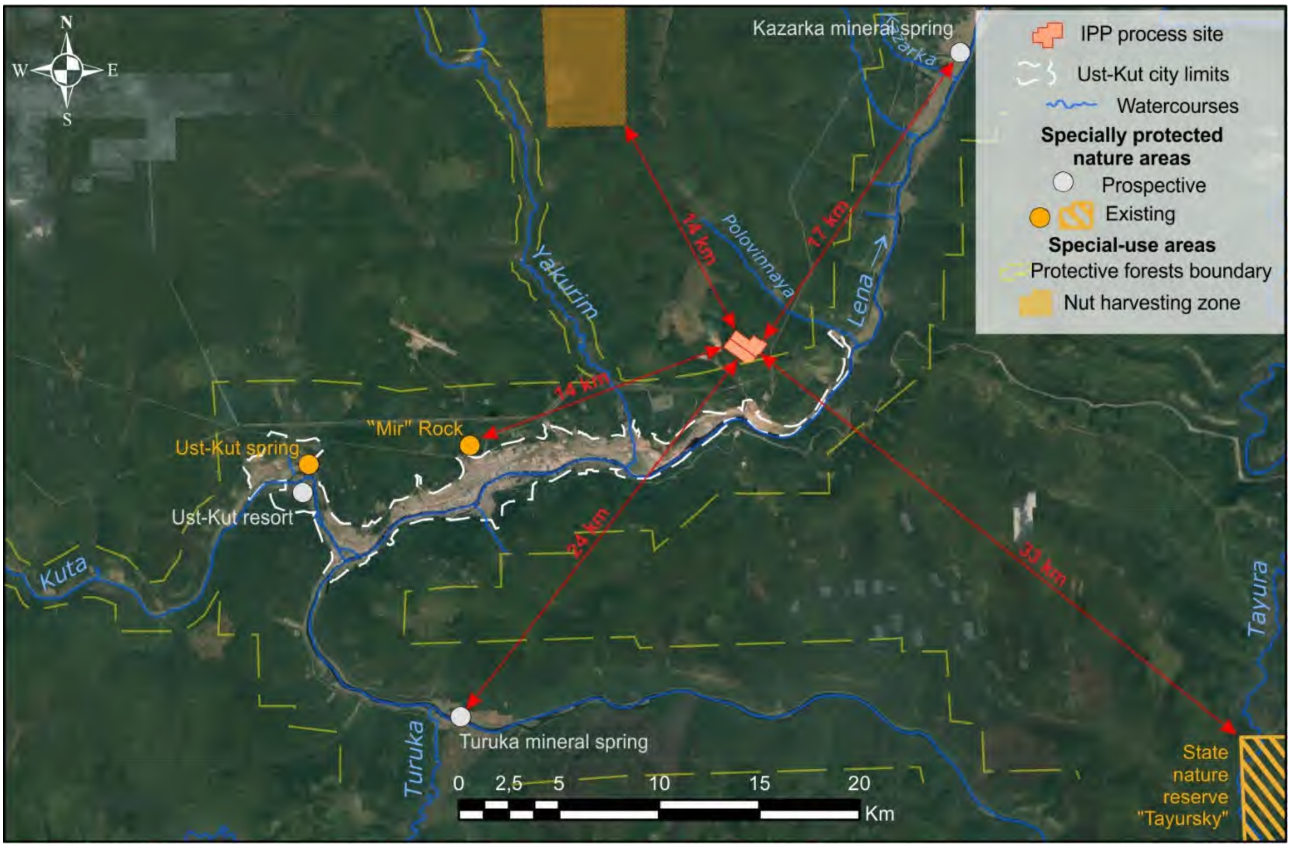

Figure 7.8.10: Position of the PPF process area in relation to nearest DCAs and other special nature management areas

7.8.12 Ecosystem services

Ecosystem services are the products and services of ecosystems that are important for community welfare. People get from the environment food, water and air which are essential for life, as well as natural resources and materials for economic activities and consumption. Less obvious ecosystem services are purification of air and water, deposition and biodegradation of waste. In addition, the environment provides conditions for recreation, safeguarding physical and moral health.

Environmental services are categorized into four groups:

- provisioning;
- regulating;
- cultural;
- supporting.

The supporting services (e.g. soil formation, primary production and genetic exchange) are the basis for three other categories. Therefore, supporting services are not assessed separately in this chapter.

The IFC Performance Standards distinguish two types of priority ecosystem services[136]:

1. those services on which project operations are most likely to have an impact and, therefore, which result in adverse impacts to affected communities; and
2. those services on which the project is directly dependent for its operations (e.g., water).

Furthermore, when affected communities are likely to be impacted, they should participate in the determination of priority ecosystem services in accordance with the stakeholder engagement process as defined in Performance Standard 1.

Provisioning services

At present, the main factor that determines the value of ecosystem services in terms of socio-economic development of Russia's regions is bioproductivity of landscape. In particular, the taiga zone is the main source of timber. The area leased by the Company for construction of the Project facilities is fully (100% or 433.3 ha) occupied by merchantable forest with coniferous trees including fir (121.9 ha), larch (72.7 ha), and smaller quantity of pine (22.5 ha). Siberian pine occupies a small area (2.6 ha) (Forest Development Project document, 2018). The largest forest user in Ust-Kut District is Trans-Siberian Wood Company (TSLK) with logging and wood processing operations.

Local communities use the forests in Ust-Kut District for commercial and recreational hunting, picking nuts, mushrooms, berries and medicinal plants. The local branch of Irkutsk Region Association of Hunters and Fishermen (IRAHF) has a tentative membership of 1100 persons (in the whole area of Ust-Kut Municipality). About 3000 persons hold licenses for hunting in the District forests. For 600 'commercial' hunters this activity is a source of income.

Local residents use the Lena River water resource for recreational and commercial fishery.

Commercial gathering of pine nuts is not practiced in Ust-Kut District, due to low fruit yield of local cedar forests. However, people gather pine nuts for own consumption.

The subject area has a certain potential of medicinal and food plants resources (Atlas of occurrence ranges …, 1976; Forest Management Regulation of the Ust-Kut District, 2008). The average annual yield of berries gathered in the Ust-Kut forestry is as follows: 143 kg/ha of lingon-berry; 55 kg/ha of cranberry, 195 kg/ha of bog bilberry; 51 kg/ha of raspberry; 42 kg/ha of current; and 136 kg/ha of bilberry.

Local communities use fresh water for drinking and household needs.

Regulating services

Air quality regulation. Ecosystems participate in regulation of atmospheric air gas composition by maintaining the balance of carbon dioxide and oxygen, ozone, for protection against the harmful UV radiation. The air quality is determined by content of various chemical substances (including man-caused pollution) and their uptake. The design should consider the wind conditions and general air circulation in

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[136] IFC Performance Standards, January 2012

the Project area. In particular, frequent calm weather and persistent anticyclones in winter predetermine the low dispersion potential to dissipate air pollutants emitted from sources, and hence pollution of ground level air.

Climate regulation. The issue of greenhouse gases or aerosols emissions and their impact on local and global climate is well known. In the northern (boreal) forests, the main media that hold carbon are soil and forest debris, as well as peat bogs where semi-decomposed organic matter is accumulated in low-temperature conditions. Carbon deposits in boreal forests are larger than in any other terrestrial ecosystem - almost two times more than in tropical forests (Sustainable Forest Management, No.3 (32), 2012).

Water regulation and conservation. The forest and meadow-marsh ecosystems within the planned area of construction are engaged in feeding and regulation of flows of small rivers - tributaries of Lena, and the Lena River itself. They also control the extent of high-water events and their consequences. The natural ecosystems perform the function of a "bio-geo-chemical barrier" that protects water from migrating pollutants and supports purification of natural water bodies (including self-purification and dilution mechanisms).

Erosion regulation. Ecosystem integrity, particularly integrity of vegetation cover, may influence soil erosion processes by reinforcing soil and sedimentary rock. Disturbance of forest vegetation, particularly in the water protection forests results in intensification of erosion and disturbance of river flows.

Cultural services

Recreational value. Local communities traditionally use taiga landscapes for recreational hunting, fishing, gathering nuts, mushrooms, berries. The Project land acquisition will inevitably limit the concerned land availability for recreational use. On the other hand, the auxiliary infrastructure, e.g. new access roads, may increase recreational value of nearby areas.

Aesthetic value. Ecosystems have a role in education processes, being a source of aesthetic pleasure and artistic inspiration. In the baseline situation, the natural valley-forest landscapes in the Project area have been transformed by previous development of the territory (forest logging, existing transport corridors, Phase I facilities under the INK Gas Programme), and partially lost their original aesthetic value.

7.8.13 Conclusions

Ecosystems within the Ust-Kut industrial area have been transformed to a significant degree as a result of economic activities, where the main contribution is made by forest felling and wood processing operations. The virgin taiga forests have been fully displaced with derivative (secondary) small-leaved and coniferous/small-leaved forests in the overgrowing clearcut or burnt areas. Ecosystems within the Project area of influence, particularly those along the River Lena match the criteria for determination of transformed habitats, as defined by IFC PS6. The natural habitats still exist in the form of fragments of slightly disturbed spawning protection forests which have been least affected by man-caused impact due to their conservation status.

No rare species of plants or terrestrial vertebrates, or species with conservation status have been identified by the environmental surveys in the Project footprint area and neighbour sites. The territory of Ust-Kut district falls within the aerials of several protected plant and animal species, however, analysis of characteristic habitats shows that their occurrence in the Project area is unlikely due to the lack of suitable conditions for the majority of mentioned rare and protected species. Specific habitats of such species must be identified during the planned environmental survey activities. Furthermore, the affected land is habitat for multiple edible and medicinal plants, and gaming animals.

Freshwater ecosystems of the Lena River and tributaries are populated by a number of fish species (mostly salmons) which, besides having a commercial value, are also recognised at the national and international level as species with conservation status. The impact water areas are not preferred biotopes for the above species; nevertheless, the Project planning shall take into account vulnerability of their populations under pressures not attributable to the Project.

The proposed location of the PPF facilities has the benefit of remote position (14-30 km) in relation to the nearest designated conservation areas which may be associated with the critical habitats (in terms of IFC PS6) nearest to the design boundaries.

7.9 Waste Management

7.9.1 Waste disposal and detoxication facilities in Ust-Kut Municipality

Waste disposal facilities in the proposed location area of IPP are deficient. Municipal solid wastes (MSW) from companies and residents of apartment blocks and single-family houses in Ust-Kut Municipality (Ust-Kut urban settlement) are collected in containers and transported for disposal to municipal MSW landfill operated by Spetsavto LLC. As of year 2017, 163 container sites for collection and temporary accumulation of municipal solid wastes were arranged in Ust-Kut city, including 153 sites in residential areas and 10 in the premises of various entities.

There are no providers of recycling/disposal services in relation to wastes of hazard classes 1-3 in the area of Ust-Kut Municipality. The only exception are thermal destruction facilities (KTO-50) operated by INK at the Yaraktinsky field - these facilities accept for disposal spent oil and other wastes of hazard class 3. Used mercury lamps are accepted for disposal by a company in Bratsk.

Besides the above municipal MSW landfill which receives the main municipal waste flows from the city, another MSW landfill is situated in Verkhnemarkovo village in the territory of Ust-Kut Municipality. The landfill belongs to INK and is used for disposal of wastes from the Company operations and from other sources, on contractual basis. Temporary waste accumulation sites are arranged in villages, and slurry ponds are available at the field operation sites of INK. In addition, INK is constructing an industrial and municipal waste landfill in the area of the Yaraktinsky OGCF, to serve the needs of INK which are not related to gas production. The existing solid wastes disposal and temporary accumulation sites are listed in Table 7.9.1.

Table 7.9.1: MSW landfills in Ust-Kut Municipality (including Ust-Kut city)

MSW landfill	Location (community)	Used landfill capacity, %	Accepted waste types
MSW landfill (owner Spetsavto, LLC)	Ust-Kut city, 14th km of 25H26 road "Ust-Kut – Uoyan", land plot cadastral number 38:18:000018:137	90 %	MSW Hazard class IV-V
MSW landfill (owner INK, LLC)	Verkhnemarkovskoye RM. Site with coordinates [137] 57.333639 N, 107.008899 E	15%	MSW Hazard class IV-V
Temporary waste accumulation site	Niyskoye RM, 56.534073 N, 106.808496 E	80%	MSW Hazard class IV-V
Temporary waste accumulation site	Zvezdinskoye UM, 56.750856 N, 106.527214 E	80%	MSW Hazard class IV-V
Temporary waste accumulation site	Yantalskoye UM, 56.923579 N, 105.241336 E	85%	MSW Hazard class IV-V
Temporary waste accumulation site	Rucheyskoye RM, land plot cadastral number 38:18:000012:3211 (designated forest land)	80%	MSW Hazard class IV-V
Temporary waste accumulation site	Kaymonovo village, Rucheyskoye RM, 56.823526 N, 104.891355 E (designated forest land)	80%	MSW Hazard class IV-V
Temporary waste accumulation site	Podymakhino village, 20 Azovskaya St. (site located at a distance of 360 m from the orienting point), land plot cadastral number 38:18:00000:2307	60%	MSW Hazard class IV-V

MSW landfill operated by Spetsavto LLC is located at the 14.5 km of road "Ust-Kut – Severobaikalsk – Uoyan" (25H26), on the right band of the Lena River (Fig.7.9.1); distance to the river line is 560 . The site occupies the area of 6.57 ha and has a capacity for disposal of 2157.57 thousand m^3 of wastes. It accepts domestic (municipal) solid wastes of hazard class IV-V. The landfill was commissioned in 1994 with a design capacity for 30 years operation. The volume of wastes received for disposal by year 2017 is 965 thousand m^3. According to the information received from the District Administration during the

[137] Here and further reference is made to tentative coordinates of landfills in WGS-84 CS, or to cadastral numbers of the land plots.

Consultant's site visit in April 2019, the landfill capacity will be used up by year 2025, if the waste flows remain at their current level.

The landfill is licensed for disposal of wastes of hazard classes IV-V (No.ОП-67-001202(38) of 16.11.2009) and registered in the State Register of Waste Disposal Sites (SRWDS).

According to Spetsavto LLC, reported average total quantity of wastes received at the landfill over the period 2009-2013 is about 90 thousand m^3 per year, maximum. Annual volume of solid wastes disposed at the land fill during the period 2017-2019 was of 121 thousand m^3, including 82 thousand m^3 from households, 8.7 thousand m^3 from budget-funded institutions in Ust-Kut, and about 30 thousand m^3 from other entities[138].

The landfill territory is fenced, and video surveillance is provided at the site. The wastes received for landfilling are registered (ticket system), and MSW originating from various entities are recorded in a log. Neither weight and radiometric surveillance, nor disinfection of vehicles and containers is provided. Local leachate treatment system is implemented at the landfill, and quality of ground and surface water, soil and ground-level air is monitored. According to the District Administration, a waste sorting facility will be commissioned at the landfill site in QIII 2019.

Figure 7.9.1: MSW landfill at 14th km of road 25H26 "Ust-Kut – Severobaikalsk – Uoyan"

Photo: Ramboll, February 2019

Given the lack of capacity of the existing MSW landfill, Ust-Kut Municipal Administration intends to construct a new MSW landfill of 30 ha in the valley of the Yakurim River, along the Mingan road. By present time, the land plot has not been allocated for the purpose, however, its suitability for construction and operation of MSW has been confirmed by results of engineering survey. The planned construction is not mentioned in the Ust-Kut Municipal Infrastructure Integrated Development Programme 2017-2028.

7.9.2 Waste management issues in Ust-Kut District

Multiple violations of waste management rules have been identified in Ust-Kut District, including inadequate conditions of temporary waste accumulation, and illegal use of land plots for disposal of wastes. Results of random inspection of various sites in the city and district in 2017 indicated that the majority of fly dumps occur at the outskirts of private housing areas and on sides of forest roads (Figure 7.9.2). Many illegal dumps were also found in the apartment block territories, along the shore line of the Lena River, along the railroad, near road and railway bridges. The total volume of illegal dumps in Ust-Kut is estimated[139] to be more than 32 000 m^3, as of year 2012.

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[138] Operational Programme of Spetsavto LLC for the period from 01.01.2017 to 31.12.2019 has been approved by the Head of Ust-Kut Municipality (urban settlement) V.G. Krivonosenko.

[139] Ust-Kut City Sanitation Master Plan. Chelyabinsk: NPF "Ecosistema", LLC, 2012.

During the site visit in May 2017 Ramboll team observed fly dumps along the road to the landfill of Spetsavto LLC, on the right bank of the Lena River; no illegal dumps were found in the area during the site visit in 2019, however, accurate assessment of the situation was not possible due to presence of snow cover.

Figure 7.9.2: MSW dump at the boundary of the "Ust-Kut water spring" conservation area

Photo: Ramboll, 19.05.2017

Figure 7.9.3: One of the multiple fly damps along the road 25H26 "Ust-Kut – Severobaikalsk – Uoyan", section between Ust-Kut city and MSW landfill

Photo: Ramboll, 19.05.2017

The following issues are highlighted in the Ust-Kut Municipal Infrastructure Integrated Development Programme 2017-2028: lack of bulky waste collection facilities in residential areas; use of obsolete containers which often mismatch design of the waste collection sites; excessive number of containers put for use at some sites; facilities at most container sites fail to meet the sanitary-hygienic requirements; hazardous wastes are partially discarded into non-hazardous waste stream. Local areas are further littered due to lack of adequate recreational facilities.

<u>TSLK timber saw waste disposal site</u>

Disposal of timber saw waste is a critical problem for Ust-Kut city. Continuous burning of timber saw wastes at the site of major local forestry operator - Trans-Siberian Wood Company (TSLK LLC or IND Timber) causes the greatest public concerns. Site used TSLK for temporary accumulation of their wastes almost abuts the planned construction site of IPP (see Appendix 4). In 2013 wastes stored at the site took fire, and despite the measures taken by TSLK and local authorities, the fire still persists (with short intervals) causing air contamination and regular smoke pollution in the Mostootryad residential area.

Figure 7.9.4: Burning timber saw wastes at TSLK site

Photo is provided by Ust-Kut District Administration, 2019

As a result of partial reclamation in 2018 intensity of smoke pollution lessened to a significant extent. At the time of Ramboll's team site visit to Ust-Kut in April 2019, only a small plume of smoke was visible over the timber waste facilities. In 2019 IND Timber (former TSLK) launched two fuel briquette lines which have reached their full capacity for recycling of timber waste. Furthermore, 3 boiler houses in the city operate on wood chips, and potential conversion of all heat generation facilities to operate on timber wastes is being considered.

7.9.3 Waste disposal and detoxication facilities of INK

INK MSW landfill in Verkhnemarkovo village with the total area of 4.45 ha was commissioned in 2013, on the land plot allocated by the Resolution of Ust-Kut Municipal Administration No.24 of 25.01.2008. The site is located in Ust-Kut District of Irkutsk Region, 1.2 km to the north-west of Verkhnemarkovo village, on the bluff left bank slope of the Lena River. South-western part of the landfill features trenched terrain of an abandoned quarry with indented slopes and soil heaps (the area size if 2.15 ha). To the north-east of it is a territory of 2.3 ha with undisturbed terrain. Distance from the landfill to the Lena River is 2.7 km. Creek Podgoleshny crosses the south-western slope at a distance of 200 m from the landfill site and debouches into the Lena River.

The landfill is intended for disposal (burial) of domestic solid wastes and other similar wastes of hazard class IV-V generated by INK, its subsidiaries, and residents of Verkhnemarkovo village. Design capacity of the landfill is 10000 m^3. The landfill is designed for 22 years operation, and about 15% of its capacity was used up by year 2017. Wastes are delivered for disposal by special vehicles of the Company and third parties.

Perimeter protection of the MSW landfill site is provided by means of a 2.5 high metal mesh fence. Access to the site is by gravel road, with access control system including a lift gate and check point. Utility zone includes: an office-and-amenities building with the check point, parking area, and fire water tanks. Disinfection of vehicles running gear is provided at the exit from the landfill territory. Wastes received at the landfill are subject to visual control, weighed and registered for accounting.

Interception channels are provided to prevent access of rain and melt water from adjacent areas. Balancing ponds in the south-west of the landfill collect surface runoff from the landfill territory. One 20 m observation well is drilled for monitoring of ground water quality.

INK is currently constructing an IMSW landfill at the Yaraktinsky field, using the design prepared by NPF DIEM, CJSC, with the site area of 25 ha. The landfill is intended for reception, detoxication and disposal of industrial wastes of hazard classes III-V, municipal solid wastes of hazard classes IV-V, drilling wastes of hazard class IV from the INK Group companies, for reception and detoxication of petroleum-contaminated snow and soil, and for treatment of industrial wastewater. Future operational waste flows from IPP subject to removal for disposal and detoxication are included in the list of materials permitted for acceptance at the landfill.

The IMSW site is located in Ust-Kut district in central area of the Yaraktinsky OGCF, in the interfluvial area of the Gulmok River and its right-hand tributary, 2 km from the sites of gas pumping and compression facilities. Settlements nearest to the site are Verkhnemarkovo (93 km) and the geologists' settlement of Yarakta (13 km).

The planned volume of wastes class III-V to be buried and thermally treated at the landfill is 369.833 thousand tons over the whole period of landfill operation (as per the valid license No.038 00120 dated 25 August 2014 for neutralization and disposal of wastes of hazard classes I-IV, the applicable Waste Generation and Disposal Limits for Ust-Kut and Katanga Districts of Irkutsk Region, and considering the local waste flows from the landfill operations).

In 2015 the landfill construction and operation project passed public hearings and was approved by Rosprirodnadzor (Order on approval of the project of 15.08.2016 No. 460, positive conclusion validity period of 18 years). Tender procedure for construction stage 1 of the IMSW landfill at the Yaraktinsky OGCF was conducted in 2018. The facility has not been registered in SRWDS and its construction is in progress. The landfill operation (and therefore construction) is divided into six stages. Each of the facilities of the stages 1-5 is designed for three-ears' service, while the 6th stage will operate for four years.

The landfill is intended for the following operations:

- reception, burial and isolation of industrial wastes of hazard class IV and drilling wastes of hazard classes IV-V;
- thermal treatment of municipal solid wastes of hazard classes IV-V, solid, petroleum-contaminated, liquid and pasteous industrial wastes of hazard classes III-IV;
- pre-treatment of wastes (tyres crushing, compaction of packaging), temporary storage of non-ferrous metals scrap to be handed over for recycling to licensed specialized;
- reception of petroleum-contaminated snow and subsequent transfer of melted water to the treatment facilities for runoff from industrial sites;
- reception and thermal treatment of petroleum-contaminated soil and ground from spill response operations;
- treatment of runoff water from industrial sites.

The landfill is designed for reception of municipal solid wastes transported by waste trucks, industrial wastes (including building waste) delivered by dump trucks and garbage trucks, drilling wastes - by dump trucks, industrial liquid and pasteous wastes - by dropside trucks with loader cranes, oily sludge - in road tankers, tyres and packaging - by dropside trucks with loader cranes.

Locally generated wastes from the landfill operations will be collected in closed containers at dedicated and appropriately equipped site, and regularly removed to burial or thermal treatment.

Commissioning is planned for 2020, i.e. before the main stage of IPP construction.

Two facilities for treatment of hazard class III wastes operate in Ust-Kut District. Those are the thermal waste neutralization systems (KTO-50) operated by INK. The facilities are situated at the Verkhnemarkovsky and Yaraktinsky oil-gas condensate fields and are used for secondary combustion of petroleum, fuel and lubricant wastes from the Company operations.

The KTO-50 units that process the wastes are standard modular units manufactured in accordance with TU 4853-001-52185836-2005. The systems are designed for thermal neutralization of municipal solid and industrial wastes and liquid oil sludge and other wastes contaminated with petroleum products (hazard class III-V according to FCCW).

The following wastes accepted by KTO units for neutralization:

- Class III: used motor oils, used transmission oils, used hydraulic oils with no halogen content, used compressor oils, used industrial oils, diesel fuel residues that have lost their consumer attributes, sludge from cleaning of pipelines and oil tanks, waste organic solvents, paints, varnishes, glue, mastics and resins;
- Class IV: oil contaminated cleaning cloth (less than 15% oil content), oil contaminated sawdust (less than 15% oil content), waste paper and cardboard with impregnating and coating compounds (paper filters contaminated with petroleum products), litter from domestic premises of organizations, household wastes;
- Class V: food wastes from kitchens and catering facilities, uncontaminated cardboard packaging wastes, uncontaminated waste paper.

The units are designed to operate 260 years per year, and their capacity is 50 kg/h for solid wastes, 20.8 kg/h for liquid wastes. The maximum amount of wastes that can be neutralized by the two units is 186.2 tons per year. Natural gas is used as auxiliary fuel to maintain the combustion process.

7.9.4 Waste management system of INK

INK operates a waste management system that covers all operations of the Company in the existing industrial area. The Company performs waste management operations on the basis of the license for collection, recycling, neutralization, transportation and disposal of hazardous wastes No. OT-67-00963(38) of 15.09.2008. A unified WGDLB (Wastes Generation and Disposal Limits Book) is developed for the Company facilities located in Ust-Kut Municipality, however, the effective WGDLB has not been provided for review.

During the period 2013-2018 (validity period of current WGDLB) the Company sites generated 42 types of solid and liquid wastes, with the total annual quantity of about 22 866 tons. Details of the types of wastes, their volumes and storage arrangements of wastes of different hazard classes are provided in Table 7.9.2.

Table 7.9.2: Waste generation norms for INK operations, 2013-2018

Description of waste	Hazard class	Generation norm
Used luminescent and mercury lamps	I – extremely hazardous	1.2
Used lead accumulators	II – very hazardous	55
Used oils, sludge from cleaning of pipelines and containers contaminated with oil and petroleum products, diesel fuel residues, antifreeze agent residues, copper scrap	III – moderately hazardous	78.2

Description of waste	Hazard class	Generation norm
Oil contaminated cleaning rags, oil contaminated sawdust (less than 15% oil content), used tires and inner tubes, polymer wastes, filter elements, oil contaminated sand, municipal wastes (sweepings from territory), domestic wastes, cesspool sludge, ash, slug and dust from KTO units and furnaces, waste paper and cardboard with impregnating and coating agents, glass and plastic packaging from chemicals	IV – low-hazard	319.4
Non-contaminated cardboard packaging and paper wastes, food wastes from kitchens, welding electrode stubs, wooden packaging, timber chips, technical rubber, used abrasion wheels, incandescent lamps, drilling mud, aluminium scrap, ferrous metals scrap and chips, timber and straw ash	V – virtually non-hazardous	22461.8

Wastes generated at each industrial site are registered and accumulated in dedicated places, with segregation by type. The following numbers of waste disposal sites of INK were reported in 2017:

- Temporary accumulation sites – in Ust-Kut city – 10, at the Yaraktinsky OGCF – 105, at the Verkhnemarkovsky OGCF – 67; the number is subject to change depending on the number of active well pads [TBD].
- Waste disposal sites – 1 MSW landfill in Verkhnemarkovo village and 6 slurry ponds at the wells drilling sites at the fields.

The waste with the largest absolute generation quantity was drilling mud (hazard class V) which is disposed in slurry ponds at the drilling sites. Municipal wastes and similar industrial wastes are transported from the temporary accumulation sites to the existing landfill of INK in Verkhnemarkovo village, transferred for treatment to specialist companies, or sold to consumers for further use. Wastes of hazard class III-IV are neutralized in two KTO-50 units, and wastes of hazard class I-II (mercury lamps and accumulators) are transferred to third parties for disposal, with engagement of licensed contractors.

Waste transportation is provided using own specialised vehicle fleet, depending on type of wastes and destination. Documentation is regularly reviewed by the Company, in order to verify that total volumes of waste generation, transfer and disposal match.

8. SOCIO-ECONOMIC BASELINE

8.1 Introduction

This Chapter is aimed at describing baseline conditions of socio-economic environment of Irkutsk Region, Ust-Kut City and Ust-Kut District, and at analysing its specific features and areas of concern.

Data sources reviewed as part of study of the socio-economic conditions of the territory are described in Section 8.2 and provided in the detailed list of referenced sources in Appendix 1. Sections 8.3-8.6 are focused on demographic situation and socio-economic parameters, existing infrastructure, public health and safety issues, vulnerable groups, types of land use, archaeological and cultural heritage of the territory in question.

Summary information analysis performed allows to draw general conclusions on socio-economic conditions in the Project area (Section 8.7). It also provides the ground for identification and assessment of potential socio-economic impacts of the Project, both adverse and beneficial, presented in Chapter 10.

8.2 Referenced Sources

The Chapter is prepared using the data collected from reports and official websites of the Irkutsk Region Division of the Federal State Statistics Service (Irkutskstat), Ust-Kut District Municipality, Ust-Kut City Administration, executive authorities and competent organisations, as well as data received from them upon request of Ramboll and Irkutsk Oil Company.

The data analysed in the course of the survey were also extracted from previous Environmental and Social Impact Assessment Reports and design documentation prepared for other neighbouring INK development projects, environmental documents, permits, approvals and licenses for the facilities within the Company’s zone of interest, INK corporate documents, materials on stakeholder engagement in relation to the INK Gas Business Development Programme.

The results of socio-economic study of Irkutsk Region, Ust-Kut District and City conducted by Ramboll at the PreESIA stage in 2017 have been also taken into account.

In addition, Ramboll carried out a series of consultations with Ust-Kut District Municipality and the City of Ust-Kut (local authorities and government institutions, as well as local communities) in March of 2019 to identify the main concerns and interests of local stakeholders.

During the visit to the Project area Ramboll interviewed representatives of the Project stakeholders including, but not limited to:

- INK personnel;
- Ust-Kut District Municipality;
- Ust-Kut City Administration;
- Director of MPCI “Ust-Kut Historical Museum”, Ust-Kut District;
- Chairman and members of the Veteran Council, primary organization in the ‘Lena residential area’ (an urban district of Ust-Kut);
- Head of the Ust-Kut Department of the Russian Ministry of Interior;
- Chairman of the Ust-Kut city branch of Irkutsk Region Association of Hunters and Fishermen;
- Representative of a media holding ‘TRK Ust-Kut Dialog’;
- Medical Director of Ust-Kut District Hospital.

It should be noted that a similar set of respondents had been interviewed for the PreESIA studies, therefore, verification of the original findings and appreciation of socio-economic development in the study area since 2017 is included in this section.

In the course of desktop studies, the publications in regional and local media have been analysed as well.

8.3 Socio-Economic Conditions of Irkutsk Region

8.3.1 Demographic situation

As of 2017, Irkutsk Region was populated with 2,408,901 people residing within the territory of 774,846 km^2 with population density of 3.11 people/km^2. By 1 January 2019, Irkutsk Region had 2,397,763 residents. The Region's area did not change, therefore the population density dropped down to 3.1 people/km^2.

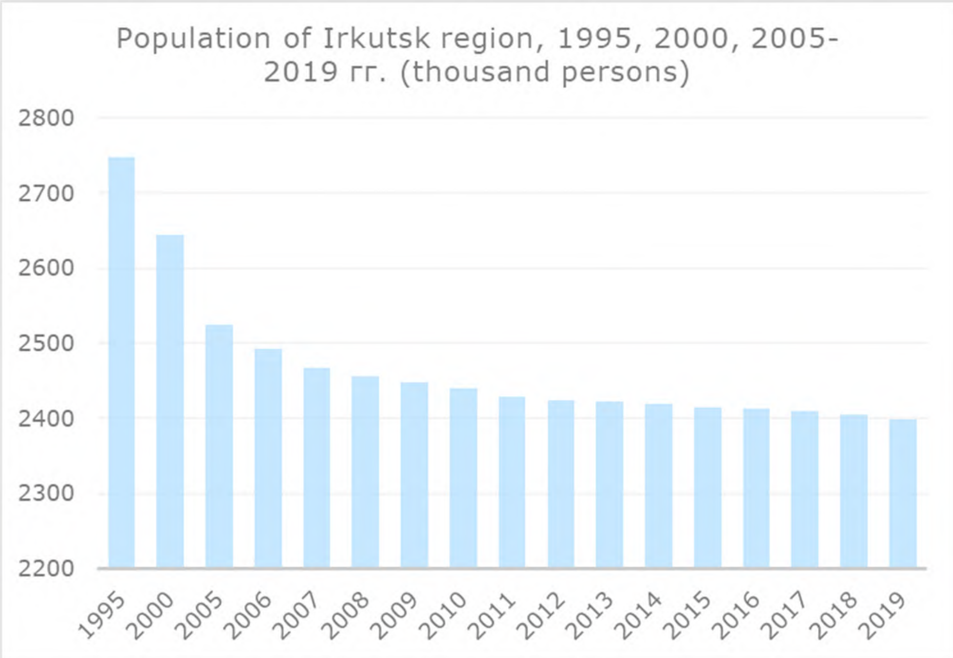

Figure 8.1: Irkutsk Region population, 1995, 2000, 2005-2019 (thousand)[140]

There are no cities with a population over one million in Irkutsk Region. According Irkutskstat, as of 1 January 2019 the population numbers of the largest cities of the region were as follows:

- Irkutsk: 623,479 persons (decrease by 257 compared to 2017 records);
- Bratsk: 227,467 (decrease by 4,135);
- Angarsk: 225,489 (decrease by 885);
- Ust-Ilimsk: 81,081 (decrease by 1,374);
- Usolje-Sibirskoye: 76,846 (decrease by 1,143);
- Cheremkhovo: 50,586 (decrease by 644);
- Shelekhov: 48,460 (decrease by 852);
- Tulun: 41,279 (decrease by 392);
- Ust-Kut: 41,149 (decrease by 1,123)

On average, there is a prevalence of urban population in Irkutsk Region (78.7%); its share is above the national average for the Russian Federation (74.6%). The trend for slow growth of rural population in Irkutsk Region has been reported in the last several years (Table 8.1).

As of January 2019, urban population of Irkutsk region is 1,888,024 (78.7%), while rural population is 509,739 (21.3%). The share of urban population slightly decreased since 2017 by 0.2 percent.

Table 8.1: Urban population percentage of the total population, as of 1 January (%)

	2011	2012	2013	2014	2015	2016	2017	2018	2019
Russian Federation	73.8	73.9	74.0	74.2	74.0	74.1	74.3	74.4	74.6
Irkutsk Region	79.6	79.6	79.5	79.4	78.9	79	78.9	78.8	78.7

[140] Irkutskstat, 2019, http://irkutskstat.gks.ru/wps/wcm/connect/rosstat_ts/irkutskstat/resources/09dc69804e42364fb64ef6395b460ee0/post_nasel_obl_2019.html

Source: Rosstat, 2019, Irkutskstat, 2019[141] [142]

In 2015, the life expectancy rate for the population of Irkutsk Region was in general significantly lower (by 4.02 years) than life expectancy rate for the overall population in the country (Table 8.2).

In 2016 the gap between life expectancy of Irkutsk Region population and population of the Russian Federation reduced to 3.7 years. In 2017 the difference further decreased to 2.71 years. The life expectancy trends are increasing both in Russia in general and in Irkutsk Region.

Table 8.2: Life expectancy in Irkutsk Region and the Russian Federation (distribution by gender and type of settlement)

	Both genders	Men	Women	Both genders	Men	Women	Both genders	Men	Women
Year	**Total population**			**Urban population**			**Rural population**		
2011	65.93	59.59	72.5	66.52	59.99	73.08	63.69	58.14	70.14
2012	66.32	59.92	72.92	66.85	60.24	73.46	64.25	58.69	70.78
2013	66.72	60.32	73.28	67.3	60.78	73.75	64.53	58.74	71.39
2014	66.87	60.53	73.36	67.29	60.86	73.63	65.22	59.3	72.21
2015	67.37	61.31	73.48	67.96	61.79	73.93	65.11	59.53	71.72
2016	68.2	62.19	74.18	68.73	62.49	74.72	66.16	61.09	71.97
2017	69.19	63.24	75.0	69.76	63.71	75.39	67.03	61.54	73.43
Life Expectancy in the Russian Federation									
2011	69.83	64.04	75.61	70.51	64.67	76.10	67.99	62.40	74.21
2012	70.24	64.56	75.86	70.83	65.10	76.27	68.61	63.12	74.66
2013	70.76	65.13	76.30	71.33	65.64	76.70	69.18	63.75	75.13
2014	70.93	65.29	76.47	71.44	65.75	76.83	69.49	64.07	75.43
2015	71.39	65.92	76.71	71.91	66.38	77.09	69.90	64.67	75.59
2016	71.9	66.5	77.1	72.35	66.91	77.38	70.50	65.36	76.07
2017	72.7	67.5	77.6[143]	73.16	67.90	77.96	71.38	66.43	76.66

Source: Rosstat, 2016, Rosstat, 2018

As of 2016, Irkutsk Region demonstrated a decline trend in absolute natural population growth along with a steady negative migration tendency. In 2012 researcher Rybakovsky established[144], "that migration losses of the region are partially compensated at the account of the "donor" regions in the periphery of Russia; nevertheless, the net migration rate has been negative for a longer period and even increased over past five years" [*according to the previous publications of the research materials – note by Ramboll*].

Table 8.3: Components of population changes in Irkutsk Region

	2012	2013	2014	2015	2016	2017	2018
Natural growth (+), decline (-)	4916	4875	3729	4001	3247	1221	-522
Net migration (+, -)	-7245	-8553	-7164	-6114	-7146	-5927	-5910

[141] http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/ru/statistics/population/demography/#

[142] http://irkutskstat.gks.ru/wps/wcm/connect/rosstat_ts/irkutskstat/resources/09dc69804e42364fb64ef6395b460ee0/post_nasel_obl_2019.html

[143] http://www.gks.ru/free_doc/doc_2018/year/year18.pdf

[144] E.V. Goltsova Young people migratory behaviour in Irkutsk region // Sotsiologicheskie issledovaniya (Sociological Studies). 2017. No. 5. pp. 103-109.

Source: Rosstat, 2017, Irkutskstat, 2018[145] [146] [147]

The population decrease trend continued in 2018. It should be noted that the natural growth had been positive since 2012; however, in 2018 it significantly diminished and turned negative. Thereat, 2017 and 2018 net migration rate values remained at the same negative level although demonstrating a positive compared to 2016 rate values.

Table 8.4: Natural population growth in Irkutsk Region, Siberian Federal District and the Russian Federation

Territory	2014	2015	2016	2017	2018	Growth/decline rate between 2018 and 2017, %
Birth rate						
Irkutsk Region	15.3	15.4	14.7	13.3	12.9	-3.0
Siberian Federal District	14.7	14.4	13.8	12.3	11.4	-7.3
Russian Federation	13.3	13.3	12.9	11.5	10.9	-5.2
Death rate						
Irkutsk Region	13.7	13.7	13.3	12.9	12.9	0.0
Siberian Federal District	13.3	13.2	13.8	12.7	12.9	1.6
Russian Federation	13.1	13.1	12.9	12.4	12.4	0.0
Natural growth						
Irkutsk Region	+1.6	+1.7	+1.4	+0.4	0.0	↓
Siberian Federal District	+1.4	+1.2	+0.8	-0.4	-1.5	↓
Russian Federation	+0.2	+0.2	0	-0.9	-1.5	↓

Source: Rospotrebnadzor[148] [149] [150]

Another researcher, K.V. Grigorichev, found out that the majority of emigrants from Irkutsk Region are of a young working age (under 40 years)[151].

A social research conducted by Goltsova (assistant professor of the Social Philosophy and Sociology Department, Irkutsk State University) explains the motivation of the migratory behaviour and reveals that 36.4% of the residents of Irkutsk Region from the age group between 17 to 34 years (young adults) plan to leave the region, of which 9.4% demonstrated a desire to leave the country. In the study, 5% of respondents (interviewed with the use of a sampling stratified by age and gender) expressed a desire to move to another settlement within Irkutsk Region.

According to Goltsova, the ones most inclined to migrate are young scientists (transnational out-migration), students (intra-national migration), and recent university graduates (transnational out-migration). The correlation between poor living conditions (accommodation in dormitories or lack of own housing) and a wish to relocate is also evident from the study. Potential migrants name Germany, China, Thailand, Moscow, and Saint Petersburg as their "target locations".

It is worth mentioning that among "non-migrants", i.e. those who expressed no desire to leave Irkutsk Region, 9.7% of the interviewees stated the "lack of finance for relocation" as the reason for their

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[145] http://irkutskstat.gks.ru/wps/wcm/connect/rosstat_ts/irkutskstat/resources/61d81e804cf380ba9038d00d9d5f7b1a/est_dvig_2017.html

[146] http://irkutskstat.gks.ru/wps/wcm/connect/rosstat_ts/irkutskstat/resources/accf20804e426ee78a04da395b460ee0/dinam_tabl_migr2018.html

[147] http://irkutskstat.gks.ru/wps/wcm/connect/rosstat_ts/irkutskstat/resources/161028804e42775f8b38db395b460ee0/komp_izm_2018.html

[148] State Report of Rospotrebnadzor "On sanitary and epidemiological welfare of the population in Irkutsk Region, 2018"

[149] Rosstat data (Statistical Bulletin "Natural population change in the Russian Federation, 2017"), 2016 year data - Rosstat current information for January-December 2016

[151] *Ibid.*

migratory behaviour. Therefore, it can be assumed that this group of respondents might change their opinion about preferred place of residence and move to the group of potential "migrants" if their economic situation improves.

According to studies published by Zibrov[152], areas with the greatest out-migration flows are located in the north of the Region (Bodaibo, Bratsk, Ust-Ilimsk and Ust-Kut).

The shares of male and female population of Irkutsk Region (Figure 8.2 below) have remained virtually unchanged during past six years.

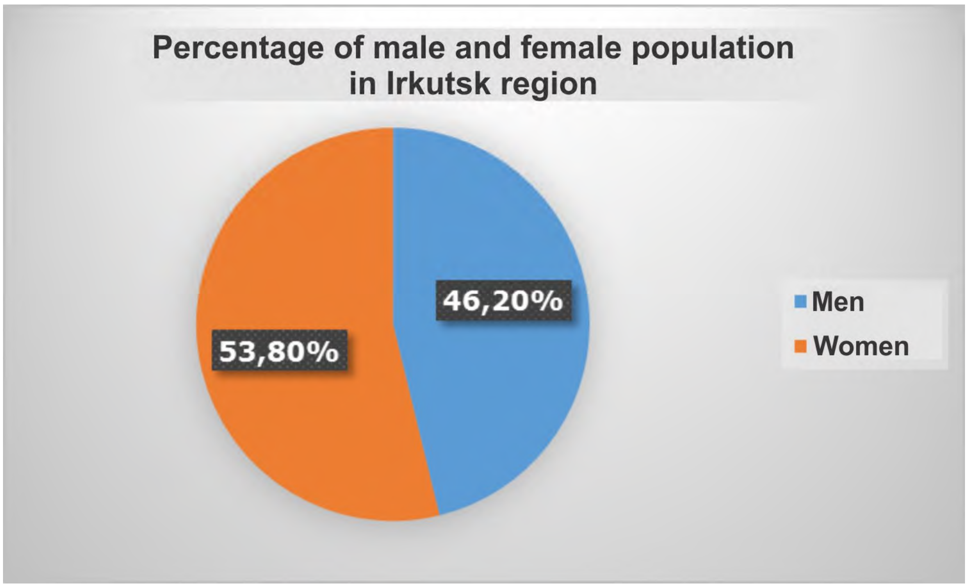

Figure 8.2: Gender profile of Irkutsk Region population, 2018 (Source: Irkutskstat, 2019)

The proportions of male and female population in Irkutsk Region are the same as in Russia in general (54% of women and 46% of men).

The respective percentage ratio in Irkutsk Region is 46.2% of male and 53.8% of female, as of 2018[153].

8.3.2 *Economic situation*

The key sectors of the regional economy are:

- extractive industry;
- manufacturing;
- logistics;
- wholesale and retail trade;
  motor vehicles repair.

The gross regional product structure of Irkutsk Region in 2016-2017 is shown in Figure 8.3 below.

[152] D.A. Zibrov. Labour migration in region with a lack of workforce (Irkutsk Region case study) // Ekonomika Truda (Labour Economics). — 2016. – Vol. 3. — No. 3. - PP. 261-278. — doi: 10.18334/et.3.3.36095

[153] http://irkutskstat.gks.ru/wps/wcm/connect/rosstat_ts/irkutskstat/resources/c966d4004db57f72871eef3107d9bf7d/chisl2018.html

Figure 8.3: Irkutsk Region gross regional product, 2016-2017 (Irkutskstat, 2019)

Extractive industry is an important element in the Region's gross product which demonstrates both absolute and relative growth (26.2% in 2016, 27.2% in 2017). Back in 2004, extractive industry accounted for 3.1% of the regional product, by 2010 its share increased to 7.5%, and by 2015 boosted to 24.6%.

The increasing importance of extractive sector is, *inter alia*, directly linked to the INK operations in Ust-Kut District. In particular, in 2016 production volumes of INK Group increased[154] by 39% to 7.8 million tons as compared to the same period in 2015. The same trend is also reported for production output. Significance of INK projects is recognized by the Regional Government and the Governor[155] who in particular noted that the Company's projects in Ust-Kut District will help to "accelerate socio-economic development of the Region".

The share of manufacturing industry has been declining since year 2007 when a peak of output was recorded (refer to Figure 8.4 below).

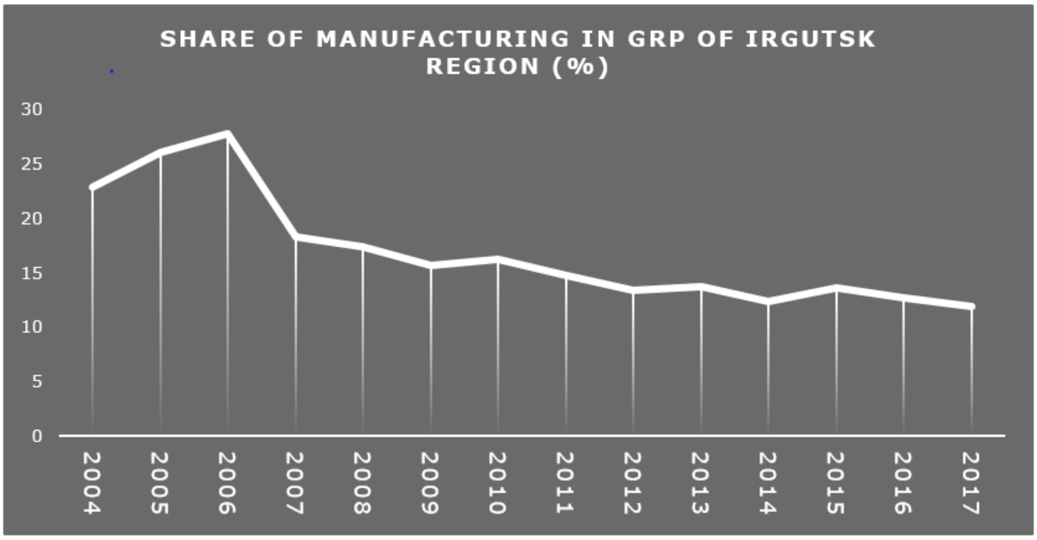

Figure 8.4: Manufacturing industry share in the Irkutsk Region GRP (Irkutskstat, 2019)

[154] Ministry of Economic Development of Irkutsk Region. Explanatory memorandum on socio-economic performance of Irkutsk Region during 12 months of 2016.

[155] http://irkobl.ru/news/46270/?sphrase_id=1534419

The above-mentioned study by Goltsova also contains the data on the perception the young professionals and students have to different aspects of life in Irkutsk Region, including economic and work environment (Figure 8.5). The diagram below clearly shows the low score of economic and employment aspects of life in Irkutsk Region, along with political and legal aspects.

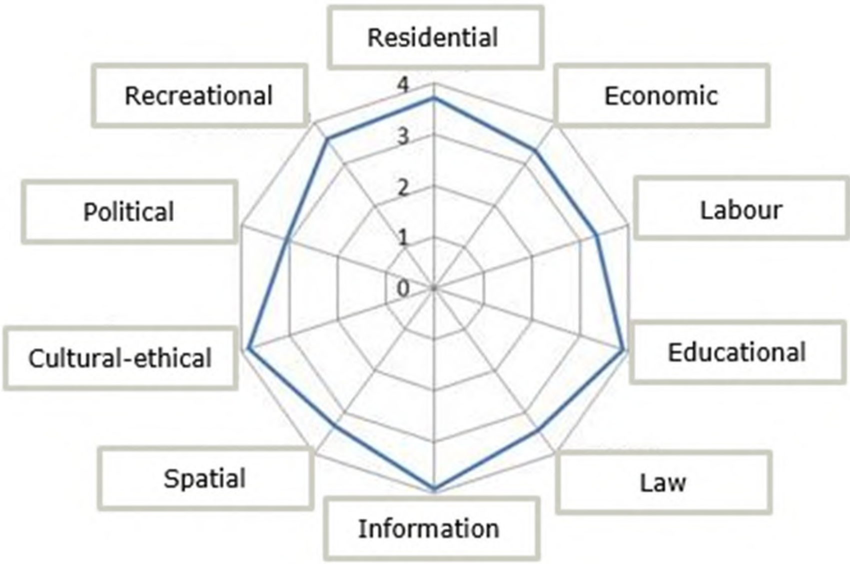

Figure 8.5: Evaluation of living environment quality at the place of residence (scale from 1 to 5)

The results of the study reflect the attitudes of young people at the end of 2016 which can be explained by several factors that are listed and described below.

Declining household incomes in real terms

Real disposable incomes in Irkutsk Region have been declining since 2014, like in the whole Siberian Federal District and Russia in general.

Table 8.5: Real household income (per cent of the previous year)

	2010	2011	2012	2013	2014	2015	2016	2017
Irkutsk Region	100.8	96.8	104.8	102.2	97.5	97.2	91.1	96.9
Siberian Federal District	102.9	102.1	105.2	103.8	98.2	96.2	94.4	97.8
Russian Federation	105.4	101.2	105.8	104.8	99.5	95.9	94.4	98.7

Source: Federal State Statistics Service, 2019

In 2018, an average income per capita for Irkutsk Region residents was estimated to be 22,743 roubles per month. According to the press service of Irkutskstat, in real terms this means a reduction by 1.4% compared to year 2017[156].

Inflation

At the end of year 2017, inflation (consumer price index) in Irkutsk Region reportedly decreased by 2.9% compared to year 2016. Inflation rate reported by Irkutsk Region in 2017 was by 0.2% higher than in Russia in general and by 0.7% higher than in the Siberian Federal District.

Table 8.6: Consumer price index (December, per cent of previous year), 2010-2017

	2010	2011	2012	2013	2014	2015	2016	2017
Russian Federation	108.8	106.1	106.6	106.5	111.4	112.9	105.4	102.5
Siberian Federal District	107.9	106.3	106.7	106.1	110.8	111.6	105.0	102.0
Irkutsk Region	109.5	107.4	106.9	105.1	110.8	112.2	106.7	102.7

Source: Federal State Statistics Service, 2019 [157]

[156] https://irkutsk.news/novosti/2019-02-12/94965-irkutskstat-srednedushevoi-dohod-naselenija-priangarja-sokratilsja-v-2018-godu-na-1.html

[157] http://www.gks.ru/bgd/regl/b18_14p/Main.htm

Retail turnover

In 2016, retail turnover increased by 6.4% as compared to the 2015 figures. This value is by 0.2% lower than the average for the Siberian Federal District and by 0.1% lower than the national average. An increase of 0.1% was reported for the retail turnover in Q1 2017 (against the corresponding period of 2016), however, without any positive development against the performance reported in 2015.

In 2017, retail turnover in Irkutsk Region grew by 5.4% compared to year 2016, and was by 0.3% higher than in Siberian Federal District and by 0.4% higher than Russia's average value.

Table 8.7: Retail turnover (actual price level, million roubles)

	2010	2011	2012	2013	2014	2015	2016	2017	2018
RF	16512047	19104336	21394526	23685914	26356237	27526793	28240885	29745536	31579372
SiFD	1768915	2064138	2330901	2555024	2696933	2740454	2797008	2918494	2738914
Irkutsk Region	197272	225846	249988	266526	285856	290845	305112	321972	348025

Source: Federal State Statistics Service, 2019 [158]

The growth of retail turnover slowed down during 2014-2017; however, in 2018 the indicator's value returned to the median growth trend of 2010-2018 period (Figure 8.6). Further monitoring is required to verify that the indicator's slowdown has been overcome.

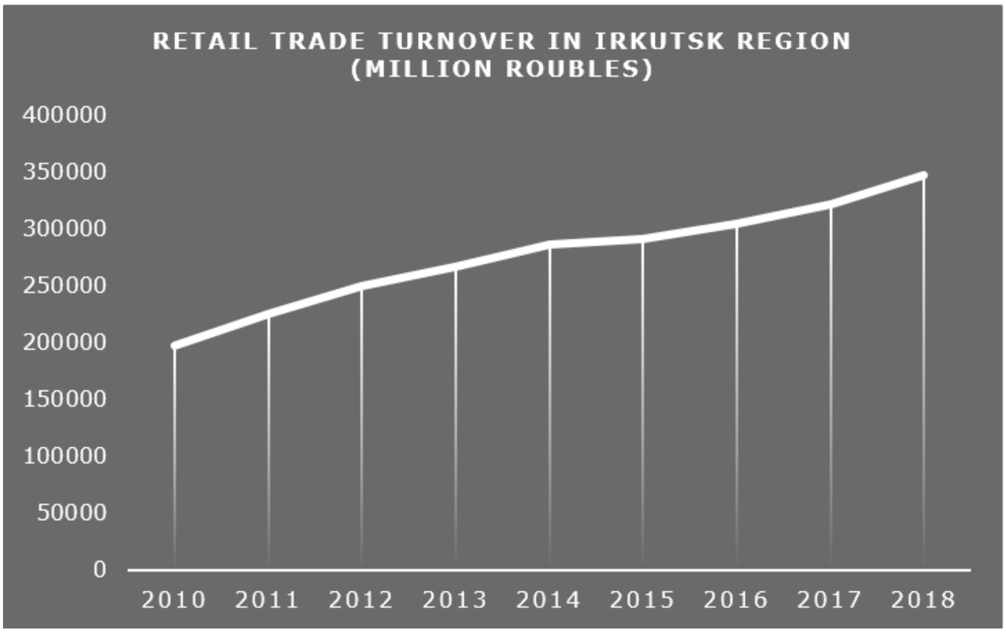

Figure 8.6: Retail turnover in Irkutsk Region (million roubles)

Conclusions

The aforementioned factors illustrate a steady decline of living standards in Irkutsk Region until year 2017, which, *inter alia*, affects the views and attitudes of the young people towards their future in the region, and their tendency to move to another regions of Russia (including Moscow), or abroad. Out-migration of young people, particularly educated and active young professionals, has an adverse effect for the human capital in Irkutsk Region including Ust-Kut district[159]. According to Zibrov studies, emigration of young people from the northern areas of Irkutsk Region and particularly from Ust-Kut district may be instigated by decline in production, closing down of industries, reduction of personal

[158] http://www.gks.ru/bgd/regl/b18_14p/Main.htm

[159] D.A. Zibrov. Labour migration in region with a lack of workforce (Irkutsk Region case study) // Ekonomika Truda (Labour Economics). — 2016. – Vol. 3. — No. 3. - PP. 261-278. — doi: 10.18334/et.3.3.36095

income levels in the settings of growing utility charges and consumer prices, severe climate and lack of education opportunities.

At this background, the extractive sector has been steadily growing. It demonstrates growth despite a decline/slowdown and lack of stability in other sectors of economy (construction, retail trade, manufacturing). These data indicate the significance of INK's role in the economy at the Regional level, which is recognised by the Regional Government and the Governor.

8.3.3 *Epidemiological situation*

According to the Rospotrebnadzor State Report 2017, Irkutsk Region was identified as a "risk territory" of Russia in terms of primary incidence of the following categories of diseases: diseases of the musculoskeletal system (incidence by 2.4 higher than Russia's average), endocrine disorders, diseases of blood and blood-forming organs, infectious and infestations (1.4 times higher incidence rate)[160]. Among children, diseases with incidence rates higher than Russia's average are respiratory diseases, mental and behavioural disorders, endocrine disorders, and diseases of digestive system[161]. The group of diseases associated with the highest morbidity among the children is the group of respiratory diseases. This group of diseases is also spread among the adolescent population. Increasing prevalence rate of respiratory diseases is also reported among the adult population of the region.

The general region morbidity rates are shown in Table 8.8.

Table 8.8: General population morbidity rates 2017, first diagnosed diseases split out by the main groups

Group of diseases as per ICD-10	Irkutsk Region	RF*	SiFD*	IR/RF
Total	**98181.7**	**77914.7**	**84975.0**	**1.3**
Certain infections and infestations	3898.7	2733.0	3116.8	1.4
Neoplasms	1401.7	1190.4	1361.4	1.2
Diseases of the blood	621.9	449.0	507.9	1.4
Endocrine diseases	1988.8	1396.5	1875.7	1.4
Mental and behavioural disorders	257.4	416.9	551.6	0.6
Diseases of the nervous system	1925.6	1501.4	1808.9	1.3
Diseases of the eye	4184.6	3161.1	3743.8	1.3
Diseases of the ear	2709.6	2587.9	2705.1	1.0
Diseases of the circulatory system	3425.6	3206.0	3677.2	1.1
Diseases of the respiratory system	45204.6	35356.6	35806.0	1.3
Disease of the digestive system	4230.3	3396.2	4674.6	1.2
Diseases of the skin and subcutaneous tissue	3781.1	4098.9	3713.8	0.9
Diseases of the musculoskeletal system	7126.9	2950.3	4029.7	2.4
Diseases of the genitourinary system	5226.9	4484.0	5449.7	1.2
Pregnancy, childbirth and the puerperium	3379.4	6072.5	6553.6	0.6
Congenital anomalies (development defects)	257.4	197.4	226.0	1.3
Injury, poisoning and certain other consequences of external causes	10409.4	8818.8	9315.0	1.2

Source: Ministry of Health of the Russian Federation[162]

The reported first diagnosed morbidity rates in Irkutsk Region have been higher than average in Russia and in Siberian Federal District during multiple consecutive years (Table 8.9).

[160] State Report of Rospotrebnadzor "On sanitary and epidemiological welfare of the population in Irkutsk Region, 2017"

[161] Children morbidity rates 2016, first diagnosed diseases split out by the main groups

[162] https://www.rosminzdrav.ru/ministry/61/22/stranitsa-979/statisticheskie-i-informatsionnye-materialy/statisticheskiy-sbornik-2017-god

Table 8.9: Morbidity rate per 1000 residents (first diagnosed)

	2005	2010	2011	2012	2013	2014	2015	2016	2017
Russian Federation	743.7	780.0	796.9	793.9	799.4	787.1	778.2	785.3	778.9
Siberian Federal District	782.9	818.0	845.3	846.1	869.1	860.9	848.0	850.5	850.6
Irkutsk Region	833.9	907.2	920.5	920.6	946.3	955.4	952.2	1000.6	980.9

Source: Federal State Statistics Service, 2019 [163]

In 2017, the rate of first diagnosed cases of children population aged 0-14 dropped by 4.4% compared to the previous year – to 204,061.0 cases per 100,000 of children.

In Irkutsk Region there is a negative tendency of the incidence of chronic alcoholism and related medical and social effects. In 2016, the regional incidence rate of alcohol poisoning exceeded the national level by 2.1 times (1.8 times in 2015).

In terms of epidemiological situation, special attention shall be paid to HIV/AIDS incidence in Irkutsk Region. In 2017 media described the situation as "epidemic"[164], as the region occupied third line in the country's rating for HIV incidence[165]. However, the reported number of newly diagnosed HIV/AIDS cases started to decline by 2019[166].

According to the Medical Director of the AIDS Centre, in 2018 the number of newly diagnosed HIV cases decreased by 12.7% as a result of the implemented comprehensive disease control efforts: 3,414 cases reported in year 2018 (141.7 cases per 100,000 residents); 3,910 cases reported in year 2017 (162.3 per 100,000 residents).

Nevertheless, the incidence rate in Irkutsk Region was still twice higher than an average rate for the Russian Federation (69.0 per 100,000 residents) and by 1.1 times higher than in Siberian Federal District (121.6 per 100,000 residents).

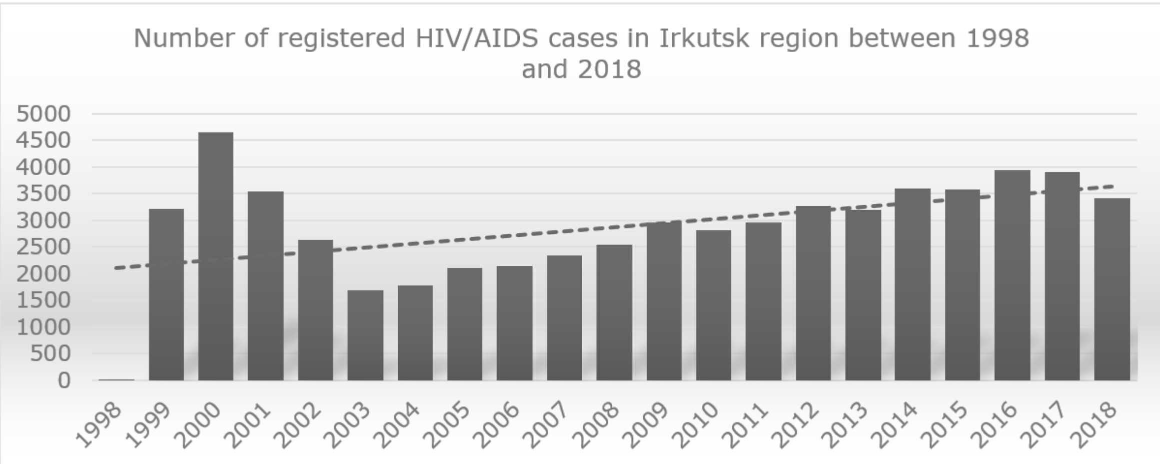

Figure 8.7: Identified HIV/AIDS cases in Irkutsk Region, 1998-2018 (absolute numbers) (Rospotrebnadzor, 2019)

By January 2019, the number of persons living with HIV was 28,808 (1,195.9 per 100,000 residents), including 940 children under the age of 14.

Similarly to the previous years' reports, in 2019 among people living with HIV prevails the residents of age group of 30-39 y.o. (43.8%) and male gender (55.2%).

Therefore, considering that the average age of the employees of the Company (38 years, as of 2017) falls within the age group at risk in relation to HIV diagnosis, as well as the fact, that men (the main

[163] http://www.gks.ru/bgd/regl/b18_14p/Main.htm

[164] http://vesti.irk.ru/news/medicine/182626/

[165] http://irkutskmedia.ru/news/506343/

[166] https://www.irk.ru/news/20190223/aids/

gender group among INK employees and contractors) are more likely to be infected, the Company shall pay special attention to the issue of HIV/AIDS in the Region and take specific measures to prevent spread of infection among Project personnel. This issue is covered in the respective thematic Sections of Chapter 10 and taken into account at development of mitigation measures.

The main ways of HIV contracting reported in 2018 include:

- sexual (heterogeneous): 81.5% (in 2017 – 76.3%; in 2016 – 75.4%; in 2015 – 78%);
- parenteral, associated with use of non-sterile appliances for injection of drugs: about 16% (in 2017 – 22.5%; in 2016 – 23.1%; in 2015 – 20.5%);
- congenital: 2% at most (same as in 2017).

The death toll over the HIV epidemic period is 14,888 including 39 children at the age of 0-14 years. In 2018 AIDS, was diagnosed for 748 people living with HIV (604 in 2017).

In 2018, 14,374 HIV-infected persons received antiviral treatment (60.4% of the total number of people who needed such treatment). In 2018, 21,884 persons living with HIV passed medical checks including viral load testing of 99.3% of patients subject to such testing, and immune status testing of 98.4% of patients; these values are higher than in previous years. In 2018, coverage of the medical checks of HIV-infected patients increased by 4.4 %. Coverage of the general population HIV-screening grew by 10%. The supply of anti-retroviral medical preparations for preventive care and treatment of persons living with HIV was fully ensured.

No cases of accidental HIV infection through transfusion or on-the-job infection of medical personnel have been reported in the Region.[167]

8.4 Socio-Economic Situation in Ust-Kut District

8.4.1 Demographic situation

By January 2019, the number of permanent population in Ust-Kut District (Ust-Kut Municipality) was 48,348 including 43,421 urban residents (90%) and 4,927 persons living in rural settlements (10%). The district population is declining: in 2017, 49,726 people resided in Ust-Kut District.

Apart from Ust-Kut City, there are two other urban settlements in the district - Zvezdny and Yantal. Other settlements are of rural type (Table 8.10).

Table 8.10: Permanent population of settlements within Ust-Kut Municipal District as of 1st of January 2019

Administrative unit	Total population number		including:	
	2017	2019	urban	rural
Ust-Kut District	**49726**	**48348**	**43421**	**4927**
Ust-Kut urban settlement	42333	41204	41149	55
Ust-Kut city	42272	41149	41149	-
Zvezdny urban settlement	854	801	801	-
Zvezdny	854	801	801	-
Yantal urban settlement	1543	1471	1471	-
Yantal	1543	1471	1471	-
Richei rural settlement	1287	1233	-	1233
Verkhnemarkovo rural settlement	1772	1729	-	1729
Niya rural settlement	1004	1013	-	1013
Podymakhino rural settlement	772	745	-	745
Inter-settlement territories of Ust-Kut Municipal District	161	152	-	152

Source: Irkutskstat, 2019[168]

[167] State Report of Rospotrebnadzor "On sanitary and epidemiological welfare of the population in Irkutsk Region, 2018

[168] http://irkutskstat.gks.ru/wps/wcm/connect/rosstat_ts/irkutskstat/ru/statistics/population/7431a180411b6c67bb10bfa3e1dde74c

In the recent years there is a tendency for decline of the number of residents of Ust-Kut District (Table 8.11).

Table 8.11: Basic demographic characteristics of Ust-Kut District

Description	Ust-Kut District					
	2013	2014	2015	2016	2017	2018
Population number (start of year), including:	**52303**	**51408**	**50718**	**50088**	**49726**	**48992**
Women	27183	26674	26311	25979	25767	25369
Men	25120	24734	24407	24109	23959	23623
People born	685	636	621	657	607	577
People died	731	766	711	713	710	708
Natural growth/decline, persons	-46	-130	-90	-56	-103	-131
Out-migrants, persons	1720	1476	1337	1290	1429	1438
In-migrants, persons	824	889	759	993	798	925
Net migration, persons	-896	-587	-578	-297	-631	-513
Population number by age groups at the start of year	52303	51408	50718	50088	49726	48992
Under working age	9845	11231	11387	11396	11435	11357
Working age	33022	29472	28601	27734	27187	26410
Over working age	9436	10705	10730	10958	11104	11225

Source: Ust-Kut District Administration, 2017; Irkutskstat, 2019 [169]

The district population decline is substantiated, *inter alia*, by the out-migration processes. The 2017 and 2018 data indicate the continued growth of migration losses. The number of district population in employable age is dropping, while the number of dependent persons (minors and retired persons) is steadily growing.

8.4.2 *Morbidity and epidemiological situation*

During the PreESIA consultations, representatives of Ust-Kut District Hospital (refer to Section 8.4.6.1 for more detail) and Deputy Head of the Ust-Kut branch of the federal budgetary healthcare institution Hygiene and Epidemiology Center in the Irkutsk Region informed Ramboll about the main health related issues and risks the local population is exposed to. According to the expert opinion and the data provided by Ust-Kut District Hospital, in 2017 the most pressing issues were related to respiratory diseases, hepatitis B/C, tuberculosis, oncology diseases, congenital defects, HIV/AIDS, hypertony (HBP) and diabetes. The data of 2017 on primary incidence of HIV and tuberculosis are summarised in Table 8.12.

Table 8.12: Primary HIV and tuberculosis incidence

	2013	2014	2015	2016
HIV incidence	40	36	31	40
Tuberculosis incidence	130	68	71	90

Source: Regional State Funded Healthcare Facility «Ust-Kut District Hospital», 2017[170]

At the consultations with the Head of Ust-Kut District Hospital sexual infection was mentioned as the main way of HIV transmission.

Specialists of the Hygiene and Epidemiology Center in the Irkutsk Region and Ust-Kut District Hospital interviewed in 2017 highlighted alcoholism and alcoholic psychosis as a significant issue for the district healthcare system, with respective numbers of registered cases 226 and 119 (451.2 and 237.6 cases per 100,000 persons). Drug abuse is also topical issue: it was mentioned that while there are 119 registered patients (333.4 cases per 100,000 persons), the 'real life' incidence is higher.

During consultations in 2019, the Head of the Hospital did not mention alcoholism and substance addiction among the most pressing problems in Ust-Kut. However, a Rospotrebnadzor report indicates a higher incidence of the these diseases in Ust-Kut District compared to other areas of Irkutsk Region (Tables 8.13 and 8.14).

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[169] http://irkutskstat.gks.ru/wps/wcm/connect/rosstat_ts/irkutskstat/ru/statistics/population/4f6fb580454b789aa13bffc4d78fa45b

[170] Ust-Kut District Hospital letter of 29.05.2017 No.1197 to the General Director of Ramboll Environ CIS I.N. Senchenya

Table 8.13: Municipalities with the highest first time diagnosed incidence of chronic alcoholism and alcoholic psychosis, 2017

Municipalities	Incidence per 100,000 persons	Municipality to region level ratio
Ust-Kut District	94.5	1.1
Irkutsk Region	85.2	1.0

Source: Rospotrebnadzor, 2019[171]

Table 8.14: Incidence of acute drug poisoning in Irkutsk Region municipalities, 2013-2018

	2013	2014	2015	2016	2017	2018
Irkutsk Region	1160	1828	955	457	306	252
Ust-Kut District	3	21	10	6	2	4

Source: Rospotrebnadzor, 2019[172]

In addition, the incidence of flu is also considered an important issue according to 2017 data; flu vaccination covers around 40% of the local population. Vaccination against pneumococcus and encephalitis is also provided by the hospital when possible; however, the District is deemed not to be an encephalitis endemic area. Among the tick-borne diseases the local physicians are mainly concerned about Lyme borelliosis, which was emphasized during consultations in both 2017 and 2019. Head of Ust-Kut District Hospital stressed that the main problems in the district are related to oncology and tuberculosis. Caries and thyroid diseases were mentioned as a significant issue, due to poor quality drinking water in the city.

Structure of mortality causes in Ust-Kut district is demonstrated in Table 8.15.

Table 8.15: Mortality structure in Ust-Kut District and City

Cause of death	Number of deaths					Death rate per 100,000 persons				
	2013	2014	2015	2016	2017*	2013	2014	2015	2016	2017*
Total deaths	731	766	711	713	165	1397.6	1478.4	1393.9	1431.5	327.4
of which										
infectious and parasitic diseases including	35	27	29	37	11	66.9	52.5	51.3	73.9	21.9
tuberculosis	27	22	22	24	8	51.6	42.8	43.4	47.9	15.9
neoplasms	80	103	81	117	26	152.9	200.4	159.7	233.6	51.9
Diseases of the circulatory system	370	372	349	318	72	707.4	723.6	688.1	634.9	143.7
Diseases of the respiratory system	55	71	16	15	2	105.2	138.1	31.5	29.9	3.9
Disease of the digestive system	55	42	63	24	3	105.2	81.7	124.2	47.9	5.9
external causes including:	114	105	104	109	32	217.9	204.2	205.1	217.6	63.9
road accidents (all kinds)	20	16	18	17	8	38.2	31.1	35.5	33.9	15.9
suicide	27	21	20	22	6	51.6	40.8	39.4	43.9	11.9
homicide	19	23	16	15	1	36.3	44.7	31.5	29.9	1.9
other	22	40	65	97	18	42.1	77.8	128.2	193.7	35.9
* Data 2017 is not conclusive										

Source: RSFHF «Ust-Kut District Hospital», 2017

Child morbidity

According to data received from the Ust-Kut District Hospital, diseases of the respiratory system prevail in the overall children morbidity structure in Ust-Kut City and District. Other significant groups of

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[171] Ibid.

[172] State Report of Rospotrebnadzor "On sanitary and epidemiological welfare of the population in Irkutsk Region, 2018"

diseases are infections, diseases of the eye, ear, skin and subcutaneous tissue. The incidence of all above diseases increased over the period 2016-2018.

Table 8.16: Overall children morbidity, per 1,000 residents in Ust-Kut City and District, 2018

Description	2016	2017	2018
Total	1652.8	1461.2	1931.5
including:			
Infectious diseases	64.49	55.4	86.6
Neoplasms	5.3	4.3	4.8
Diseases of the blood and blood-forming organs	10.3	3.9	6.6
Endocrine diseases	12.4	11.1	34.7
Mental disorders	45.1	40.8	24.6
Diseases of the nervous system	31.9	8.7	28.5
Diseases of the eye	91.7	45.3	144.8
Diseases of the ear	46.2	43.6	66
Diseases of the circulatory system	1.1	1.5	0.9
Diseases of the respiratory system	1160.9	1079.4	1283.1
Disease of the digestive system	30.3	10.1	26.2
Diseases of the skin and subcutaneous tissue	25.9	62.7	88.8
Diseases of the musculoskeletal system	27.5	39.1	71.4
Diseases of the genitourinary system	15.89	9.6	16
Perinatal diseases	26.9	N/A	N/A
Congenital anomalies	23.4	21.2	12.6
Injury and poisoning	33.3	24.1	35.4

Source: RSFHF «Ust-Kut District Hospital», 2019

Adolescent morbidity

Respiratory diseases dominate in the adolescent morbidity structure. Other significant groups are diseases of the nervous system, eye, musculoskeletal system, injuries and poisoning. The incidence of all above diseases increased over the period 2016-2018.

Table 8.17: Overall adolescent morbidity, per 1,000 residents in Ust-Kut City and District, 2018

Description	2016	2017	2018
Total	1508.7	1543	2128.6
including:			
Infectious diseases	23	7.3	26.7
Neoplasms	5.6	5.6	3.2
Diseases of the blood and blood-forming organs	7.3	4.5	5.9
Endocrine diseases	38.2	20.3	15.2
Mental disorders	107.4	73.5	59.4
Diseases of the nervous system	34.3	60.5	113.8
Diseases of the eye	255.2	194.5	407.6
Diseases of the ear	26.4	35.6	58.8
Diseases of the circulatory system	5.1	7.3	7.6
Diseases of the respiratory system	682.4	719	870.8
Disease of the digestive system	86	40.7	56.7
Diseases of the skin and subcutaneous tissue	20.8	20.3	69.7
Diseases of the musculoskeletal system	56.8	200.7	251.7
Diseases of the genitourinary system	60.7	56.6	63.2
Pregnancy, childbirth and the puerperium	7.9	N/A	N/A
Congenital anomalies	20.8	19.7	7.6
Injury and poisoning	70.8	75	110

Source: RSFHF «Ust-Kut District Hospital», 2019

Adult morbidity

The main classes of diseases (primary incidence) of adult population of Ust-Kut district include the following:

- Diseases of the respiratory system
- Diseases of the genitourinary system
- Diseases of the circulatory system

- Disease of the digestive system

Table 8.18: Overall adult morbidity, per 1,000 residents in Ust-Kut City and District, 2018

Description	2016	2017	2018
Total	1250.5	1095.4	1329
including:			
Infectious diseases	34.8	27	35.1
Neoplasms	57.4	61.8	69.2
Diseases of the blood and blood-forming organs	9.9	9.2	9.1
Endocrine diseases	78.9	80.3	85.3
Mental disorders	48.8	46.6	35.4
Diseases of the nervous system	18.2	19.9	28.4
Diseases of the eye	73.9	44.5	56.4
Diseases of the ear	13.1	16.9	21.3
Diseases of the circulatory system	286.5	302	361.5
Diseases of the respiratory system	88.1	123	168.2
Disease of the digestive system	113.2	98.6	111.4
Diseases of the skin and subcutaneous tissue	18.1	11.8	45.3
Diseases of the musculoskeletal system	188.5	75.5	93.5
Diseases of the genitourinary system	152.6	114.9	133.7
Pregnancy, childbirth and the puerperium	21.9	19.2	21.5
Congenital anomalies	0.4	0.4	0.5
Injury and poisoning	46.2	43.4	52.7

Source: RSFHF «Ust-Kut District Hospital», 2019

8.4.3 Activities of indigenous small-numbered peoples of the North in the area of Ust-Kut Municipality

According to different sources, there are 15 to 45 persons[173] of indigenous small-numbered peoples of the North within Ust-Kut Municipal District. All indigenous community memebers of the District are Evenks residing in Rychey, Verkhnemarkovo and Yantal rural municipalities.

Evenks are an ethnic community of the North, Siberia, and Far East. Currently, the territory of Evenks dwelling in Russia covers the area from the Sea of Okhotsk in the east to the Ob-Irtysh interfluve in the west, and from the Arctic Ocean in the north to the Amur river in the south. Aside from Ust-Kut District, Evenks also live in Irkutsk Region municipal districts of Katanga, Kachug, and in Kazachinsko-Lensky District.

Hunting and fishing are the traditional economic activities of Evenk people. Historically, farming has not been their typical occupation. Already by 1965, most Evenk people living in the north of Irkutsk Region adopted sedentary or semi-sedentary life. In particular, about 100 Evenks lived in the area that was administratively subordinated to Ust-Kut City (the villages of Tayura, Mikhnevo and Maksimov). According to research conducted by Tugolukov[174], by 1965 groups of Evenki hadn’t yet lost their ethnic identity and language.

According to information received in the course of consultations with the representatives of local administrations, Ust-Kut District doesn’t belong to the areas of high concentration of indigenous small-numbered peoples of the North (ISPN), and there are no associations, tribal enterprises, indigenous businesses, or areas of customary activities.

According to the representatives of local self-government, all Evenks living within Ust-Kut District have been assimilated by now. Many settlements that had been considered as the territories of residence of indigenous peoples, are now abandoned and abolished.

There are no dedicated support programmes and/or strategies at the municipal level for indigenous peoples’ culture and customary economic activities.

[173] O.G. Sedykh. Social support for indigenous small-numbered peoples in Irkutsk Region / O.G. Sedykh, K. D. Ilyina // Baikal Research Journal. — 2017. — Vol. 8, No. 2. — DOI: 10.17150/2411-6262.2017.8(2).34.

[174] V.A. Tugolukov, “Changes in economy and households of Evenki in Irkutsk Region over one and a half century”. Sovetskaya Etnografiya (Soviet Ethnography). 1965. – № 3. - PP. 12-24.

Dedicated programmes exist at the regional level: the Irkutsk Region Programme "Implementation of the National Policy in Irkutsk Region 2014-2020" including a sub-programme titled "Indigenous small-numbered peoples residing in Irkutsk Region 2018-2020", and the Irkutsk Region Programme "Protection of traditional habitats and lifestyles of indigenous small-numbered peoples of Irkutsk Region".

As ISPN within the Project area of influence and near the Project sites have abandoned their customary economic and cultural practices, the impact on the activities of indigenous peoples has been scoped out of the ESIA.

8.4.4 Economic situation

The main sectors of Ust-Kut city economy are:

- industrial production (manufacturing; generation and distribution of heat energy, water);
- forest logging;
- transport and communications;
- trade;
- services.

A steady growth of revenues from sale of goods, products, works and services are reported in Ust-Kut city: in 2013 the revenue was 11,497.4 million roubles, in 2015 – 21,645.6 million roubles, and by 2017 it increased to 27,646 million roubles. The revenue structure of Ust-Kut city economy is shown in Figure 8.8.

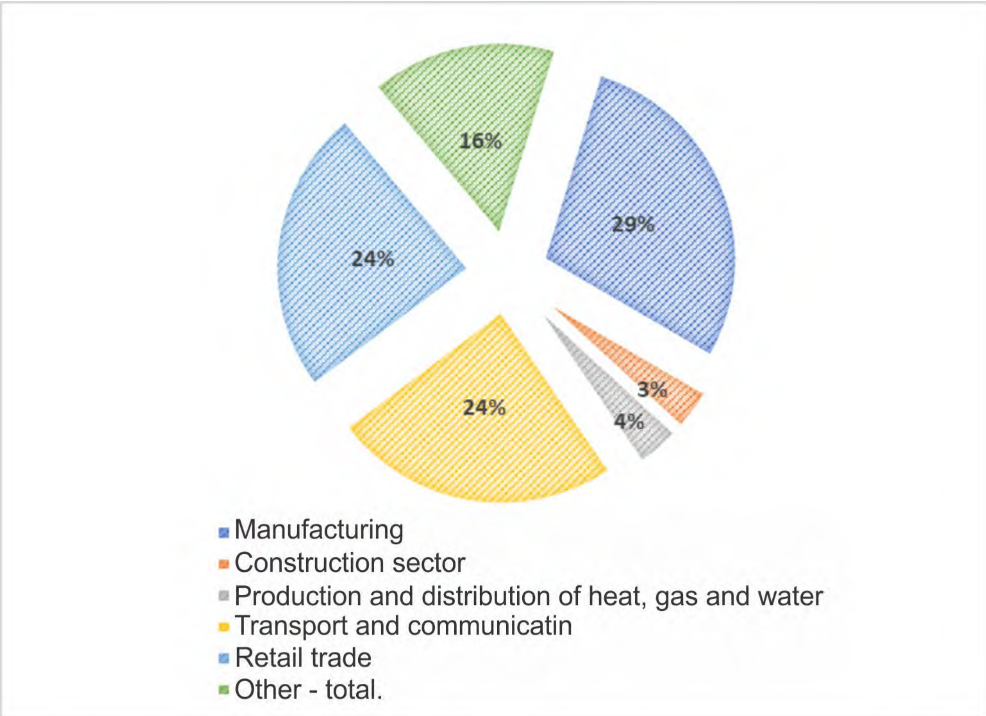


Figure 8.8: Share of economic sectors in the total revenue from sale of works and services (including small businesses) in Ust-Kut City as of 2017

The diagram shows that manufacturing industries and forestry account for a major part (29%) of total revenue. The shares of trade and transport/communication are also large (24% each).

Industrial production, particularly extractive industry, plays a significant role in the economy of Ust-Kut District. The industrial output has grown significantly over the recent years due to multiple investment projects being implemented in Ust-Kut District and City (refer to Section 8.4.4.6). The agricultural sector in the District is much less developed and demonstrates only minor growth (refer to Section 8.4.4.2).

Industrial sector, particularly extractive and manufacturing enterprises, is the key element of the District economy (refer to Figure 8.9). In 2018, total output of goods, works and services in the extractive sector was worth 242.3 billion roubles (increase by 53.4% in comparison with 2017). The District Administration acknowledges the role of the Company's development projects that instigated this growth. Extractive industry is also one of the most important sources of income for local communities (Section 8.4.4.4).

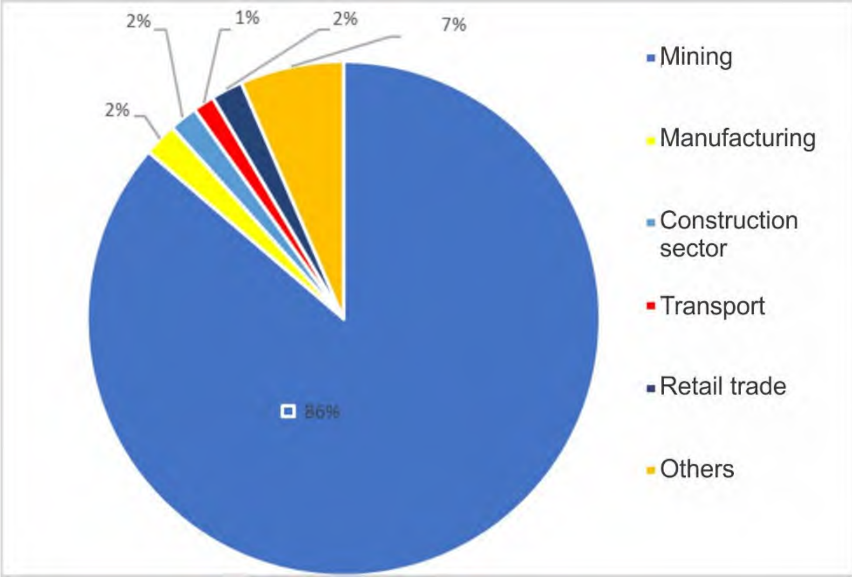


Figure 8.9: Ust-Kut District economy structure (by output)

According to the "Socio-economic development projection for Ust-Kut Municipality until 2019", the district economic development faces the following main challenges:

- unstable macroeconomic situation and inflation;
- public concerns over the growing prices for essential goods (including food);
- reduction in loan finance and its unavailability for real sector of economy (including small and medium businesses);
- lack of accurate statistical data on the activities of economic entities.

8.4.4.1 Industry

Industrial production is a major component of the economy of Ust-Kut District. During the last years, extractive enterprises have been the most significant for the local economy, which, *inter alia*, is connected to the development of the major INK project for exploration and development of oil fields and oil and gas condensate fields in Ust-Kut District (e.g. in Verkhnemarkovo Municipality). By 2017, this sector produced 97% of the total industrial output of the District, which equals to 102.4 billion roubles (the total industrial output is estimated at 106 billion roubles). Last year, extractive industry reported an increase by a factor of 1.4; in particular, oil production grew by 1.5 times. The District Administration recognizes the significance of the extractive industry, in particular, the Head of Administration noted that output of goods, works and services in this sector in 2018 grew by 53.4% compared to the previous year and amounted 242.3 billion roubles.

Summary information on industrial output in Ust-Kut District is provided in Table 8.19.

Table 8.19: Industrial output by years

Description	Ust-Kut District			
	2013	2014	2015	2016
Industrial output, million roubles	29267.8	73136.6	105974.2	138419.2

Source: Ust-Kut District Municipality (2017) and Irkutskstat (2019)

Timber industry is another important sector of the District economy (sawn and unprocessed timber). Since 2006 Trans-Siberian Wood Company (currently Ind Timber LLC) has been implementing a wood processing development project in the District. The project includes development of integrated sawing and wood processing facility with a capacity of 500,000 m^3 of dry lumber per year, and a wood waste recycling and disposal facility. The products range includes fuel pellets (annual production capacity - up to 70,000 tonnes). By 2018, the integrated facility produced 435,000 m^3 of lumber.

Forest industry makes a significant contribution to the economy of Ust-Kut city. Besides logging and wood processing (production of sawn timber), the forestry-based companies implement wood waste recycling projects. Ind Timber is the largest wood processing company in Irkutsk Region. By an Order of the RF Ministry of Industry and Energy, its projects are included in the list of the priority national investment projects in the sphere of forests development. The company produces dry sawn timber, and waste wood from sawing (chips, sawdust, flakes) is recycled to produce wooden pellets.

Another important enterprise in the forestry sector belongs to Lenalesservice, LLC engaged into logging, wood processing and sales. It produces dry dressed lumber and recycles wood waste (sawdust, flakes) for manufacturing of fuel briquettes (wood bricks).

Other operators in the sphere of wood logging and processing are Veles CJSC, Irkutsk Region Main Department of the Federal Service for the Execution of Sentences, LP Angara LLC, etc. There are 20 forest concession areas in the District, with estimated total logging area of 4,566,200 m^3. In 2018 the sector produced 2,382,000 m^3 of unprocessed wood, 509,600 m^3 of lumber, and 74,000 m^3 of chips.

8.4.4.2 Agriculture

Farming activities have an insignificant share in the economy of Ust-Kut District[175]. The agricultural sector of the District is represented by mainly small business entities:

- 5 farms (individual entrepreneurs);
- 1 agricultural enterprise;
- 2 agricultural production cooperatives;
- 1 subsidiary farm of correctional facility OIK-5.

The main agricultural products are meat and dairy, as well as grain.

Table 8.20: Main Economic Characteristics of Agricultural Sector in Ust-Kut Municipality

Description	Ust-Kut District				
	2013	2014	2015	2016	2017
Agricultural output by the type of businesses (thousand roubles), including	235775	332612	337607	356558	246778
Agricultural entities	3855	6878	9794	4555	8427
Private farms (individual entrepreneurs)	2007	2014	3320	5414	6015
Household farming	229912	323719	324493	346589	232336

Source: Ust-Kut District Administration, 2017; Irkutskstat, 2019 [176] [177]

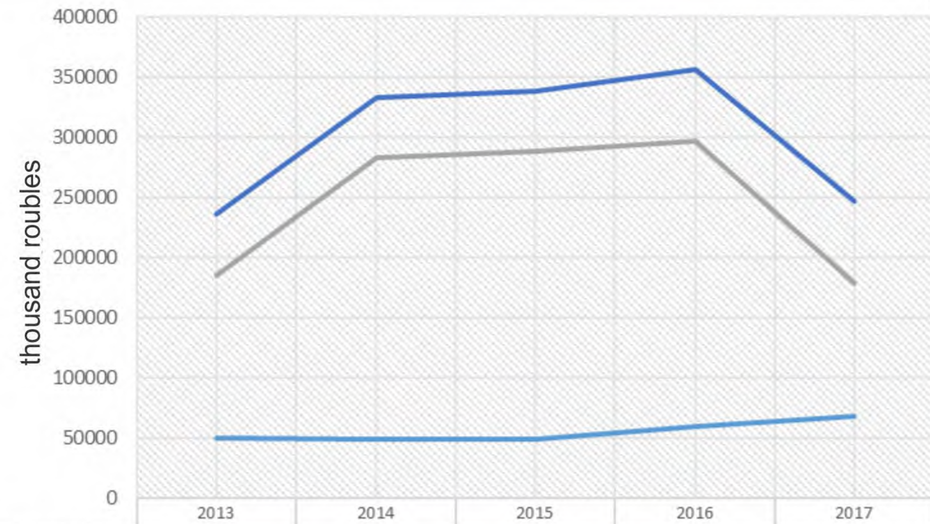
Additionally, in the District there are 1850 personal subsidiary farms.

According to the District Administration estimations, gross output of agricultural products in 2018 amounted 370.0 million roubles, i.e. by 5.7% more than in 2017. It should be noted that, according to the agricultural performance indicators published by Irkutskstat (Figure 8.10), a significant decline of agricultural output was reported in 2017 - down to 246,778,000 roubles, which does not correlate with the estimations prepared by the District Administration.

[175] Ust-Kut Municipal District Administration. Ust-Kut Municipality Socio-economic Development Forecast for year 2017 and for the planning period 2018-2019. 2016

[176] http://www.gks.ru/scripts/db_inet2/passport/table.aspx?opt=256440002013201420152016201720182019

[177] http://irkutskstat.gks.ru/wps/wcm/connect/rosstat_ts/irkutskstat/resources/7e77d5804e76d49b8691b7cc5af035be/%D0%BE%D1%82%D1%80%D0%B3%D1%80%D1%83%D0%B6%D0%B5%D0%BD%D0%BE.pdf
http://www.gks.ru/scripts/db_inet2/passport/table.aspx?opt=2564400020062007200820092010201120122013201420152016201720182019



	2013	2014	2015	2016	2017
Agricultural production	235775	332612	337607	356558	246778
Horticultural production	185599	283041	288038	296986	178672
Breeding production	50176	49571	49569	59572	68106

Figure 8.10: Agricultural output in Ust-Kut District, all categories of agricultural operations, actual prices

The Gostekhnadzor Service reported[178] that by 2016 there were no secondary schools left in Ust-Kut District with training programs for tractor and machine operation, which also demonstrates lack of demand for agricultural sector-related professions and highlights the minor role of the sector in the District economy.

8.4.4.3 Water transport

Regular navigation of the Lena river is conducted from the port of Osetrovo to the Lena river delta. River transportation historically plays an important role in the economy of the city and the district, and Osetrovo river port is one of the largest river ports in Russia. However, consultations at the PreESIA stage in 2017 highlighted the shallowing of the Lena river as a major, which is considered one of the major problems in the sphere of river navigation (Figure 8.11). According to Ust-Kut Administration, the main task of the port operations is logistics support for the "Severny Zavoz" (deliveries of goods to the Northern Territories).

The Osetrovo River Port facilities are distributed among three areas:

- Western cargo area (processing of technical cargoes and heavy loads up to 160 tons);
- Northern cargo area (transfer of medium-tonnage and multi-tonnage containers);
- Central cargo area (handling of packed goods and technical cargoes, bulk commodities, etc.).

[178] State Supervision Service for Technical State of Mechanical Vehicles and other Machinery in Irkutsk Region (Gostekhnadzor Service) Report on activities during 2015 and objectives for 2016.

Figure 8.11: Shallowing of the Lena River in Ust-Kut city (2017)

There are 18 berths in the city, few of which are currently out of service due to the river shallowing.

The river port operational maintenance facilities are located on the right bank of the Lena River. The port operates its own fleet and a well-developed railway infrastructure.

Dry cargoes account for two thirds of the total freight transport volume, and one third is oil and petroleum products. The following companies are active in the transport market of the District:

- Osetrovo River Port, JSC;
- Osetrovo Fleet REB, LLC (Operation Maintenance);
- VLRP, LLC
- Bunkernaya baza - Terminal Sever, LLC (Bunker Terminal);
- Irkutsk-terminal, LLC;
- Alrosa-Terminal, OJSC;
- Lenrechtrans, LLC;
- Lensky transit, LLC.

The companies listed above generally perform the following operations:

- cargo shipment and storage;
- loading and unloading operations;
- other inland water transport activities.

The passenger transport services are provided by Lena-express, LLC and Kirensk River Port, LLC from the river boat station in the city centre. Reportedly, 5,000 passengers were served in 2015.[179]

Despite of the aforementioned river shallowness problem, in 2018 water level in the Lena River was higher than assured limit. The growing number of cargoes was reported in 2016-2017 due to construction of the "Power of Siberia" gas pipeline. Among the major clients of the Osetrovo River Port are Surgutneftegas OJSC, Rosneft OJSC, PO Yakutcement OJSC, Verkhnelenskoe River Shipping Company LLC, Irkutsk Oil Company LLC, as well as contractors of Gazprom PJSC engaged for implementation of the Power of Siberia Project. In 2018 the revenues of transport companies dropped by 2.5 billion roubles due to a decline in cargo transportation for the Power of Siberia Project purposes[180].

[179] Ust-Kut City Municipality Transport Infrastructure Integrated Development Programme 2017-2028.

[180] Report of the Mayor of Ust-Kut Municipality T.A. Klimina on the performance of the Mayor, Ust-Kut Municipal Administration and other local self-government bodies subordinated to the Mayor of Ust-Kut Municipality in 2018

The effect of shallow water conditions in previous years was also reported in year 2018 as the fleet capacity was not fully utilized due to the increasing share of light-weight cargoes and customers' preference to other modes of transportation during inter-navigational season.

8.4.4.4 Population income and employment

As of 2016, 18,905 persons (out of 27,734 of employable population) were officially employed, i.e. 68.17%. At the same time, the registered level of unemployment (i.e. persons officially registered by the Employment Centre) was only 1.8%.

In 2018, the number of employable population was 29,164 of which 21,047 (72.2%) were employed in various sectors of economy. The official unemployment rate was 0.8%, as of start of year 2018. In 2017 unemployment rate of 0.9% was reported. 2,096 foreign nationals were employed in Ust-Kut at the end of year 2017.

In the structure of employment, the share of extractive industry is increasing: in 2017 the sector employed 4,250 persons, and by 2018 the number grew to 6,148 (Table 8.21). Aside from extractive industry, the following sectors of economy are the main employers of the local workforce:

- transport and communications;
- real estate operations, leasing and consumer services;
- education;
- public governance, military defence and social security.

Table 8.21: Employment by economic sectors of Ust-Kut District Municipality, persons

Description	Ust-Kut District					
	2013	2014	2015	2016	2017	2018
Average number of people employed by large and medium enterprises	18761	18874	19323	18905	19051	19403
including economic sectors						
Farming, hunting, and forestry	532	591	192	545	774	266
Mineral extraction	2814	3361	3381	4256	5086	6148
Manufacturing	737	515	1065	721	733	393
Production and distribution of power, gas and water	814	735	723	648	636	679
Construction	1426	666	330	713	1004	1511
Wholesale and retail trade; repair of vehicles, household and personal appliances	215	365	410	507	484	194
Hotels and restaurants	72	42	42	42	42	94
transport and communications;	2959	2855	3318	3152	2918	3448
Financial sector	303	247	177	153	151	136
Real estate operations, leasing and consumer services	2912	3799	4238	2718	3082	N/A
Public governance, military defence and social security	1755	1841	1724	1748	1682	1535
Education	2314	2125	2117	2075	2042	2046
Healthcare and social services	1478	1414	1277	1283	1245	1250
Other services	430	318	329	344	N/A	N/A
(*) Data 2018 is not conclusive						

Source: Ust-Kut District Administration, 2017; Irkutskstat, 2019

The extractive sector is also at the top position in terms of average monthly wage. The average earnings in this sector exceed the earnings of "the second best" construction sector by almost 30,000 roubles. The high level of wages in agricultural, hunting, and forestry sectors should also be noted, since it emphasizes the significance of these types of economic activities as a source of income for the population engaged in them, despite of the general lack of "weight" of these sectors in terms of Gross Domestic Product of the District.

In addition, the trend of the average monthly wage in manufacturing sector is peculiar as it grew by almost 5 times between 2014 and 2017 and then abruptly declined.

In 2017-2018, the lowest wages that are well below the district's average (67,300.2 roubles) were paid to those employed in sectors of education, healthcare and other services (see Table 8.22).

Table 8.22: Wages level by economic sectors of Ust-Kut District Municipality

Description	Ust-Kut District					
	2013	2014	2015	2016	2017	2018
Average gross monthly wage, roubles	42174.7	48099.1	49017.9	55161.1	62429.4	67300.2
including economic sectors						
Farming, hunting, and forestry	37120.1	39072	38037	53310	62291.8	44614.3
Mineral extraction	72635.8	85094	79192	85701	93186.8	94814.9
Manufacturing	15004.1	10291	29062	46537	51751.7	38087.5
Production and distribution of power, gas and water	33006.4	38299	40191	43423	47174.3	51614.8
Construction	41486.7	43443	35322	70154	64187.7	68258.9
Wholesale and retail trade; repair of vehicles, household and personal appliances	18000	24475	24060	35916	41378.5	36707.3
Hotels and restaurants	33370.5	42182.5	41824	36084	48499.7	39004.1
transport and communications;	43049.5	46135	51224	53886	58026.7	58912.9
Financial sector	44999.1	47384.7	46573.7	46582	49662.9	48769.9
Real estate operations, leasing and consumer services	42285.2	46568.8	48153.6	47635	47642	N/A
Public governance, military defence and social security	51378.0	52136	52302	47928	50377.4	56893.8
Education	26793.6	29433	30296	28800	30010	N/A
Healthcare and social services	26208.6	27640	30343	30574	34143.7	42155
Other services	20088.2	26258	25502.8	25467	21722.6	31001.5
Average per capita monthly income, roubles	25167.6	26918.7	30722	35380.3	N/A	N/A
Subsistence minimum, average per capita, in roubles	7546	9933.5	11999.3	12074.3	11995	N/A

Source: Irkutskstat, 2019

In comparison with district figures, at the city level lower incomes were reported in 2016 with average monthly wage being 47,557.7 roubles. On the other hand, this indicator grew by 9.8% since 2017[181].

In Q1 2017, subsistence minimum was 11,995 roubles.

It should be noted that the average number of people employed by enterprises in Ust-Kut District reported in the Investment Passport of Ust-Kut Municipality is higher than in the Irkutskstat reports – 21,190 persons, i.e. 72% of the total number of employable population. According to the Investment Passport, the average monthly wage in large, medium and small enterprises was 57,957 roubles, i.e. significantly lower than reported by Irkutskstat. The document also provides information on the official

[181] Memo for the Ust-Kut City Municipality Socio-economic Development Forecast

rate of unemployment: 1.4% of employable population. According to the Employment Centre, about 1400 vacant positions were registered in 2018[182].

Irkutsk Oil Company plays an important role in the labour market in Ust-Kut district: as of beginning of 2017 the Company employed 2,551 persons. Information on the district most significant employers is provided below (Table 8.23).

Table 8.23: Number of people employed by major enterprises in Ust-Kut City and District (with more than 500 employees)

Enterprise	Sector	Number of employees, as of the beginning of 2017/2016
Irkutsk Oil Company, LLC	Extractive industry	2551/1951
LDK-Ust-Kut, Autonomous division of Trans-Siberian Wood Company, LLC (as of 2019 - IND Timber, LLC)	Manufacturing	516/521
Osetrovo River Port, JSC	Transport	525/504
Geotek-VGK, LLC	Real estate operations, leasing and other services	1982/1819

Source: Ust-Kut District Administration, 2017

According to the Ust-Kut City Municipality Socio-economic Development Strategy until 2030, further development of the INK projects, including the project subjected to this ESIA, will generate more employment opportunities: it is expected that at least 755 new vacancies will be opened.

The Ust-Kut Municipality Socio-economic Development Forecast till 2019 that was made available by the Municipal Administration during the consultations in 2017 predicted a decline in inflation (Table 8.24). This, however, does not correlate with the list of key problems of the District economy in the same document as the increasing inflation is mentioned among the major issues. No up-to-date information on the inflation processes in Ust-Kut District was available as of 2019.

Table 8.24: Consumer price index (inflation) in Ust-Kut District, forecast until 2019

	2015 (actual)	2016 (estimated)	2017 (forecast)	2018 (forecast)	2019 (forecast)
Consumer price index, %	114.1	109.2	105.5	104.8	104.3

Source: Ust-Kut Municipal Administration, Ust-Kut Municipality Socio-economic Development Forecast till 2019

8.4.4.5 Small enterprises

Small and medium businesses are referred to by the head of Ust-Kut administration[183] as the most important components of the city's economy. Small and medium businesses are represented in nearly all sectors of economy while the main spheres of their operations are related to consumer market, housing and utility services.

Table 8.25: Main Economic Characteristics of Small Businesses in Ust-Kut City, 2018

Description	2016	2017
Number of small business entities (SBE) (active)	440	504
SBE number per thousand of persons	10.3	12
Average number of SBE employees	1199	1330
SBE share in the total employment (%)	6.7	7.5

[182] Investment Passport of Ust-Kut Municipality, 2018.

[183] Report of the Head of Ust-Kut City Municipality on the results of year 2016

Description	2016	2017
Number of individual entrepreneurs (self-employed individuals)	850	1012
Combined share of small businesses (SBE + individual entrepreneurs) in total employment (%)	11.5	13.3
Revenue from sale of products, works and services (million roubles)	8860.9	10303.7
Works and services share in total revenue (%)	36	37

Source: Ust-Kut City Municipality Socio-economic Development Strategy for the period till 2030, 2018.

The following small and medium enterprises support programmes are run in the District and the City:

- Municipal Programme "Small and medium business support in Ust-Kut Municipality" for 2019-2020;
- Programme "Small and medium business development and support in Ust-Kut City" for 2017-2021.

Besides the above Programmes, the City established a microfinance facility that provides loan funding to support development of small businesses. The parties interviewed in 2017 mentioned a reduction in loan finance and its unavailability for real sector of economy (including small and medium businesses). This statement correlates with the problem of the lack of finance for business development which is highlighted below.

The Ust-Kut City Municipality Socio-economic Development Strategy for the period until 2030 provides a list of the key problems facing small and medium businesses including:

- high rate of inflation;
- taxation system unsuited to the needs of small businesses;
- lack of production capacities;
- lack of own financial capital for business start-up and development;
- scarcity of adequately trained personnel and insufficient level of professional skills of local workers.

Most economic opportunities for small and medium businesses are related to retail trade (Table 8.23). Despite the increasing number of retail trade entities by year 2017, the turnover reported in this sector did not demonstrate a steady growth trend.

Table 8.26: Trade performance indicators in the city of Ust-Kut

Parameter	2013	2014	2015	2016	2017
Number of retail entities, start of year	453	453	471	483	470
Retail trade turnover, million roubles	5607	5705	5510	4772	5095
Number of wholesale entities, start of year	3	3	5	6	6
Number of catering service providers, start of year	58	58	60	61	68

Source: Ust-Kut District Administration, 2017; Ust-Kut City Municipality Socio-economic Development Strategy for the period till 2030, 2018.

Special sale areas (in total 8 areas) are provided in the city for individuals willing to sell produce of their private subsidiary farms.

8.4.4.6 Investment projects and economic forecasts

Investments into the economy of Ust-Kut grew by multiple times over past few years and reached the level of 39.5 million roubles in 2017 (Table 8.27).

Table 8.27: Capital investments in 2011-2017

Indicator	2011	2012	2013	2014	2015	2016	2017
Capital investments, billion roubles	5.3	10	16	19.3	28.7	36.4	39.5

Source: Ust-Kut District Administration, 2017

Vast majority of the investment projects planned in Ust-Kut District are part of plans for industrial development of the area. According to the Investment Passport of Ust-Kut Municipality, industrial projects account for a significant share in the total amount of investments. The largest contribution is made by the Company implementing its projects in the sphere of oil and gas production.

Currently, the plan for Lenskaya combined heat and power plant is under preparation. The plant is projected to have capacity of 1.2 GW with estimated investment cost of 13 billion roubles (as of 2017).

In 2016 the project of 500kV Substation "Ust-Kut" was initiated; the project will include high voltage powerlines 500kV and 220kV. As part of the project a new substation will be constructed to enable connection of the main oil pipeline "Eastern Siberia-Pacific Ocean" new substations to the to the United National Power Grid. The planned investment cost is 5 billion roubles.

The full list of the major investment projects in Ust-Kut city as of 2019 is provided in Table 8.28 below.

Table 8.28: Investment projects in the city of Ust-Kut, as of 2019

Titles of investment projects in Ust-Kut Municipality
Trans-Siberian Wood Company, LLC (TSLK, by 2019 - IND Timber, LLC) – Sawmill and woodworking complex development
TSLK , LLC in partnership with Sibirskiye Granuly, LLC – Pellets production
Construction of Lenskaya combined heat and power plant
PJSC FGC UES (Federal Grid Company of the Unified Energy System) investment project "PS 500kV "Ust-Kut" with high voltage powerlines 500kV and 220kV
Energosfera-Irkutsk, LLC – Heat supply reliability enhancement, transition to biofuel (wood chips), employment of cheaper fuel, including reconstruction of multiple boiler houses (e.g. in Yakurim and Stary Ust-Kut areas) (till 2021)
Lenskaya Teplovaya Kompaniya, LLC – Conversion of boiler house capacity 12 MW in the REB area for operation on biofuel (wood chips, sawdust) (till 2014)
Ust-Kutskiye Teplovye Seti i Kotelnye, LLC – Improvement of heat supply systems (till 2024)
Lenateploinvest, LLC – Construction of a new municipal boiler house "Biriusinka" (till 2032)
INK, LLC – gasification investment project (construction of a gas fractionation unit in the city of Ust-Kut)
INK, LLC – Further development of the Yaraktinskoye oil and gas condensate field
INK, LLC – Further development of the Markovskoye oil and gas condensate field
INK-Zapad, CJSC – Ichedinsky oil field development (Zapadno-Yaraktinsky Licence Area/Block)
NK-Zapad, CJSC – Bolshetirsky oil field development (Bolshetirsky Licence Area/Block)

Source: Ust-Kut District Administration, 2017; Ust-Kut City Municipality Socio-economic Development Strategy for the period till 2030, 2018.

8.4.4.7 Telecommunications sector

In 2017, the following communication service providers were active in Ust-Kut city and district:

- 1 landline phone operator;
- 4 wireless cellular phone operators.

There are also 3 public phone boxes in the city, as well as:

- 1 postal service provider;
- 8 internet providers;
- 11 TV service providers (digital wireless, satellite, cable TV and online TV).

8.4.5 Land use

There are no settlements at the territory of the Irkutsk Polymer Plant, Irkutsk Gas Chemical Integrated Plant and associated facilities. The nearest permanent settlements and temporary accommodation facilities are listed in the table below.

Table 8.29: Distance to permanent settlements and temporary accommodation facilities from the Project and other facilities of INK

Description	Distance to PPF, km	Distance to IGCP, km	Distance to INK cites, km
Polovinka village	5.5	6.2	4.1 (NW - pipeline main) 4.1 (SW - interfacility road)
Kedr-2 Gardening Association	2.7	3	0.35 (SW - interfacility road)
Private housing area in the east of Mostootryad area of Ust-Kut (2 Lesnaya Street)	4	3.5	0.2 (North - Western TAC) 1.9 (East - LPG RS&O)
Mostootryad area of Ust-Kut city	4.5	4	0.62 (NE - Western TAC) 2.2 (East - LPG RS&O) 2.2 (North - two-line OHTL 220 kV)

The main facilities of the Irkutsk Polymer Plant, Irkutsk Gas Chemical Integrated Plant will be constructed in the forest area leased by INK. The forest area within the footprint of the above facilities will be re-categorised into the industrial land category. Majority of Project facilities and associated facilities will be constructed in the lands categorized at the time of report preparation as designated forest land.

The Project construction site adjoins land plots of the following categories:

- forest land (most of the area around the construction sites);
- agricultural land (areas to the east of the main Project site, to the north of the forest land plot leased by INK as "backup" land plots, about 350 m from the interfacility road. This land is used by local communities for gardening);
- Land designated for industry, energy, transport, communications, radiobroadcasting, television, information technology, support land for space activities, defence and security land, and other land of special designation (to the south and south-east of the Project site, along the Lena River);
- Lands of inhabited localities (federal motor road "Vilyui" to the south of the Project site).

8.4.5.1 Use of designated forest land and water resource of the Lena River

Designated forest land in Ust-Kut District is controlled by the Ust-Kut Forestry with the total area of 4,535,060 ha[184]. By the intended use, the forests are either merchantable or protective. 669 land plots are leased for the following purposes:

- timber harvesting (38 plots);
- geological exploration and development of subsoil deposits (380);
- construction of linear facilities (250);
- wood processing (1).

Hunting

Designated forest land of Ust-Kut district is used for hunting and gathering. The hunting provider is Ust-Kut city branch of Irkutsk Region Association of Hunters and Fishermen (IRAHF).

The IRAHF has 679 members in Ust-Kut area, as of March 2019[185]. For legal hunting within the area controlled by Ust-Kut city branch of Irkutsk Region Association of Hunters and Fishermen, hunter must

[184] Letter of the Ust-Kut Forestry Department at the Forest Resource Ministry of Irkutsk Region, No.555 of 28.05.2017

[185] Letter from the Ust-Kut city branch of Irkutsk Region Association of Hunters and Fishermen No.53 of 06.03.2019

have a license, IRAHF membership ticket, a gaming permit, and a voucher.[186] About 3000 persons are registered as hunters by the Irkutsk Region Forest Resource Ministry and hold licenses for hunting.

According to the Irkutsk Region Wildlife Management Service[187], Ust-Kut district provides habitats for the following game species (Table 8.30).

Table 8.30: Game animal and bird species in Ust-Kut District, 2010-2017

Game species	Average population density (individuals per 1000 ha)							
	2010	2011	2012	2013	2014	2015	2016	2017
Elk	0.29	0.2	0.26	0.31	0.37	0.32	0.43	0.66
European red deer	0.44	0.32	0.32	0.44	0.56	N/A	N/A	N/A
Wild reindeer	0.2	0.05	0.11	0.21	0.11	0.13	0.27	0.31
Musk deer	N/A	0.01	0.17	0.19	0.27	0.31	0.56	0.76
Sable	3.43	4.33	4.63	4.25	4.95	5.00	5.30	5.45
Squirrel	14.99	10.58	9.77	16.65	15.3	N/A	N/A	N/A
Grey wolf	0.02	0.04	0.02	0.01	N/A	N/A	N/A	N/A
Ermine	N/A	0.22	0.45	0.5	0.11	N/A	N/A	N/A
Mountain hare	5.2	2.57	2.85	3.84	3.55	N/A	N/A	N/A
Wolverine	0.04	0.01	0.04	0.04	0.02	N/A	N/A	N/A
Lynx	N/A	0.01	0.01	0.02	0.01	N/A	N/A	N/A
Red fox	0.22	0.21	0.29	0.22	0.22	N/A	N/A	N/A
Capercaillie	2.12	1.32	3.63	7	2.58	6.48	6.07	8.86
Hazel grouse	30.91	33.6	31.5	43.96	19.57	N/A	N/A	N/A
Black grouse	8.81	4.76	4.76	7.42	8.87	14.41	16.94	14.15
Mink	1.02	1.02	1.02	N/A	0.92	N/A	N/A	N/A
Otter (the specie is listed in the Red Data Book of Irkutsk Region)	0.11	0.11	0.11	N/A	0.11	N/A	N/A	N/A
Musk rat	1.32	1.32	1.32	N/A	1.39	N/A	N/A	N/A
Manchurian deer	N/A	N/A	N/A	N/A	N/A	0.54	0.59	0.62

Source: Data of 2014 and earlier - Irkutsk Region Wildlife Management Service, 2014; data of 2015-2017 - Ust-Kut city branch of Irkutsk Region Association of Hunters and Fishermen, 2019

According to the Head of Ust-Kut city branch of Irkutsk Region Association of Hunters and Fishermen, the main game resource around Ust-Kut are capercaillie, hare, and hazel grouse.

Information on actual game production within the area controlled by Ust-Kut city branch of IRAHF is provided in the table below.

Table 8.31: Game production within the area controlled by Ust-Kut city branch of Irkutsk Region Association of Hunters and Fishermen, hunting season 2017-2018

Game species	Hunting limit (animals)	Actual production of game animals during the season 2017-2018
Elk	42	8
Manchurian deer	59	14
Reindeer	39	13
Musk deer	102	86
Sable	5809	3000
Grey wolf	15	7

[186] Ust-Kut city branch of Irkutsk Region Association of Hunters and Fishermen, Chairman Order No.31 of 02.08.2018

[187] Letter of the Irkutsk Region Wildlife Management Service No. 81-37-1276 re. "Provision of information" dated 26.08.2014

Game species	Hunting limit (animals)	Actual production of game animals during the season 2017-2018
Squirrel	N/A	2926
Mountain hare	N/A	311
Brown bear	24	12
Capercaillie	269	222
Hazel grouse	N/A	3050
Black grouse	183	173
Duck	N/A	2100
Goose	N/A	250

Source: Ust-Kut city branch of Irkutsk Region Association of Hunters and Fishermen, 2019

Fishing

Local residents (including the members of the Ust-Kut city branch of Irkutsk Region Association of Hunters and Fishermen) use the Lena River for angling and commercial fishing. Most of the IRAHF members engaged into hunting are also active commercial fishermen. Head of the local branch of IRAHF estimates that about one third of all residents in Ust-Kut city and district are fishers. He further estimates that a smaller part of the catch (less than 10%) is sold to retail chains, and the rest is consumed for own needs.

Territory on the bank of the Lena River in the area of Cape Tolsty will be occupied by a pumping station for technical water supply of the Polymer Plant. Significant angling and fishing species in the Lena River are[188]:

- khatys sterlet sturgeon (a high-value commercial fishing specie);
- taimen (this specie is especially popular among amateur anglers);
- lenok (object of both angling and commercial fishing);
- grayling (the main fishing specie in the Lena River, object of sport fishing; the fishing ban terms are not respected by local population);
- Siberian whitefish (pydschjan) (fishing specie, limited resource in Irkutsk Region);
- muksun (a valuable fishing specie, very rarely present in catch);
- pike (a very common fishing specie, object of both amateur angling and commercial fishing);
- burbot (fishing specie, average size of individuals and population reduction of this specie is observed in all areas, due to contamination of water and over-fishing);
- perch (a very common fishing specie, object of both amateur angling and commercial fishing);
- rockfish (secondary fishing specie, object of amateur angling);
- Siberian roach (a very common specie, object of both amateur angling and commercial fishing);
- Siberian dace (low-numbered specie, object of both amateur angling and commercial fishing);
- Gold carp (object of both amateur angling and commercial fishing).

Head of the local IRAHF highlighted the issue of depletion of Siberian roach resource.

Community concerns about hunting and fishery activities

The local IRAHF Head further expressed specific concerns about the land use practices in the district in general, and in particular around the city of Ust-Kut:

- serious violations of the forest use rules in Ust-Kut district, including the Project area;

[188]Letter from FSBI "Baikal Catchment Management Authority for Fishing and Conservation of Aquatic Biological Resource (Baikalrybzavod)" re. "Fishery value of the Lena River", No. 03-09/1423 of 22.08.2014

- hare, capercaillie and hazel grouse are the most vulnerable species in view of the potential hunting by personnel of construction contractors of INK;
- habitats fragmentation due to construction of linear facilities;
- increasing load on fresh water ecosystems of the Lena River and decrease of its water content;
- permanent odours in the area, including the odour of hydrogen sulphide and mercaptane;
- reduction of sable population as a result of alienation of the hunting grounds, fragmentation of habitats, and disruption of migration routes;
- more frequent encounters with brown bear, which is reportedly caused by the development of road network, disturbance of habitats of this specie, and in particular, by the violations of the waste storage regulations (herewith the Head of local branch of IRAHF mentioned that the Association does not have any information which would indicate an increase of the specie population);
- damage caused by clearfelling (as opposed to narrow-strip felling) of forest;
- lack of forest nurseries in Ust-Kut district (according to the Forest Plan of Irkutsk Region, there is 0.5 of forest nursery areas in the district[189]) and the need to deliver planting material from other districts of Irkutsk Region;
- the serious problem of poaching is further aggravated by the high technology level of equipment used by illegal hunters, and the massive involvement of local residents in such practices (i.e. people know the area and get information about the dates of planned inspections, in order to escape from potential punishment).

Head of Ust-Kut city branch of Irkutsk Region Association of Hunters and Fishermen refers to the timber harvesting and processing company Trans-Siberian Wood Company LLC (TSLK, now Ind Timber LLC) as the district's largest user of forest assets. TSLK is the object of the greatest concerns among local hunters and anglers, which is demonstrated by at least two documents:

- open letter of a community group (including head of local organization of hunters and anglers) to the President of the Russian Federation;
- letter from the Head of Ust-Kut city branch of Irkutsk Region Association of Hunters and Fishermen to the Head of Ust-Kut District Branch of the Irkutsk Region Forest Management Authority.

In general, Head of the local branch of IRAHF highlights the negative practices in respect of landscape conservation (including hunting areas) that have been observed for many years.

Land use in and around the Project area

<u>Hunting</u>

The construction sites of the Project and associated facilities are located within or in the direct vicinity of 12 forest quadrants controlled by the Ust-Kut Forestry Department: Osetrovskaya Forestry Division, Osetrovskaya Lesnaya Dacha (quadrants 195-197, 213-216, 218, 233-236).

[189] Annex to the Order of Irkutsk Region Governor of 26 November 2013 No.335-ug "Forest Plan of Irkutsk Region"

Figure 8.12: Project area and forest quadrants of the Osetrovskaya Forestry Division

Information on the gaming animal and bird species populations within the quadrants is provided in Table 8.32.

Table 8.32: Game animal and bird species in quadrants of the Osetrovskaya Forestry Division immediately affected or located close by the Project sites

Game species	Population density, units per 1000 ha
Manchurian deer	0.59-1.2
Elk	1.9-2.2
Mountain hare	4.2-5.5
Sable	4.2-5.3
Squirrel	5.2-6.1
Brown bear	2.6-3
Capercaillie	2.8-3.7
Black grouse	4.2-5.1

Source: Ust-Kut city branch of Irkutsk Region Association of Hunters and Fishermen, 2019

Two hobby hunters make annual agreements with Ust-Kut city branch of IRAHF for fur animals hunting in the 12 quadrants mentioned above (the hunters fully comply with their contractual duties). Furthermore, 20-50 hobby hunters procure licenses for production of upland game (capercaillie, black grouse) and water fowl (duck and goose) during the spring hunting period (4-13 May).[190].

Specific information on individuals engaged in hunting fur animals is treated as confidential and not publicly available. No separate records are kept about other hobby hunters active in the study area as these persons are allowed to practice hunting within the whole area controlled by Ust-Kut city branch of IRAHF. Therefore, information on hunters was collected at the interviews with the Chairman of the Ust-Kut city branch of IRAHF in May 2017 and March 2019. Further identification of hunters and their

[190] Letter from the Ust-Kut city branch of Irkutsk Region Association of Hunters and Fishermen No.53 of 06.03.2019. Information was also collected at the interview with the Chairman of the Ust-Kut city branch of IRAHF in March 2019.

representatives will be provided during the consultations under the Stakeholder Engagement Plan, and also through the stakeholder grievance mechanism (refer to the SEP).

Wild Crops Gathering

There are no areas actively used by local communities for wild crops gathering within the Project sites. Gathering is practiced in forest land throughout the District area, however, mostly in the territories in immediate proximity to the settlements[191].

8.4.5.2 Agricultural land use

The nearest agricultural land area is occupied by the Kedr-2 Gardening Association (GA) which is located at a distance of about 3 km from the Project site, and 350 m from the designed interfacility road. By the time of this report, a motor road in the close vicinity of the GA Kedr-2 gardens is used by the Company's trucks.

Local people use the gardens for growing agricultural crops for own consumption. It is assumed that the gardens do not have the function of permanent residence.

Figure 8.13: GA Kedr-2 gardens and motor road used by INK vehicles

The Kedr-2 Gardening Association is located outside the Project SPZ.

8.4.5.3 Use of industrial, energy and transport land

Land use of the neighbour sites is mainly related to industry and transport activities, including:

- Berth and explosives storage of Alrosa;
- Wood processing facilities of Trans-Siberian Wood Company LLC / Ind Timber LLC, with births and access railroad spur;
- Temporary storage site for wastes from wood processing operations of TSLK (the site is immediately adjacent to the land allocated for INK projects).

8.4.5.4 Use of lands of inhabited localities

Among the sites located in the vicinity of the Project sites, the lands of inhabited localities are represented by the "Vilyui" motor road of federal significance which runs to the south of the Project site and administratively belongs to the Ust-Kut City Municipality. The Project-associated activities will include reconstruction of the "Vilyui" road section between the access road junctions for connection to the process and offloading areas.

8.4.6 Social infrastructure

8.4.6.1 Healthcare infrastructure

Ust-Kut District Hospital has 290 beds, and is supplemented with a day patient facility (Markovsky Rural District Hospital) in Verkhnemarkovo village.

The number of medical and paramedical personnel have been gradually growing since 2013. Therefore, considering the decline trend of the district population number, the level of medical services provision per

[191] Information received at the interview with the Chairman of the Ust-Kut city branch of IRAHF in March 2019.

10,000 residents has increased (refer to Table 8.28). Herewith, information collected through the consultations process indicates the lack of medical personnel of the following specializations in the hospital:

- ophthalmology;
- gynecology;
- phthisiology;
- pediatric endocrinology.

In 2018, the hospital employed a post-internship neurologist and a cardiologist via a municipal support programme and using the mechanism of attracting young professionals from other areas. In addition, as of 2019 11 students specializing in pediatry and medical care, and 10 medical postgraduate interns (ophtalmology, surgery, anaesthesiology and reanimation, psychiatry, otolaryngology, X-ray radiography, and phthisiology) are being trained under employer-sponsored education contracts. The head of the District Hospital mentioned the low level of housing availability among the key obstacles in attracting new personnel.

Rotation shift personnel of the companies operating in Ust-Kut city and district use the services of the District Hospital (including occupational health checks). On the other hand, the head of the hospital mentioned that Irkutsk Oil Company provides periodic health checks of personnel on its own.

The District Hospital has the following departments:

- 24-hour service:
    a. Therapeutic
        i. therapy
        ii. neurology
    b. Gynecology
    c. Infectious diseases
    d. Maternity
    e. Surgery
        i. surgery
        ii. traumatology
    f. Children’s ward
    g. Tuberculosis
    h. Markovsky Rural District Hospital
        i. psychiatry
        ii. therapeutic
- Day care
    a. Day patient facility #1
        i. therapy
        ii. neurology
    b. Day patient facility #2
        i. therapy
        ii. neurology
    c. Markovsky Rural District Hospital

An out-patient clinic branch of the central District Hospital functions in Mostootryad area. Similar healthcare divisions are also provided in the areas of REB, Stary Ust-Kut, Neftebaza, and in Gorkogo Street.

As demonstrated below (Table 8.33), despite the overall positive trend of medical personnel numbers, staffing level of secondary medical personnel in Ust-Kut District decreased over the period 2013 - 2017. The Hospital has 85 doctors 294 secondary medical staff employed covering 188 doctor positions and 511.5 secondary medical positions, respectively, as the job combination (meaning that one person may ‘cover’ more than 1 position) factor of doctors is 2.2, of secondary medical staff – 1.8. Staffing level for doctors is 45.2%, secondary medical staff – 57%.

Table 8.33: Ust-Kut District healthcare system

Description	Ust-Kut District							Ust-Kut City						
	2013	2014	2015	2016	2017	2018	2019*	2013	2014	2015	2016	2017	2018	2019*
Hospital beds number	320	320	320	290	290	N/A	N/A	285	285	285	290	290	325[192]	N/A
number of beds per 10,000 residents	61.2	62.2	63.1	57.9	58.3	N/A	N/A	64.2	65.8	66.6	68.3	69.0	74.8	N/A
Number of outpatient/polyclinic healthcare institutions	1	1	1	1	1	N/A	N/A	4	7[193]	1	1	1	N/A	N/A
Capacity of outpatient/polyclinic healthcare institutions, visitors per shift	1005	1005	1005	1005	1005	N/A	N/A	700	700	700	700	700	N/A	N/A
visitors per 10,000 residents	57849	67027	66900	65243	13459	N/A	N/A	64094	72350	72791	73438	14341	N/A	N/A
Number of medical and obstetric stations (MOS)	10	10	10	10	10	N/A	N/A	10	10	10	10	10	N/A	N/A
Number of doctors	78	84	83	82	85	85	87	67	76	78	77	79	N/A	N/A
per 10,000 residents	14.9	16.3	16.4	16.4	17.1	17.3	N/A	15.2	17.4	18.2	18.1	18.6	N/A	N/A
Number of secondary medical staff	339	337	327	312	298	294	294	252	272	286	281	270	N/A	N/A
per 10,000 residents	64.8	65.6	64.5	62.3	59.9	60.0	N/A	52.2	62.4	66.5	66.1	63.5	N/A	N/A
Doctors staffing level, %	41	44.8	44.3	44	45.1	45.2	46	40.5	46.8	45.7	44.2	45.3	N/A	N/A
Secondary medical personnel staffing level, %	66.5	65.9	64.1	61.7	60.7	57.5	57.5	61.3	65.4	63.5	60.5	58.1	N/A	N/A

Source: Ust-Kut District Hospital 2017, Ust-Kut District Hospital 2019, (*) data 2019 is not conclusive

[192] A full-time 35-bed psychiatric unit functions at the Markovsky Rural District Hospital (MRDH) since 29.08.2017. One day-care bed at the MRDH has been converted into full-time medical (therapeutic) care bed using the compulsory health insurance (CHI) funding

[193] Ust-Kut City Municipality Integrated Socio-economic Development Programme 2017-2022

There is also a Railway Hospital in Ust-Kut, with associated out-patient clinic at the Lena railway station. According to the official website[194], the hospital is assigned to provide medical services to the following groups:

- personnel of the Russian Railways OJSC (RZD);
- pensioners and veterans of railway transport;
- family members of RZD personnel (adults aged 18 or older).

The hospital provides outpatient and day patient treatment services.

- Rated capacity of the clinic is 150 adult visitors per shift.
  - The day patient facility has 25 beds.
  - The facility provides general therapeutic services.

Out-patient clinic at the Lena railway station provides the following services:

- services under compulsory medical insurance policy (primary care, specialist care, emergency medical services, palliative care);
- paid services (clinical pathology, X-ray radiography, physiotherapy, tocogynecology, therapy, neurology, otorhinolaryngology, dentistry, ultrasound scanning, surgery and endoscopy);
- health surveys and regular examinations (heart disease prevention, health examinations of certain adult groups and railway personnel).

Ust-Kut city has 7 large and 15 smaller pharmacy shops. A new pharmacy was opened in 2016 in Rechniki area.

Other providers of medical services are: Doctor LLC, Stomcomfort LLC, Dental Clinic "Proskokov and Co." LLC, I.N. Grigoryev Ultrasound Diagnostic Facility, Ust-Kut Sanatorium CJSC, Eiseira Sanagorium LLC.

8.4.6.2 Sanatorium-resort infrastructure

The Ust-Kut balneal-mud-therapy resort was established in 1928. The resort provides services using radon, sodium-chloride brine which contain bromine (used for baths after dilution), as well as silt mud from the Ust-Kut Lake. The resort serves patients of the following profile:

- locomotor system diseases;
- gynecological disorders;
- peripheral nervous system disorders.

The resort consists of a balneary and a sanatorium for 220 patients.

Another sanatorium in Ust-Kut – "Eyseyra" – provides therapeutic beaches, salt rooms, park, as well as traumatotherapy with herbs and honey, and aromatherapy. Other methods include gas therapy (oxygen cocktails), cerotic-paraffin treatment, baths with sea salt, pine needles, iodine-bromine, bishofite, mineral water for internal use, silt mud, sapropelic mud (the Lena river). The sanatorium provides treatment for the following diseases:

- gynecological disorders;
- nervous system disorders;
- ICP;
- respiratory diseases;
- kidney and urinary tract diseases;
- locomotor system diseases;
- dermatology diseases;
- diseases of blood circulation organs;
- diseases of digestive system.

[194] http://uskulenauzb.ru/

8.4.6.3 Education infrastructure

In 2018, in Ust-Kut district there are 22 kindergardens (in 2016 there were 21 kindergartens) with the total of 3071 pupils[195] (in 2016 – 3009 pupils[196]). The total design capacity of the kindergartens is 3145 pupils. The majority of the institutions are situated in the following districts:

- Stary Ust-Kut;
- Rechniki area;
- REB;
- Kvadrat;
- Biriusinka village;
- Sudoverfi district;
- Kirzavod village;
- YGU area;
- Lena station area;
- Mostootryad area.

The institution in Mostootryad settlement is of special importance for the Project as it is located in the nearest residential area that is equipped with social infrastructure. Kindergarten No.63 of Ust-Kut Municipality of Irkutsk District which is located in this area has a design capacity of 220 and had 106 pupils registered, as of 01.09.2018. The number of pupils declined by 32 compared to school year 2016/2017.

As of 2016, the city has 18 schools with 7,184 students registered; the schools, in addition to the above listed areas, were also present in the following residential areas:

- Rechniki-2;
- Lena;
- Neftebaza.

By year 2017, the number of students increased to 7,398; the number schools did not change.

In 2018, the school No.7 of Ust-Kut Municipality in Mostootryad area had 300 students which is 31 students fewer than in 2016. The current number of students registered exceeds the design capacity of the school (240 students).

Branches and divisions of the Siberian State University of Water Transport, Bratsk State University, Modern Humanitarian Academy, Irkutsk Humanitarian and Technical College are active in the Ust-Kut District area. Also, vocational education is provided by the Ust-Kut Industrial Technical School[197].

8.4.6.4 Activities within the framework of the Youth Policy and Culture Policy in Ust-Kut city and Ust-Kut district

Administrations of Ust-Kut city and Ust-Kut district run regular activities under the Programmes titled “Youth Policy – Priorities and development prospects 2017-2019” (at the city level) and “Ust-Kut District Youth Policy 2018-2020” (at the district level). The City’s Programme is focused on “military-patriotic, moral and aesthetic upbringing” through a range of activities: festivals, intellectual and recreational games, sports competitions, provision of computers and other equipment for educational institutions, etc.

According to the City Administration,[198] the number of people practicing physical training and sports is steadily growing. The data on sports facilities and events are summarised in Table 8.34.

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[195] Irkutskstat, 2019: http://www.gks.ru/scripts/db_inet2/passport/pass.aspx?base=munst25&r=25644000

[196] Head of Education Department, Ust-Kut Municipality. “Summary characteristic of educational facilities in Ust-Kut Municipality” provided to Irkutsk Oil Company in 20017.

[197] Investment Passport of Ust-Kut Municipality, 2018.

[198] Ust-Kut City Municipality Socio-economic Development Strategy for the period till 2030

Table 8.34: Ust-Kut City sports infrastructure and events

Description	2016	2017
Sports facilities - total number	72	72
Gym halls	42	42
Stadiums	1	1
Children and youth sports schools	2	2
Number of attendants of sports groups, total	1200	1340
Number of public sports events	36	36
Number of participants in the sports events	2500	2600

Source: Ust-Kut City Municipality Socio-economic Development Strategy for the period till 2030

As part of the culture policy of the city, a system of libraries and a library-based culture centres is developed; the system has branches in various districts of Ust-Kut. People are invited to use Internet centres for educational purposes. Ust-Kut Municipal Library has 20 branches in Ust-Kut district, including 10 of them located in the city of Ust-Kut.

The Program "Cultural Development in Ust-Kut Municipality 2017-2019" is being implemented at the district level. Its objectives are similar to those of the city programme and include the following topics:

- enhancing cultural potential of employees of institutions of culture (including via refresher trainings);
- arrangement of festivals and competitions;
- activities for "military training and patriotic upbringing" of young people;
- improvement of facilities and technical resources of the library system.

8.4.7 Municipal infrastructure

8.4.7.1 Housing

Information on housing units in Ust-Kut city is provided in the table below.

Table 8.35: Ust-Kut city housing, 2013-2018

Indicators	2013	2014	2015	2016	2017	2018
Total floor area of residential buildings, thousand m^2	997.6	999.6	1003.4	1007.7	1011.6	1003.9
Per capita total floor area of residential buildings, m^2	22.87	22.91	23.3	23.6	23.8	24
Total floor area of newly commissioned residential buildings, thousand m^2	5.1	2.5	11.9	28	3.9	13.3
Area of dilapidated and substandard housing, thousand m^2	34.7	28.7	31	45.1	41.2	28.1
Share of dilapidated and substandard housing, %	4.7	2.9	3.1	4.3	4.07	2.8

Source: Ust-Kut City Administration, 2019

As shown in the table, about 3% of total housing area in the city is "dilapidated and substandard".

Modern comforts are provided in over 80% of the total housing area. The following levels of utility services availability were reported by year 2018:

- cold water supply - 82%;
- wastewater disposal (sewerage) - 81%;
- heating - 84;
- hot water supply - 82%.

Central gas supply service is not available in the city.

The city is active in construction of apartment blocks supported by various state programmes, including the programme for relocation of residents of dilapidated and substandard houses in the Far North. 35 apartment blocks were constructed and 2 blocks were rehabilitated by March 2018. The total funds of 1735 million roubles were used for construction of 992 apartments over the period of 2013-2018. The housing construction unit cost in Ust-Kut city is 35,500 roubles/sq.m.

In year 2018 the waiting list for resettlement from poor housing included 3,672 persons (928 households).

Table 8.36: Ust-Kut city housing construction, 2013-2018

Indicator	Value
Commissioning of residential houses, sq. m	51722
New apartments built, no.	992
Value of the construction works, thousand roubles	1734900

Source: Ust-Kut District Administration, 2019

At the consultations in 2017, the representatives of City Administration mentioned the growing demand for housing in the city which entails the growth of price for purchase and rent of residential units. It should be noted that such situation is not typical for either both federal or regional market[199]. The interviewed representatives of local Administration explain the growth of housing prices in the city by the effect of implementation of various projects (including those of INK), and by renewal of housing stock.

Consultations with local authorities identified the problem of disposal of wastes from demolition of substandard and dilapidated houses as part of the programmes mentioned above. The problem is further aggravated by the long hauling distance to the waste disposal landfill on the opposite bank of the Lena River, which was commissioned in 1995.

8.4.7.2 Waste management

As mentioned above, extensive residential development within the scope of the housing improvement programmes in the city, including relocation of residents from dilapidated and substandard houses, entails a serious problem of disposal of wastes, particularly construction wastes.

Table 8.37: Waste treatment in Ust-Kut District Municipality, 2013-2017

Indicators	2013	2014	2015	2016	2017
Municipal and industrial waste disposal companies, no.	1	2	2	2	N/A
Annual quantity of collected municipal solid waste, thousand m^3	99	142.7	142.7	143.9	146.1
Annual quantity of collected liquid waste, thousand m^3	57.6	383.1	4311.7	61.2	N/A

Source: Irkutskstat, 2019[200]

Parties interviewed during the consultations noted that individuals and companies are not always diligent on the matter, and mentioned multiple occasions when domestic and construction wastes were dumped at inappropriate sites.

[199] http://www.gks.ru/bgd/regl/b18_14p/Main.htm

[200] http://www.gks.ru/scripts/db_inet2/passport/table.aspx?opt=25644000201420152016201720182019

Figure 8.14: Entrance of the municipal solid wastes landfill operated by SpetsAvto LLC

The total number of municipal solid waste landfills in Ust-Kut District (including the city) is 8 (Figure 8.14). More details are provided in Section 7.9.1 "Waste disposal and detoxication facilities in Ust-Kut Municipality".

8.4.7.3 Transport infrastructure and transportation

Transport system of the district includes railways (Figure 8.15), river routes, motor roads (Figure 8.16), airways and pipeline transport. Ust-Kut is the centre of the Osetrovo-Lena transport hub – the largest river hub in the Eastern Siberia. The hub is located at the junction of railway and water transport routes. The local airport is capable of serving long-haul aircraft. Access to the federal motor road network is available in all seasons. The nearest urban destinations are: Bratsk – 320 km by motor road; Zheleznogorsk-Ilimsky – 107 km to the west; Kirensk – 300 km to the north-west, downstream the Lena River. Distance to the nearest large city – Bratsk – by railway is 381 km (from the Lena station to the Gidrostroitel station), to the region's central city - 1,392 km. By air, the distance to Irkutsk is 520 km.[201]

Settlements within the District are interconnected by means of railway, motor roads and river transport communications. The main transport modes for communication with other regions are railway (the Baikal-Amur Railroad) and airways (via the Ust-Kut airport).

In 2018, the total number of passengers carried by all types of transport was 388,000. Railway transport accounted for the largest passenger flow (56%), 21% passengers travelled by motor roads, 22% - by air. 1% of passengers used water transport.

Table 8.38: Transport facilities in Ust-Kut District, 2013-2018

Parameter	2013	2014	2015	2016	2017	2018
Total passenger transportation, persons	354,926	292,379	297,047	295,678	380,049	387,978

[201] Ust-Kut City Municipality Transport Infrastructure Integrated Development Programme 2017-2028.

Parameter	2013	2014	2015	2016	2017	2018
By motor roads	78,100	77,500	79,400	78,500	79,599	80,000
By air	133,326	70,129	71,737	72,150	73,643	85,734
By railroad	140,000	141,000	14,149	141,658	213,523	218,861
By water	3,500	3,750	4,761	3,370	3,284	3,383
Total cargo transportation, tons	5,414,000	4,731,000	5,521,000	711,900	894,689	5,120,000
By motor roads	93,000	95,000	100,000	115,000	100,000	120,000
By air	650,000	690,000	700,000	814,000	503,000	650,000
By railroad	2,900,000	2,950,000	3,000,000	2,734,000	2,900,000	3,000,000
By water	1,771,000	996,000	1,721,000	1,328,000	1,307,000	1,350,000

Source: Ust-Kut City Administration, 2019

Total quantity of transported cargo was 5210 thousand tons including 59% by railway and 26% by water. Only 2% of cargo was transported by motor roads.

Current logistics and transport development projects in the District include:

- construction of federal motor road;
- Baikal-Amur railroad upgrading project.

The designed Vilyui A-331 motor road of federal significance is routed across the area of Ust-Kut District. The road will provide a link between Irkutsk Region and the Republic of Yakutia. The road section of 52 km had been constructed by 2018, including 36 km within the boundaries of Ust-Kut District. The bridges across Kazarka and Yelovka rivers have been re-commissioned after capital rehabilitation.

Construction and upgrading of transport infrastructure are included in the scope of the Baikal-Amur Railways 2nd Line Project[202].

River navigation is ensured via the port of Osetrovo; navigation period if from the middle of May till the end of October each year. The main elements of cargo carried by water transport are dry cargoes and petroleum products.

Ust-Kut has a general aviation airport (main category of regional air communication airports). Publications in media highlight urgent need for rehabilitation of the city's airport[203]. The renewal project under the Programme "Development of transport system of Russia" for the period 2016-2018 provides for construction of a new building and modernization of the air strip. The Ministry of Housing Policy, Energy and Transport of Irkutsk Region (Ministry of Municipal Services, MMS) refers to repeated delays in rehabilitation of Ust-Kut airport as a key problem hindering development of the Region's transport system[204]. The issue of the airport renewal remained open also in 2018 - the City Mayor highlighted that the problem even intensified due to the growing passenger flow[205].

No emergency situations of natural origin were reported during the navigation period in 2018. Although water level of the Lena River was above the required depth limits, the shallow water conditions in previous years had aftereffects in 2018: the fleet capacity was not fully utilized due to the increased share of light-weight cargoes and due to the preference that potential clients made to other transport modes during internavigational season.

In 2018, total revenues of transport companies dropped by 2.5 billion roubles compared to the level of 2017 due to a decline in cargo transportation for the Power of Siberia Project[206].

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[202] Report of the Mayor of Ust-Kut Municipality, 2018.

[203] http://irkobl.ru/news/191523/?sphrase_id=1534419

[204] Report of Ministry of Housing Policy, Energy and Transport of Irkutsk Region for year 2015

[205] http://www.ogirk.ru/2018/11/21/ust-kutskij-aeroport-zhdet-remonta/

[206] Report of the Mayor of Ust-Kut Municipality T.A. Klimina, 2018.

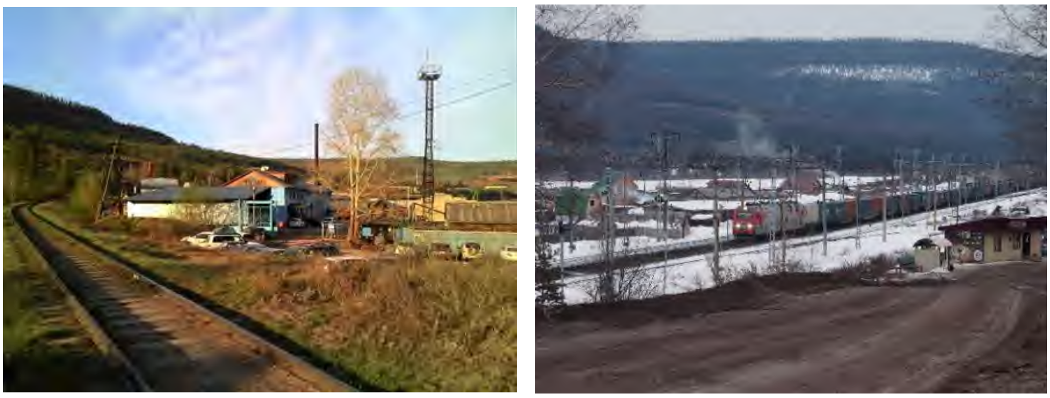

Figure 8.15: Ust-Kut City railways. Photo: Ramboll 18-19 May 2017, 18-22 March 2019

The public transport system in Ust-Kut includes 7 municipal routes within the city, 1 suburban route, and 2 inter-city routes (Irkutsk – Ust-Kut, Krasnoyarsk – Ust-Kut). The passenger transportation services are provided by the municipal operator "Avtodor" and private businesses. Certain routes (e.g. "summer cottage" routes) offer privileged rates to specific groups of passengers. 62 vehicles that are used for day-to-day passenger transportation are equipped with GLONASS satellite navigation system.

The City representatives report that the authorities regularly make agreements for compensation of damage caused by the vehicles transporting heavy and/or oversized loads by the local roads[207]. In particular, agreements have been made with:

- Gazprom Transgaz Tomsk LLC (in relation to construction of the Sila Sibiri gas main);
- Gazprom Dobycha Noyabrsk LLC.

The data on compensation for road damage may be treated with caution as during 2017 consultations the Head of the local branch of Irkutsk association of hunters and fishers highlighted deterioration of roads and bridges caused by heavy machinery as a serious issue and mentioned the lack of timely reinstatement measures.

The City adopted a road damage compensation methodology which is integrated into the regulation titled "Procedures for compensation of damage caused by heavy and oversized loads transportation along local roads within Ust-Kut City Municipality".

Special features of Ust-Kut City transport infrastructure include the ice bridge near Turuka village which is constructed every year.

Transport system improvement in the Ust-Kut city is supported by several municipal programmes including:

- Ust-Kut City Municipal Programme "Road system development in Ust-Kut city 2016-2020";
- Ust-Kut City Integrated Transport Infrastructure Development Programme 2017-2028;
- Municipal Programme "Automotive public transport development in Ust-Kut City Municipality 2018-2022".

[207] Report of the Head of Ust-Kut City Municipality "On the socio-economic situation in Ust-Kut City Municipality in 2016"

Figure 8.16: Motor roads in the Project area

Vilyui A-331 road (1 - western entrance to Ust-Kut city, 2 - within the Biriusinka area, 3 - Ust-Kut exit in the direction of Verkhnemarkovo village, 4 - section km19+300 – km20+500 subject to reconstruction); 5 - 25N26 road "Ust-Kut - Severobaikalsk - Uoyan"; 6 - intra-city road - access road to Mostootryad area, with bus stop pavilions; 7 - access road to the Kedr-2 Gardening Association; 8 - service driveway of INK. Photo: Ramboll 18-19 May 2017, Ramboll CIS 18-22 March 2019

According to publications in media, poor condition of roads is among the key problems of Ust-Kut District[208]. The following roads are in particularly poor condition:

- regional road "Ust-Kut – Omoloy", section "Ust-Kut – Veteran";
- road "Ust-Kut – Niya";
- section "Ust-Kut – Verkhnemarkovo" of the federal road (major overhaul of the road is needed, due to the increasing difficulties encountered by residents of Podymakhino and Verkhnamarkovo villages on the way to Ust-Kut).

Poor quality of the roads precludes possibility of regular passenger transportation between settlements. Various projects which are implemented in Ust-Kut city and Ust-Kut district contribute to the problem of poor status of road pavements. It is noted that transportation of large pipes for construction of the gas main has driven Ust-Kut roads to the "dire state". The damage is estimated at 20 million roubles.[209]

8.4.7.4 Power and Heat Supply

Bratskaya HPP is the main power generation facility for Ust-Kut. Heat energy is sourced from 13 boiler houses including 3 boiler houses owned by industries. The boiler houses provide heating for 832 residential houses, 35 community service facilities, and 165 other facilities.[210] As reported by the Head of Ust-Kut Municipality[211], the current development trend in the city's heat supply system (Figure 8.17) is oriented toward reduction of number of small boiler houses and construction of new bio-fuelled boiler houses (e.g. woodchips-fired). Rehabilitation of heat supply system is mentioned among the priority tasks for the city Administration.

Figure 8.17: REB Boiler House, Ust-Kut (before and after reconstruction)

The aforementioned rehabilitation of heat supply system provides for large-scale development of the gas distribution networks in Ust-Kut city. According to information available by year 2015[212], the development of Ust-Kut gas supply system was directly linked to construction of INK gas processing infrastructure in Ust-Kut city and district, including the Project. According to the authorities, INK "confirms its readiness to invest in construction of the gas main, gas distribution station in the area of Cape Tolsty, without reference to decision of Irkutskenergo OJSC about construction of Lenskaya CHP". The MMS estimates that by 2025 the heat generating facilities and households in Ust-Kut will consume up to 81.2 million m^3 of gas per year, which is less than the economically feasible level of 100 million m^3 per year. Therefore, the Company prepared a proposal for supply of liquefied natural gas to Ust-Kut city. According to the Ministry's report, the operation of the gas supply network in the city was due to start in 2018-2019, which is also confirmed by the approved update of Ust-Kut Heat Supply Scheme[213]. However,

[208] http://irkobl.ru/news/191523/?sphrase_id=1534419

[209] *Ibid.*

[210] Ust-Kut City Municipality Socio-economic Development Strategy for the period till 2030

[211] Report of the Head of Ust-Kut City Municipality "On the socio-economic situation in Ust-Kut City Municipality in 2016"

[212] Report "Irkutsk Region Ministry of Housing Policy, Energy and Transport performance report 2016"

[213] Updated Heat Supply Scheme of Ust-Kut Municipality for the period 2013-2017 and until 2025

according to the updated information received from the City Administration representatives in March 2019, the city gas supply scheme has been reconsidered, and the gasification project may be cancelled.

8.4.8 *Vulnerable communities*

This section describes the groups of residents of Ust-Kut city and Ust-Kut district which are defined as vulnerable, i.e. groups "that may be directly and differentially or disproportionately affected by the project because of their disadvantaged or vulnerable status"[214]. The vulnerable status is identified using the following criteria:

- economic status;
- property status;
- social status;
- limited physical capabilities;
- age;
- exposure to existing negative factors;
- state of health.

It should be noted that vulnerability of specific groups may be enhanced by a combination of the above factors. For example, people living with HIV/AIDS are vulnerable as a result of combination of their property, economic and social situation, and also due to weak health. The following vulnerable groups have been identified at this stage:

- disabled and senior persons, children;
- people living with HIV/AIDS;
- low-income groups.

The PreESIA studies also identified the following vulnerable groups:

- residents of Mostootryad and Yakurim areas (Ust-Kut city);
- former court prisoners residing in gardening associations near the proposed Project site.

The latter two groups' vulnerable status has not been confirmed by the full ESIA. A detailed explanation is provided in the sections below.

Women were not considered as a separate vulnerable group at the stage of PreESIA; the full ESIA did not identify women as a separate vulnerable group either. The stakeholder consultations and review of additional documents did not yield any information to suggest potential impairment of women's rights of a significance in the context of ESIA.

It was noted at the PreESIA stage that in Russia women are barred from certain occupations (the total list of such professions includes 456 items)[215]. The list was first prepared in 1974 and subsequently UN recognized it as infringing the women's rights[216].

However, the full ESIA has been prepared considering the Company's commitment to providing equal opportunities for men and women, and the fact that proportions of male and male personnel in the staff structure are monitored. In particular, the INK's Code of Ethics establishes the following key principles for Company's relationships with employees:

- respect the right for freedom and other personal rights;
- providing each person with equal rights and opportunities to be able to unlock professional and creative potential;
- zero tolerance to labour discrimination based on gender, age, race or nationality, religion, political views, etc.

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[214] IFC Performance Standards on Environmental and Social Sustainability (2012)

[215] Government of the Russian Federation, Resolution of 25 February 2000 No.162, Moscow "On approval of the list of heavy works and works with harmful or dangerous conditions, in which the use of female labour is prohibited"

[216] http://www.ohchr.org/RU/NewsEvents/Stories/Pages/MedvedevaVRussia.aspx

The Company has established a Commission on Ethics and charged it with responsibility for ensuring compliance with the Code of Ethics. All members of personnel are obliged to respect the Code. In view of the above, Ramboll concludes that the Company is applying significant efforts to ensure equal opportunities for women and men in the sphere of labour relations, and women are not considered as a separate vulnerable group in the process of the Project impact assessment.

More details of the issues of vulnerable groups and grounds on which certain groups have been removed from this category are discussed in more detail in sections 8.4.8.1 – 8.4.8.5 below.

8.4.8.1 Residents of Mostootryad and Yakurim areas (Ust-Kut city)

The main Project construction site has been moved to a longer distance from Mostootryad and Yakurim areas, therefore residents of these areas are removed from the list of vulnerable groups. However, they still fall within the Project's social area of influence (refer to Chapter 10) and are identified as communities affected by the Company's activities.

8.4.8.2 Former court prisoners residing in gardening associations near the proposed Project site

According to the information received at the consultations in 2017 and 2019, the security penal colony that existed in Ust-Kut since 1960 was closed in 2016. By year 2017, about 200 prisoners remained in the secured area "Penal colony settlement No. 20 with special conditions for activities of the Main Department of the Federal Service for the Execution of Sentences for Irkutsk Region" (FKU KP20 OUHD GUFSIN of Russia for Irkutsk Region). It was noted that the released prisoners normally stay in the district and reside in Ust-Kut and gardening associations. However, presence of court prisoners in the area of Kedr-2 Gardening Association was not confirmed during the consultations in 2019. Therefore, the group was excluded from the list of vulnerable communities. In the future, if presence or residence of former court prisoners is identified in the Kedr-2 Gardening Association, the Company should consider restoring this group in the list of vulnerable communities.

8.4.8.3 Persons with disabilities, seniors and children

The share of people with disabilities among residents of Ust-Kut district is significant. According to the official data provided by Ust-Kut District Administration, 8,357 persons were registered as disabled in Ust-Kut District in 2016 (16.86% of the total population number), including 5,131 persons older than employable age, and 279 children. Reportedly, Ust-Kut city does not provide adequate infrastructure to ensure accessibility of significant municipal infrastructure.

Notably, in 2016, the Russia's average proportion of people with disabilities in the total number of population was 8.74%, i.e. significantly smaller than in Ust-Kut District.

Children and persons in post-retirement age accounted for 31.4% and 7.5% in the total number of population in Ust-Kut, respectively. Average monthly pension paid in Ust-Kut city during 6 months of year 2018 was 15,288.7 roubles. 2,180 retired persons have pensions below the subsistence minimum level.

During consultations with local stakeholders, representatives of the Council of Veterans of Ust-Kut city highlighted the problem of transfer of children to schools which is reportedly caused by lack of developed transport infrastructure, and the city layout (40 km long). In certain localities children have to use river transport (boats) in summer or to walk on ice in winter to get to their schools.

Children residing in Mostootryad settlement of Ust-Kut city can be considered as a separate vulnerable group due to high exposure to the health risks caused by the air pollution in the area.

Therefore, disabled persons, seniors and children are considered as vulnerable groups, due to their limited physical abilities and age, as well as the lack of adequate infrastructure in Ust-Kut.

8.4.8.4 People living with HIV/AIDS

As mentioned above, the problem of HIV/AIDS morbidity and infection among population of Irkutsk Region is salient and requires urgent attention. However, the reported number of newly diagnosed HIV/AIDS cases started to decline by 2019. Nevertheless, in 2018 the incidence rate in Irkutsk Region is still 2 times higher than average incidence in the Russian Federation (69.0 per 100,000 residents) and by 1.1 times higher than in Siberian Federal District (121.6 per 100,000 residents).

Irkutsk Regional Center for the Prevention and Control of AIDS and Infectious Diseases reports that morbidity in Ust-Kut District does not exceed the regional average morbidity level (12.4 per 100 thousand of residents).

Nevertheless, as mentioned in Section 7.3.3, the trend over the period 2013-2016 does not demonstrate any decline in the level of primary HIV incidence. Importance of this problem was highlighted by Deputy Head of the Ust-Kut District Hospital during the consultations in 2017.

8.4.8.5 Low-income groups

People with income below the subsistence level (12,074 roubles) make up a significant share of Ust-Kut district population (14.88% in 2016). In 2017, the subsistence level dropped down to 11,895 roubles (Table 8.39).

Table 8.39: Subsistence level and pensions accrued in 2016/2017

Vulnerable groups	Number, persons
	Ust-Kut district, total
Subsistence level per capita, RUR	12,074/11,895
Number of population with income below the subsistence level, persons	7,452 (as by 01.01.2016)
Average amount of pensions accrued	14,432/15,282

Source: Ust-Kut District Administration, 2017; Ust-Kut City Municipality Socio-economic Development Strategy for the period till 2030

In Ust-Kut District, the number of low-income residents, (i.e. with inome below the subsistence minimum) is declining: in 2018 there were 3,710 of them, i.e. by 18% less than in 2017 (4,523 persons).[217]

Low-income individuals are considered as vulnerable as they typically:

- are less flexible in terms of adaptation to the changes in their living environment which may be caused by implementation of infrastructure projects;
- have lower level of education and scarce economic resource to establish their own business;
- have limited resources to provide the most essential items for themselves and their families.

It is particularly important to emphasize the significant role that subsidiary farming plays for low-income groups as one of the livelihood sources. In general, IFC PRs require provision of support to affected communities whose living environment becomes more vulnerable as a result of project implementation.

8.4.9 Brief characteristic of selected areas within Ust-Kut city

The below list includes the areas of Ust-Kut city exposed to potentially higher impact of the Project or being of specific interest in the context of ESIA:

- Mostootryad neighbourhood;
- The neighbourhood of single-family detached housing units located to the east of Mostootryad neighbourhood (2nd Lesnaya Street);
- Yakurim neighbourhood;
- Staraya REB and Novaya REB neighbourhoods;
- YGU neighbourhood;
- Kedr-2 Gardening Association
- Polovinka village (the village does not possess a status of a formal settlement);
- Polovinka lodge.

The above areas and territories are schematically shown in Figure 8.18.

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[217] Report of the Mayor of Ust-Kut Municipality, 2018.

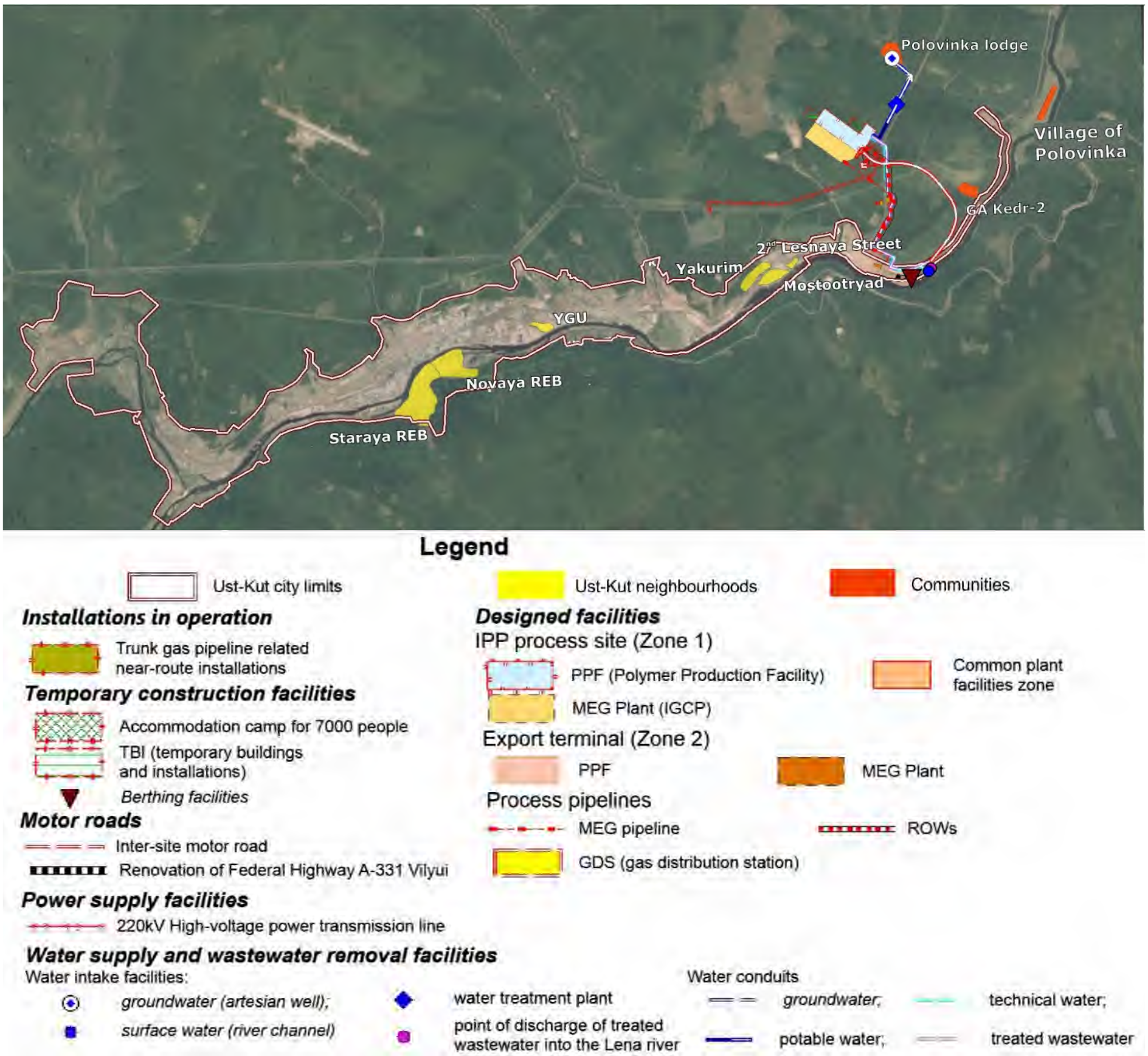

Figure 8.18: Map of Project facilities located in Ust-Kut city in relation to the city areas and territories

According to the Company and Ust-Kut City Administration, the following areas or their adjacent territories are being considered as alternative locations for construction of the INK residential area: Mostootryad/Yakurim (Mostootryad-2), Staraya REB/Novaya REB (REB-2 and additional (secondary alternative) REB-3 area), and YGU (YGU-2 and additional (secondary alternative) YGU-3 area).

According to the Feasibility Studies (FS) Report prepared by the Research Institute (NII) "Zemlya i Gorod" for selection of location for the future residential area for the Irkutsk Polymer Plant personnel, the operation phase residential area will include multiple infrastructure facilities. Therefore, the additional load on the existing municipal (particularly social) infrastructure will be largely or completely offset. In particular, development of the INK residential area will include the following elements:

- Apartment blocks;
- A general education institution (secondary school);
- Pre-school facilities (kindergartens); and
- Multi-functional consumer services block.

The FS Report provides the following design population numbers of the residential area, depending on its final location site:

- YGU-2: 3019 capita
- Mostootryad-2: 3213 capita
- REB-2: 3188 capita
- YGU-3 (secondary alternative): 4087 capita

The FS Report refers to results of the poll that was conducted in Ust-Kut using the VKontakte (VK) social media. Reportedly, people voted for Mostootryad-2 and REB-2 sites as preferred locations for the future residential area. Notably, REB-2 appeared most acceptable new home place for almost a half of respondents (45%). It should be noted that vast majority of respondents (80%) are aged 18 to 35 years, i.e. they are described as "young people".

Following a review of the above options, NII "Zemlya i Gorod" concluded in the FS Report that REB-2 site is the best location for the residential area during the Project operation phase, for the following reasons:

- Large unbuilt territories are available for development of the residential area in the future;
- Development at the YGU-2 site is hardly acceptable, as the sanitary protection zone of the future Lenskaya CHP will overlap with YGU-2;
- The sites of YGU-2 (100%) and Mostootryad-2 (65%) and adjacent territories are designated protective urban forest areas, therefore, certain land use restrictions are applicable; the REB-2 site is located outside urban forests;
- The area of Mostootryad-2 is affected by the air traffic approach lines of Ust-Kut aerodrome, which also implies limitations on the use of this area;
- The existing heating sources (subject to upgrading) can be used to serve the REB-2 area;
- REB-2 area is the most attractive for local residents, according to results of the poll in social media.

Development and/or upgrading of existing utility and social infrastructure is an important prerequisite for construction of the residential quarters in the REB-2 site. Furthermore, due to the remote location of REB-2 from the Project site, in absence of mitigation, local roads in Ust-Kut may be affected by traffic related to operation of the Project residential area (refer to Section 10.3.12).

8.4.9.1 Mostootryad and Yakurim neighbourhoods

Mostootryad and Yakurim neighbourhoods are located along the Vilyui A-331 road to the east of Ust-Kut city, close to the railway bridge on the Baikal-Amur railroad. According to the city Administration, as of 2019 population number in Mostootryad neighbourhood is 1998 persons.

No hard data was available about the number of residents in Yakurim area at the time of report writing; however, according to the field observations by Ramboll, and based on satellite imagery materials, the area may include 30-40 single-family houses and few two-storey barrack-type apartment blocks.

There are several social infrastructure facilities in Mostootryad area the brief characteristic of which is provided in Table 8.40.

Table 8.40: Main social infrastructure facilities in Mostootryad area

Description	Address	Details
Secondary school No.7	13, 2nd Naberezhnaya st.	35 teachers, 331 students
Regional Public Centre for Children Without Parental Support in Ust-Kut District	3 Molodezhnaya St.	100 places
Kindergarten No.63	1a, 2nd Molodezhnaya St.	46 of personnel (including 18 teachers), 121 children
Out-patient clinic branch of the Ust-Kut District Hospital.	11, 2nd Naberezhnaya st.	N/A

The following culture and sports facilities function in Mostootryad neighbourhood:

- Culture and Recreation Centre of Ust-Kut Municipality;
- Library of Ust-Kut Municipality;
- Gym hall.

Businesses based in the neighbourhoods of Mostootryad and Yakurim are listed in Table 8.41.

Table 8.41: Businesses based in the neighbourhoods of Mostootryad and Yakurim and adjoining territories

Entity	Main operations	Registered address
Baikal Logistika, LLC	Cargo transportation	Ust-Kut, Eastern Industrial Area, Section 3
NK Dulisma, CJSC	Crude oil extraction	Ust-Kut, Eastern Industrial Area, Section 3
NPK-Terminal, LLC	Cargo handling	Ust-Kut, Eastern Industrial Area, Section 3
MKS, LLC	Custom concrete production	Mostootryad, 21 Stroitelnaya Street (concrete mixing plant)
Ind Timber, LLC	Forest logging	Ust-Kut, Tolsty Mys village
Irkutsk Oil Company, LLC	Crude oil extraction	Ust-Kut, Tolsty Mys village
Transportno-Stroitelnaya Kompania, LLC	Cargo transportation	Mostootryad, Taezhnaya Street, Petrol Station Site
Alyans Transportnykh Predpriyatiy, LLC	Cargo transportation	Mostootryad, Taezhnaya Street, Petrol Station Site
Teploinvest, LLC	Wholesale trade of fuel and similar products	Mostootryad, Taezhnaya Street, Petrol Station Site
SibOksiTreid, LLC	Fuel gas distribution Forest logging	Mostootryad, Taezhnaya Street, Petrol Station Site
PromStroyMontazh-Irkutsk, LLC (PSM-Irkutsk)	Construction of residential and non-residential buildings	Mostootryad, Taezhnaya Street, Petrol Station Site
YeniseiTransLogistika, LLC	Cargo transportation by motor roads	Mostootryad, Taezhnaya Street, Petrol Station Site
Transportnaya Kompania "Yenisei", LLC	Cargo transportation by motor roads	Mostootryad, Taezhnaya Street, Petrol Station Site
SpetsTekhServis, LLC	Construction and drilling	Mostootryad, Taezhnaya Street, Petrol Station Site
Ust-Kutskaya Toplivnaya Kompania SK, LLC	Wholesale trade of solid, liquid and gas fuel and similar products	Mostootryad, 2nd Tayozhnaya Street

Source: Ust-Kut City Administration, 2019

The neighbourhoods of Mostootryad and Yakurim are separated by the Baikal-Amur railroad line and the Vilyui A-331 road.

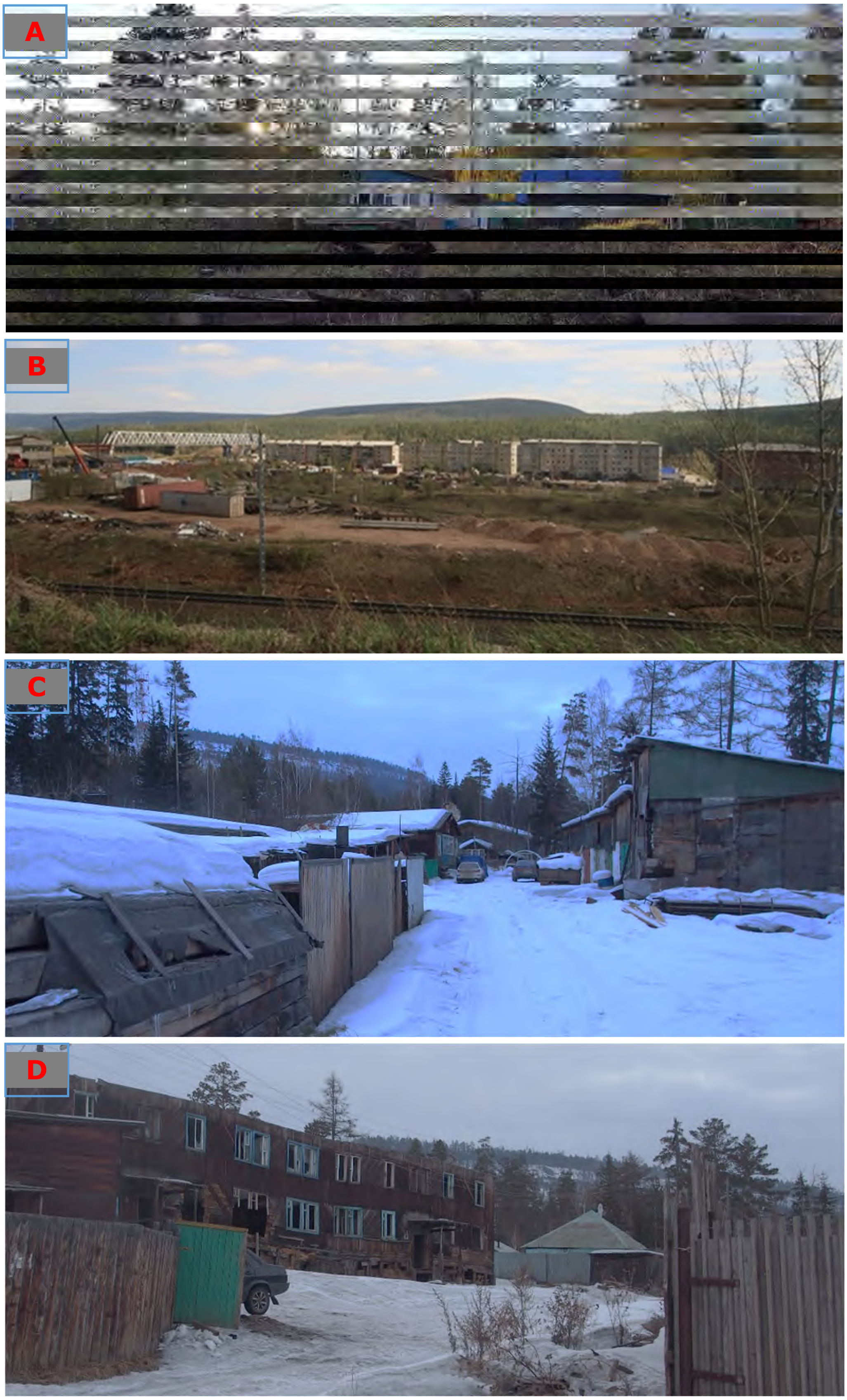

Figure 8.19: The neighbourhoods of Mostootryad (B) and Yakurim (A, C, D)

Existing infrastructure in the neighbourhoods includes a Culture and Recreation Centre, a library, and a gym.

The whole area of Mostootryad is served by power supply system (operated by Irkutskenergosbyt, LLC) and central heating networks (a boiler house is operated by Energosfera-Irkutsk, LLC). The existing water and sewerage networks (operated by UK Vodokanal-Servis, LLC) cover 97% of the neighbourhoods.

The neighbourhoods may be affected by the potential construction of residential quarters for personnel of Irkutsk Oil Company in the territory shown in the map below.

Figure 8.20: Mostootryad-2 alternative location of INK residential quarters

The neighbourhoods of Mostootryad and Yakurim are separated by the railway line; the line also separate Mostootryad from areas presumably used by local residents for subsidiary farming (to the east of Mostootryad).

According to information received from representatives of the City Administration during the consultations in 2017, residents of Mostootryad neighbourhood are exposed to the negative impact of operations of Ind Timber LLC. Facilities of this company are considered by locals as the most significant source of air pollution. In particular, uncontrolled burning of wood wastes (remains of cutting and sawdust) at Ind Timber waste disposal site continues for three year by now. The burning reportedly causes significant impacts on air quality of Mostootryad neighbourhood, in view of the prevailing wind rose.

Furthermore, the territories of Mostootryad and Yakurim adjoin the road to municipal solid waste landfill of SpetsAvto LLC, which causes further contamination of air with dust from heavy trucks on the way to the landfill, and increases the level of noise.

8.4.9.2 2nd Lesnaya Street

The area is located to the north-east of Mostootryad neighbourhood separated by the Baikal-Amur railroad and "Mostootryad No.5" operational maintenance facilities. The field observations indicate that 15 to 20 land plots with single-family detached houses and other household outbuildings are present in the area of 2nd Lesnaya Street. The Consultant's experts who visited the area in March 2019 noticed several users of the land plots, which indicates their potential occupancy during winter season. However, hard data including precise number of residents and visiting patterns by residents of Ust-Kut (frequency, seasonal variations) are not available. According to some residents of Ust-Kut, the area of 2nd Lesnaya Street may be used by people from Mostootryad for subsidiary farming.

Area to the north of the plots used for subsidiary farming and permanent or short-time residence is occupied by abandoned buildings (according to Ust-Kut Administration, in the past the buildings were used by the Ministry of Defence of the RF) and the machinery storage yards (Figure 8.21).

Figure 8.21: 2nd Lesnaya Street

8.4.9.3 YGU neighbourhood

YGU neighbourhood is located in the eastern part of Ust-Kut, near the Portovaya railway station and the residential area of Biriusinka neighbourhood, from which YGU is separated by the railway line and by Neftyanikov Street. According to the City Administration, as of 2019 YGU neighbourhood's population is 680 persons. Most buildings in the neighbourhood are single-family one- or two-storey houses, with few two-storey apartment blocks.

To the north of YGU production and storage facilities of Veles JSC are located on 32 Geologicheskaya St.; the facilities are used for production of sawn timber (plain) and unimpregnated wooden railway sleepers. Another company located at the same address is Les Sibiri LLC engaged into wood logging operations.

Area to the south of YGU is occupied by warehouse facilities (including those owned by freight forwarding company SAKHATRANSEKSPRESSSERVIS LLC, and by Alrosa-Terminal JSC), and by a berth.

Further to the north of the aforementioned facilities of Veles JSC and Les Sibiri LLC is the Perekrestok Oil fuel station. According to the District Administration, the YGU-2 alternative site of INK residential quarters is located near the fuel station (Figure 8.22).

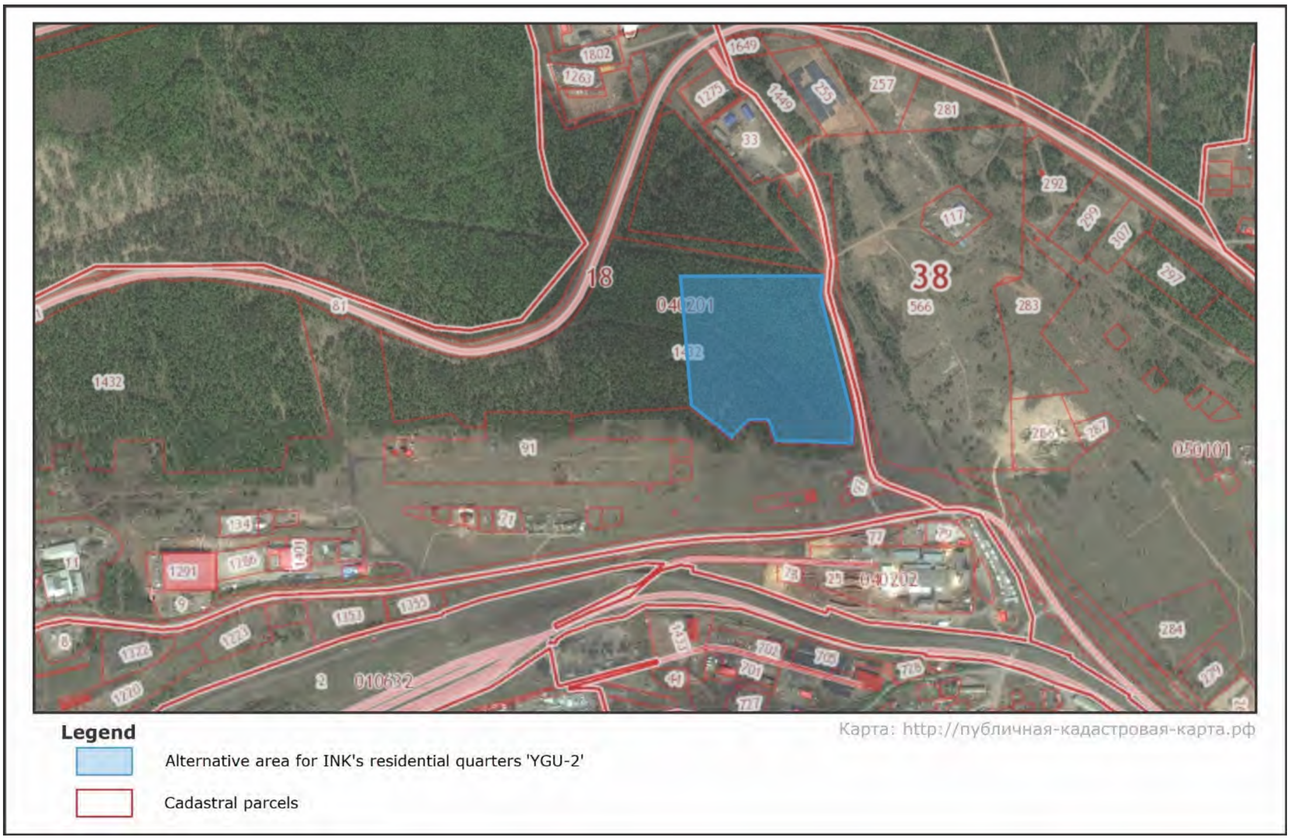

Figure 8.22: YGU-2 alternative location of INK residential quarters

The social infrastructure of YGU neighbourhood includes Kindergarten No.32 with 4 staff workers and attendance of 50 children. The municipal services coverage in the area is as follows: power supply - 100% (operated by Irkutskenergosbyt, LLC), water and sewerage - 92% (UK Vodokanal-Servis, LLC), district heating - 92% (Ust-Kutskiye Teplovye Seti i Kotelnye, LLC). The culture and recreational facilities in YGU area include a football stadium, an indoor court (ice ring), and a gym.

8.4.9.4 Staraya REB and Novaya REB neighbourhoods

The neighbourhoods of Staraya REB and Novaya REB are located on the right bank of the Lena River, near the only existent motor road bridge across the river (Figure 8.23).

Figure 8.23: View of motor road bridge across the Lena River from Staraya REB (on the left) and Novaya REB (on the right)

According to Ust-Kut City Administration, as of 2019 the neighbourhoods are densely populated: population of Staraya REB is 512 persons; of Novaya REB – 2,200 persons. Single-family houses dominate in Staraya REB neighbourhood. In Novaya REB both single-family houses and multi-storey apartment blocks are present.

An alternative site for the INK residential quarters is located close by the Staraya REB and Novaya REB (Figure 8.24).

Figure 8.24: REB-2 alternative location of INK residential quarters

The following businesses are based in the area of Novaya REB:

- Verkhnelenskoye Rechnoye Parokhodstvo, LLC (inland water passenger transportation);

- Verkhnelenskaya Sudokhodnaya Kompania, LLC (inland water cargo transportation).

Information on utility service availability is summarised in Table 8.42.

Table 8.42: Power, water and heating utility services available in the areas of Staraya REB and Novaya REB

	Novaya REB	Staraya REB
Power supply (%)	100	100
supplier	Irkutskenergosbyt, LLC	
Water supply (%)	100	57
supplier	UK Vodokanal-Servis, LLC	
Sewerage (%)	100	0
wastewater treatment plant	UK Vodokanal-Servis, LLC	
District heating (%)	100	63
boiler house;	Lenskaya Teplovaya Kompaniya, LLC	

Source: Ust-Kut City Administration, 2019

Out-patient clinic branch of the Ust-Kut District Hospital functions in Novaya REB. Social infrastructure of Staraya REB includes Secondary School No.6 (as of 2019: 33 teachers, 353 students) and Kindergarten No.13 (as of 2019: 7 staff workers, 88 children). A Culture and Library Centre is also located in Novaya REB.

8.4.9.5 Kedr-2 Gardening Association

As already mentioned in this Chapter, Kedr-2 Gardening Association is located at a distance of 3 km of the main Project site and belongs to the agricultural land category. Distance from the gardens to the future Project interfacility road is 350 m. At present, existing motor road in the close vicinity of the GA Kedr-2 gardens is used by the Company's trucks.

According to observations made by Ramboll in 2017 and 2019, residents of Ust-Kut city and district use the gardens for subsidiary farming: growing of crops for own consumption. No signs of permanent residence in the gardens in winter time were found during the site visit.

Figure 8.25: Kedr-2 Gardening Association

Information collected during consultations with various stakeholders in 2019 did not confirm that former court prisoners reside in the area of the gardening association, which was presumed at Preliminary ESIA stage.

8.4.9.6 Polovinka village

Area of the former Polovinka village is located on the left bank of the Lena River, close by the Vilyui A-331 road, to the south-east of the main Project site. Administratively, the area is a part of Ust-Kut city. Its permanent population consists of two households; however total number of 10 families reside in Polovinka in summer seasons. During the interviews, representatives of such families explained that their parents lived in the village long time ago and, therefore, they regard this land as "ancestral". There is a village cemetery to the south-west of the residential houses.

At an earlier time, the village belonged to Podymakhino rural municipality.

During the site visit, the Consultant observed construction of new houses and auxiliary buildings.

Figure 8.26: Kedr-2 Gardening Association

Currently, the main activity in Polovinka village is subsidiary farming (growing crops and breeding animals). According to the interviewed villagers, the area is officially registered as a gardening association; however, this information was not confirmed by the Ust-Kut City and District Administration. On the other hand, according to the data of SPARK-Interfax, the Polovinka Gardening Association was registered in 2014 in Ust-Kut with the following primary activities listed: growing of grain (except rice), pulse and oil crops as main activity. The secondary activities of the association are dairy farming, production of raw milk, pig farming, poultry farming, etc.

8.4.9.7 Polovinka lodge

Polovinka lodge is located to the north-east of the main Project site. At present, the Project drilling activities are being conducted in the lodge area (Figure 8.27).

Figure 8.27: Borehole drilling for the Project

Old building frames in the area are remains of the penal colony settlement that existed here until 1990-s. There is also a building in Polovinka lodge which is presumably used by a local hunter (according to the Administration, the lodge serves as a “base” for the hunter’s activities). Tracks of a snowmobile were observed during the site visit (Figure 8.28).

Figure 8.28: Polovinka lodge territory

8.5 Community Health, Safety and Security

8.5.1 Public order

According to the Report[218] of the Ust-Kut Department of the Ministry of Internal Affairs of Russia, the police service in the city was under-staffed by 26 agents, as of the end of 2015. The crime rate in Ust-Kut in 2015 is reported to be among the highest in the region, with 268 offences per 10,000 residents. In 2015, the main problems in the sphere of public order were defined as follows:

- Illicit sale of alcohol and drugs.
- Road traffic safety violations (including driving under influence, severity of road accidents consequences in 2015 increased by 2.6%).
- Theft and fraud (increase by 118% compared to the indicator's value in 2014).

During the consultations in 2017, the Head of the Ust-Kut Department of the Russian Ministry of Interior named the following public order issues in Ust-Kut:

- former court prisoners settling in the city and gardening partnerships upon release from the penal colony settlement in Ust-Kut;
- vulnerability of shift workforce who become victims of offences committed under influence of alcohol or narcotic drugs at, in most cases, night time;
- increasing tendency of offences committed under influence of alcohol or narcotic drugs;
- in general, Ust-Kut is considered to be the most "criminal" city in Irkutsk Region, alongside Cheremkhovo city as confirmed by the abovementioned report.

It was also mentioned that the high-security penal prison was closed in 2016, and only the penal settlement remained in Ust-Kut. By 2017, the penal settlement's population was circa 200 court prisoners.

[218] Ministry of Internal Affairs of Russia Department for Ust-Kut. Information and analysis memo on the results of operation of IM of Russia Department for Ust-Kut during 12 months of year 2015.

The structure of crime remained fairly stable during recent years, with a dominating share of property offences. A decline has been reported for certain components of crime:

- 3 cases of robbery were reported in 2018 (62% reduction in comparison with 2017 figures);
- the number of arsons in 2018 dropped by 25%;
- the number of home thefts dropped by 10%, home-invasion robberies – by 26%;
- reported frauds by means of cell phone communication decreased by 26%; several fraud cases were solved in the previous year.

In 2018, the number of plunder offences remained at about same level as a year before (reduction by 2%), and automobile thefts decreased by 6% (from 34 to 32 cases).

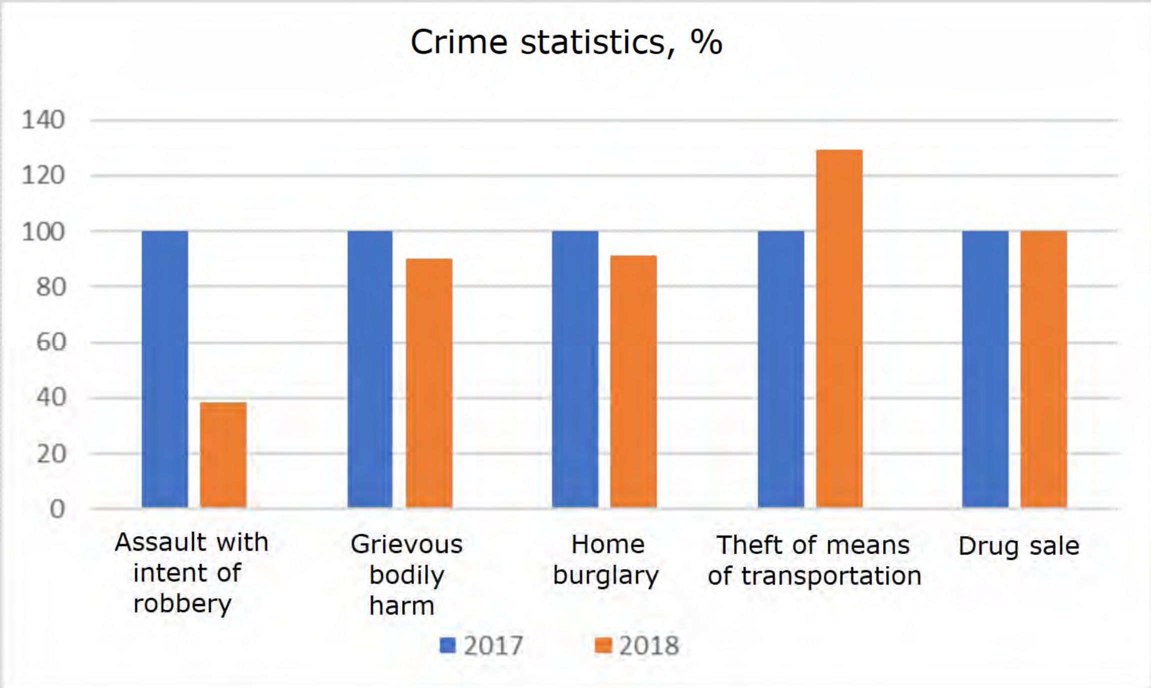

Figure 8.29: Criminal statistics in Ust-Kut District Municipality, 2017-2018, %

Most offences are committed by persons aged between 25 and 29 y.o. (91 offences) and between 30 and 39 y.o. (143 offences).

A growth is reported in the number of crimes committed by juvenile offenders (Table 8.43).

Table 8.43: Offences and crimes in Ust-Kut city and district, 2014-2018

Description	Ust-Kut District				
	2014	2015	2016	2017	2018
Total number of registered offences, including	1218	1361	1207	1384	1396
by juvenile offenders (teen crime)	56	44	47	58	61

Source: Ust-Kut District Administration, 2017; Department for Ust-Kut of the Ministry of Internal Affairs. Information and analysis memo on the results of operation of the Department for Ust-Kut during 12 months of year 2018.

Most crimes were committed by juvenile offenders between 7 a.m. and 8 p.m. which, according to the District Head, may indicate idleness of teenagers during study-free time.

In 2018, the main efforts of enforcement authorities were focused on combating arms and drug trafficking, illegal migration, organized crime and corruption, improvement of proactive control of crime, prevention of illicit sale of alcohol and drugs, improving road traffic safety.

11,008 traffic offences were reported in 2018, including 496 under-influence driving cases.

8.5.2 Natural disasters

According to information[219] received from the Advisor of Ust-Kut Municipality on Civil Defense and Emergency Response, long-term observations indicate presence of flood risks in Ust-Kut district. Recent statistical data demonstrate that high water levels resulted in partial flooding of the following settlements of Ust-Kut district:

- 2010, 2013: Ust-Kut city, Kaymonovo settlement;
- 2010: Orlinga village;
- 2015: Zvezdny settlement.

In May 2010, water level in Ust-Kut elevated to 712 cm, i.e. 12 cm above the critical level. The flood was caused by heavy rains and increasing daily mean temperatures, and resulted in flooding of houses in the following areas of the city:

- Ust-Kut station area: 4 houses;
- Karpovo: 6 houses;
- REB: 2 houses.

Early start of ice drift and heavy rains, alongside with increasing daily mean temperatures and extensive snow-melting process in April-May 2013, resulted in rise of water level in the Lena River to 660 cm (the critical level is 700 cm) in Ust-Kut city (Ust-Kut station and Karpovo area); the maximum water level in the Kuta River (the Ruchey monitoring station) was 583 cm (critical level 590 cm). In April one section of road bridge across Kuta River at Island Domashniy collapsed. The elevated water level in River Kuta also resulted in partial flooding of the Vilyui federal motor road. Houses were flooded in the following settlements:

- Kaymovo: 3 houses;
- Ust-Kut (Karpovo area): 2 houses.

In 2015 the municipal administration implemented specific measures to prevent reoccurrence of the events of 2013, including, *inter alia*, preparation of a list of all settlements prone to flooding, and list with names of residents subject to evacuation. As a result of these actions, the high water period in 2015 was relatively safe, with the only exception: dramatic rise of water level in River Niya flooded 9 houses occupied at the time by 35 persons.

It is noted[220] that the main problem related to high water periods is lack of funding for flood-protection activities (including flood prevention measures).

Another source of potential natural disasters is the high risk of fires in Irkutsk Region in general and in Ust-Kut district in particular. Local forests are classified as "high fire danger" forests by the Irkutsk Department of the Ministry of the Russian Federation for Civil Defense, Emergency Management and Natural Disasters Response. It is reported that forests of this category create specific threats for settlements in the form of fire and smoke contamination[221].

8.6 Cultural Heritage and Archaeological Value of the Area

Ust-Kut is one of the oldest settlements on the Lena River, and at the same time one of the youngest cities of Irkutsk Region. The city is first mentioned in 1629, however the year of foundation is deemed to be 1631. Since its foundation, Ust-Kut served as "window to the North" for travellers and migrants on their way to the Laptev Sea.

In 1925, health resorts were established in the city, using the nearby resource of water with low content of hydrogen sulphide and high radioactivity. The city area is also rich in therapeutic muds with high radon

[219] Analysis of operation of Ust-Kut Section of Irkutsk Region Area of the Russian System of ES Prevention and Response for ensuring safety during spring high water period 2015

[220] *Ibid.*

[221] Main Department of the MES of Russia for Irkutsk Region. Characteristic of the Subject. Access point: http://38.mchs.gov.ru/document/3064843

content, which made it a popular destination for sanatorium therapy in 20th century (see also Section 8.4.6.2).

Ust-Kut acquired the ‘city’ status in 1954, which coincided with a start of development of the local oil and gas deposits and transformation of the district into industrial centre.

It is important to note that historically the area of today’s Ust-Kut district and Ust-Kut city was occupied by indigenous small-numbered peoples of the North, including sedentary communities (for more details please refer to Section 8.4.3).

Table 8.44 below provides the list of the heritage sites identified in Ust-Kut district (with indication of their type and historical period they belong to), of which the closest to the proposed Project site are Yakurim and Sukhoi Ruchei sites (No.32 and No. 33, respectively). This information was used by the archaeologists who conducted the survey for more accurate location of the areas of potential finds.

Table 8.44: List of identified heritage sites in Ust-Kut district

No.	Type	Description	Period	Location	Date of identification
1	settlement site	Basovo-1	4-5 millenia B.C., 1-2 millenia A.D.	Right bank of the Lena River, 1.5 km upstream of Basovo village	1973
2	settlement site	Basovo-2	4-5 millenia B.C., 1-2 millenia A.D.	Right bank of the Lena River, 1.5 km upstream of Basovo village	1973
3	settlement site	Dudkino	4-5 millenia B.C.	Left bank of the Lena River, 1 km upstream of former Dudkino village	1973
4	settlement site	Tarasovo	2-1 millenia B.C.	Right bank of the Lena River, 1.3 km upstream of Tarasovo village	1973
5	settlement site	Kokuj	1 millenia B.C. – 1 millenia A.D.	Right bank of the Lena River, 6.5 km downstream of Tarasovo village, upstream of former Kokuj village	1983
6	settlement site	Nyashynsky Perekat-1	6-5 millenia B.C. 1-2 millenia A.D.	Left bank of the Lena river, 7 km downstream of Boyarsk village	1972
7	burial site	Nyashynsky Perekat-1	1-2 millenia A.D.	Left bank of the Lena river, 7 km downstream of Boyarsk village	1972
8	settlement site	Nyashynsky Perekat-2	1-2 millenia A.D.	Left bank of the Lena river, 7 km downstream of Boyarsk village	1983
9	burial site	Nyashynsky Perekat-2	1-2 millenia A.D.	Left bank of the Lena river, 7 km downstream of Boyarsk village	1973
10	settlement site	Riga-1	4-8 millenia B.C.	Right bank of the Lena River, 1.0 km downstream of former Riga village	1973
11	settlement site	Riga-2	4-8 millenia B.C.	Left bank of the Lena River, on the opposite bank from former Riga village	1983
12	settlement site	Vodyanisny Ruchei	10-12 millenia B.C.	Right bank of the Lena River, 5.0 km downstream of former Potapovo village	1941
13	settlement site	Turuka	2-1 millenia B.C.	Right bank of the Lena River, 1 km upstream of Turuka village	1966
14	burial site	Turuka	5-4 millenia B.C.	Right bank of the Lena River, near Turuka village	1992 1993
15	settlement site	Turuka-1	6-5 millenia B.C.	Right bank of the Lena River, 1 km to the north-west from Turuka village	1992
16	settlement site	Turuka-2	3-1 millenia B.C.	Right bank of the Lena River, 1 km to the west from Turuka village	1992
17	settlement site	Turuka-3	6-3 millenia B.C.	Right bank of the Lena River, 1.7 km to the north-west from Turuka village	1992
18	settlement site	Turuka-4	1-2 millenia A.D.	Right bank of the Lena River, 1.8 km to the north-west from Turuka village	1992
19	settlement site	Turuka-5	4 millenia B.C. – 1 millenia A.D.	Left bank of the Lena River, on the opposite bank from Turuka village	1992
20	settlement site	Tungussky Ruchei-1	6-2 millenia B.C.	Left bank of the Lena River, 5 km to the west from Turuka village	1989

No.	Type	Description	Period	Location	Date of identification
21	settlement site	Tungussky Ruchei-2	3-1 millenia B.C.	Right bank of the Lena River, 4.5 km to the west from Turuka village	1989
22	settlement-burial site	Butakovsky Ruchei	5 millenia B.C. – 1 millenia A.D.	Left bank of the Lena River, 7.5 km downstream of Turuka village	1992
23	settlement site	Shipichny Ruchei	6-2 millenia B.C.	Right bank of the Lena River, 8 km downstream of Turuka village	1994
24	burial site	Zakuta	3-4 millenia B.C.	Left bank of the Lena River, Zakuta village in Ust-Kut city	1994
25	settlement site	Ust-Kuta	14-12 millenia B.C.	Left bank of the Lena River, northern edge of the western outskirts	1992
26	settlement site	Zyrianovka-1	14-12 millenia B.C.	Right bank of the Lena River, 0.5 km downstream of Zyrianovka village	1989
27	settlement site	Zyrianovka-2	1-2 millenia B.C.	Right bank of the Lena River, to the east from Zyrianovka village	1989
28	settlement site	Tchaika-1	4-1 millenia B.C.	Right bank of the Lena River, 1.2 km downstream of Zyrianovka village	1991
29	settlement site	Tchaika-2	10-8 millenia B.C. – 1 millenia A.D.	Right bank of the Lena River, 1.7 km downstream of Zyrianovka village	1990
30	settlement site	Bragin Ruchei	30-10 millenia B.C.	Right bank of the Lena River, REB Village, suburb of Ust-Kut	1992
31	settlement site	Biriusinka	10-6 millenia B.C.	Left bank of the Lena River, 0.3 km to the west from Ust-Kut city	1985
32	settlement site	Yakurim	30-10 millenia B.C.	Left bank of the Lena River, 2.0 km to the south-west from Yakurim village	1966
33	settlement site	Sukhoi Ruchei (BAM most)	10-6 millenia B.C.	Left bank of the Lena river, 2.0 km downstream of Ust-Kut city	1985
34	settlement site	Rak Ruchei	1-2 millenia B.C.	Right bank of the Lena River, 3.0 km upstream of Polovinka village	1985
35	settlement site	Chudnichny Ruchei	5-1 millenia B.C.	Right bank of the Lena River, 1.0 km downstream of Polovinka village	1985
36	settlement site	Zaostrovy Ruchei	6-3 millenia B.C.	Right bank of the Lena River, 6.0 km upstream of Podymakhino village	1992
37	settlement site	Perevoz	3-1 millenia B.C.	Right bank of the Lena River, 4.0 km upstream of Podymakhino village	1993
38	settlement site	Ust-Karolikha	4-1 millenia B.C.	Left bank of the Lena River, 3.0 km upstream of Podymakhino village	1992
39	settlement site	Gluboky Ruchei	6-2 millenia B.C.	Right bank of the Lena River, 1.0 km upstream of Podymakhino village	1993
40	settlement site	Ust-Kazarka-1	10-2 millenia B.C.	Left bank of the Lena River, 1.5 km to the west from Novaya Kazarka village	1993
41	settlement site	Ust-Kazarka-2	10-2 millenia B.C.	Left bank of the Lena River, 1.0 km to the north-west from Podymakhino village	1993
42	settlement site	Ust-Kazarka-3	16-10 millenia B.C.	Left bank of the Lena River, 0.5 km to the west from Novaya Kazarka village	1993
43	settlement site	Novaya Kazarka-1 (Podymakhino)	6-5 millenia B.C.	Right bank of the Lena River, on the opposite bank from Novaya Kazarka village	1986
44	settlement site	Novaya Kazarka-2 (Podymakhino)	8-6 millenia B.C.	Right bank of the Lena River, on the opposite bank from Novaya Kazarka village	1986

No.	Type	Description	Period	Location	Date of identification
45	settlement site	Novaya Kazarka-2 (Podymakhino)	14-10 millenia B.C.	Left bank of the Lena River, 1.0 km to the north from Novaya Kazarka village	1993
46	settlement site	Chudnichny-Kazarki-1	20-16 millenia B.C.	Left bank of the Lena river, 2 km downstream of Novaya Kazarka village	1993
47	settlement site	Chudnichny-Kazarki-2	4-1 millenia B.C.	Left bank of the Lena River, 1.8 km downstream of Novaya Kazarka village	1993
48	settlement site	Yarukha	10-8 millenia B.C.	Left bank of the Lena River, 3.0 km to the north-east from Novaya Kazarka village	1993
49	settlement site	Yelovka	4-1 millenia B.C.	Left bank of the Lena River, 5.3 km downstream of Novaya Kazarka village	1993
50	settlement site	Kokuj-Ubiyennaya	1 millenia B.C. – 1 millenia A.D.	Left bank of the River Lena, 1.0 km to the south-east from Kokuj	1985
51	settlement site	Ust-Ubiyennaya	4-1 millenia B.C.	Left bank of the Lena River, 1.5 km to the east from Kokuj	1994
52	settlement site	Ust-Verkhniaya Bocakhta	3-1 millenia B.C.	Right bank of the Lena River, 4.0 km upstream of Tayura village	1994
53	settlement site	Vneshny Ruchei	12 millenia B.C. – 1 millenia A.D.	Right bank of the Lena River, 1.0 km upstream of Tayura village	1994
54	settlement site	Tayura-1	12-6 millenia B.C.	Right bank of the Lena river; Tayura village	1986
55	settlement site	Tayura-2	4-2 millenia B.C.	Right bank of the Lena River, on the opposite bank from Tayura village	1986
56	settlement site	Novoselovo	1 millenia B.C.	Left bank of the Lena River, 1.0 km upstream of Novoselovo village	1994
57	settlement site	Sukhovsky Ruchei	4-2 millenia B.C.	Left bank of the Lena River, 7.0 km downstream of Novoselovo village	1986
58	settlement site	Gremyachy Ruchei (Letnik)	8-6 millenia B.C.	Right bank of the Lena River, 9.5 km downstream of Novoselovo village	1986
59	settlement site	Nazarovo	3-2 millenia B.C.	Right bank of the Lena River, 2.5 km upstream of Nazarovo village	1986
60	settlement site	Ust-Sennaya	3-2 millenia B.C.	Left bank of the Lena River, 3.0 km upstream of Verkhnemarkovo village	1993
61	settlement site	Verkhnemarkovo-1	4-1 millenia B.C.	Left bank of the Lena River, 5.0 km upstream of Verkhnemarkovo village	1986
62	settlement site	Verkhnemarkovo-2	12-10 millenia B.C.	Left bank of the Lena River, 2.0 km to the north-west from Verkhnemarkovo village	1994
63	settlement site	Zayarnovo	7-6 millenia B.C.	Left bank of the Lena River, Zayarnovo village	1966
64	settlement site	Domashniy Ruchei	3-1 millenia B.C.	Left bank of the Lena River, 2 km downstream of Kajmonovo village	1993
65	settlement site	Kurort Ust-Kut	3-1 millenia B.C.	Right bank of the Lena River, 0.2 km to the north from the Ust-Kurt Resort	1986
66	settlement site	Ust-Kut-2	12-10 millenia B.C.	Right bank of the Lena River, 0.5 km to the north from Zakuta village in Ust-Kut city	1992
67	settlement site	Kokuj (Ubiyennaya-2)	12-10 millenia B.C.	Right bank of the Lena River, 2.0 km to the east from Kokuj	1994
68	settlement site	Ruchei Domashniy	11 millenia B.C. – 1 millenia A.D. (1-5 century A.D.)	Right bank of the Lena River, at the mouth of Domashny creek, 2 km from Basovo village	1999
69	settlement site	Zhemchiugova	16-14 millenia B.C.	Right bank of the Lena River, 1.5 km to the east from Zhemchiugova village	2001

Source: Ust-Kut Historical Museum

In December 2018, the Company received a feedback to information request, in which the Heritage Conservation Service of Irkutsk Region confirms absence of heritage sites in the area selected for construction of the Irkutsk Polymer Plant. The land plot is located outside of heritage protection and buffer zones.

In 2014 INK engaged Raritet LLC to conduct archaeological survey[222] covering the following land plots in Ust-Kut district:

- land plot requested for construction of LPG/LGC reception, storage and shipment terminal (LPG Terminal) and associated access road;
- land plot requested for construction of the high-voltage 10 kV from Yakurim substation to the LPG Terminal;
- land plot requested for construction of oil and gas with railroad spur, with the total area of 54.6131 ha;
- land plot requested for access road to the LPG Terminal, with the total area of 21.18 ha.

The survey concluded that no heritage sites or other artefacts are present in the surveyed area.

During the consultations in 2017 and 2019, the head of the local history and culture museum mentioned that archaeological chance finds are occasionally encountered during construction activities in Ust-Kut town and districts, and some of the finds are of a cultural and historical value. The chance finds can be attributed to ancient history, or to the activities of indigenous small-numbered peoples of the North.

Therefore, considering that heritage sites are present in Ust-Kut District (settlement sites, burial grounds, etc.), there is a risk that similar sites may be found in the Project area, particularly in the territories where no detailed archaeological surveys were conducted. Such areas may include the site of the offloading terminal (about 3.2 ha), service water supply and drainage facilities on the Lena river, drinking water supply facilities in the valley of the Polovinnaya River, sites of the linear facilities connecting Areas 1, 2, 3 and 4 (refer to Section 5.4) with each other and with the existing external infrastructure facilities in the City of Ust-Kut and Ust-Kut District.

8.7 Conclusions

Out-migration flows are observed both in Irkutsk Region and in Ust-Kut District. At the regional level this situation is explained by migration of young professionals seeking better wages in the European part of Russia or in other countries. The proportion of "youth" age category in the total population number is significant, and young people are prone to emigration.

Data at the level of Ust-Kut district and Ust-Kut city demonstrate overall decline in population numbers, which is attributable to the emigration trend, and natural decline. The number of district population of employable age is dropping, while the number of dependent persons (minors and retired persons) is steadily growing.

Respiratory diseases are the most common cause of morbidity among all age groups of Ust-Kut residents. The problem of HIV/AIDS morbidity was specially highlighted in 2017, however, situation improved by 2019. The problem of HIV/AIDS is still pressing, but its incidence rate in Ust-Kut area does not exceed the average level in the Region. In 2017 representatives of city's healthcare institutions highlighted the issues of drug abuse, tuberculosis and alcoholism. During consultations held in 2019, the head of the hospital did not name alcoholism and drug abuse among the most pressing problems.

Extractive industry plays important role in the structure of economy in the district and region. The role of INK in economic development of the region and, in particular, of Ust-Kut district is emphasized by the local stakeholders. Average accrued salary in the sector is by far higher than in other sectors. Other significant sectors in Ust-Kut city and Ust-Kut district economies are wood processing, construction and transport.

The local public health system suffers the lack of personnel of certain specializations. However, condition of healthcare infrastructure in general (including health resorts) is satisfactory. The education system is

[222] R&D Report: Implementation of measures aimed at conservation of an area having indications of archaeological heritage located within the land area requested for construction of the integrated facility for LPG reception, storage and offloading terminal, access road to the above facility, 10kV power transmission line from Yakurim substation to the site of the LPG reception, storage and offloading terminal, oil and gas facilities with railway tracks in Ust-Kut District, Irkutsk Oblast. - Irkutsk: OOO "Raritet", 2014

estimated as satisfactory, despite certain deficiencies (e.g. poor accessibility of selected educational establishments for some groups of children, reduction of education programmes).

From the perspective of municipal infrastructure development, it is noted that the rate of housing construction has significantly increased due to participation of Ust-Kut in the federal programme for relocation of residents from dilapidated and substandard houses. Boiler houses in the city are regularly upgraded. The plans for conversion of district heating system for gas-based operation have been suspended. The road network, although relatively well-developed, is in poor condition, due to the substandard quality of the roads and the damage caused, *inter alia*, by the businesses operating in Ust-Kut Municipality.

The following vulnerable communities have been identified around the proposed site of the Polymer Plant, which may require specific mitigation steps on the part of the Company:

- persons with disabilities, seniors and children;
- persons living with HIV/AIDS;
- low-income groups.

The following groups have been excluded from the list of vulnerable communities, based on the assessment results:

- residents of Mostootryad and Yakurim neighbourhoods;
- former court prisoners residing in gardening associations.

Crime rate in Ust-Kut is among the highest in Irkutsk Region. In 2017, representatives of the local police department (part of national Ministry of Internal Affairs) highlighted the problem of "narcotization" of offences. An increase of crimes and offences committed by juvenile offenders was reported in 2019.

The area of Ust-Kut city and Ust-Kut district is exposed to regular flood risks. Serious floods occurred in the city and other settlements of the district in 2010, 2013 and 2015. Forest fires are another source of risk for residents of Ust-Kut district.

Considering that heritage sites are present in Ust-Kut District (settlement sites, burial grounds, etc.), there is a risk that similar sites may be found in the Project area, particularly in the territories where no detailed archaeological surveys were conducted.

9. ENVIRONMENTAL IMPACT ASSESSMENT

9.1 Air Quality Impact Assessment

This section provides a preliminary generalized assessment of possible impact from the operation of the proposed Polymer Production Facility on the level of chemical pollution of the near-ground atmosphere within the PPF site. The information provided by INK on the composition of the proposed installations, their intended location and functional purpose, the composition of raw materials and manufactured products was used as baseline data.

Due to the lack of technological information on the composition, distribution and sources of air emissions, the assessment of air pollution within the site of the proposed Polymer Production Facility is preliminary.

As regards the PPF project, it should be noted that the main production facilities and tank farms are located on a site in Zone 1, which is adjacent to IGCP, and, in addition, the PPF will utilize flare systems designed to ensure the IGCP operation, among other things. The PPF's finished products site and chemical plant will be located in Zone 2 (the "lower zone"), a part of a large industrial zone, which houses the UKGFU, the LPG/LGC RSST and IGCP's finished product tank farms.

Thus, the air quality in Zone 1 will be affected by cumulative emissions from emission sources at both the PPF and the IGCP, and in Zone 2 by emissions from sources at the UKGFU, the LPG/LGC RSST, the PPF and the IGCP.

When evaluating the air impact in the vicinity of the PPF and the IGCP it is also necessary to consider constant pollutant emissions from the sawmill residue disposal site located 600 m west of the border of the PPF's Zone 1. Wastes stored at that site are constantly burning causing visible air pollution that extends over a considerable distance, sometimes as far as the eastern suburb of Ust-Kut.

Without a fundamental solution to the problem of burning logging residue, it will be almost impossible to achieve prescribed levels of atmospheric air quality, either within the common SPZ of the PPF and the IGCP or in air of working zones within the industrial site.

9.1.1 Basic requirements for assessing the impact of the proposed activity on air quality. Air pollution sources overview

The polymer production facility is a natural gas processing company and a hazard class I enterprise with the corresponding SPZ sized 1000 m according to SanPiN 2.2.1/2.1.1.1200-03.

The size of the sanitary protection zone should be chosen to prevent the maximum allowable concentrations (MACs) for air pollutants in residential areas and the maximum allowable levels (MALs) for physical air impact from being exceeded at its boundary or beyond. At the same time, for groups of industrial or production facilities and for an industrial hub, sanitary norms require the establishment of a common sanitary protection zone, both estimated and final, taking into account the totality of air emissions and physical impact from sources at industrial and production facilities included in that common zone.

Therefore, taking into account the proximity of the Polymer Production Facility, Ramboll believes it would be best, in terms of compliance with the sanitary norms, to develop a project for a common sanitary protection zone for the PPF and the IGCP.

Since at this design stage the main technological parameters of emissions sources at the PPF and the IGCP have not been identified, in its ESIA Ramboll assumes it will be possible to give an approximate assessment of the facility's impact on the quality of near-ground air for the operation phase.

9.1.2 Air quality impact during the construction phase

Emissions of pollutants during the construction phase are associated with the operation of transport, construction machinery and mechanisms, welding and painting work. Transportation and loading/unloading of loose materials may cause air dusting.

The main pollutants released from running engines are: carbon monoxide, nitrogen oxides, soot, sulfur dioxide, hydrocarbons (gasoline, kerosene).

During earthworks and loading/unloading operations, inorganic dust is emitted into the atmosphere: 70-20% SiO_2.

In the process of welding, welding aerosol components (iron oxide, manganese and its compounds, etc.), nitrogen oxides, carbon oxide are released into the atmosphere.

During painting works, volatile components of varnishes and paints (xylene, toluene, butyl acetate) are emitted into the atmosphere.

An assessment of pollutant emissions during construction of similar facilities (Zabsibneftekhim (Tobolsk), Nizhnekamskneftekhim (Nizhnekamsk)) showed that NOx emissions make the greatest contribution to air impact.

A preliminary assessment of emissions during the construction of the PPF showed that at the boundary of the prescribed SPZ (1000 m from the PPF site border) NOx concentrations are not expected to be higher than 0.1–0.2 $MAC_{ot.max}$[223]. Thus, the quality of atmospheric air at the SPZ boundary and beyond the SPZ will meet the hygienic standards.

One of the top priority pollutants during welding is manganese and its compounds. At the SPZ boundary, the concentration of manganese can reach 0.5-0.6 $MAC_{ot.max}$.

Concentrations of other pollutants (CO, xylene, toluene, butyl acetate, iron oxide, sulfur dioxide, etc.) will not exceed 0.1-0.2 $MAC_{ot.max}$ at the SPZ boundary of Zone 1.

Construction and installation work in Zone 2 are quite different in its nature and scope from construction and installation work in Zone 1. The main construction sites will include finished goods warehouses, the main type of work affecting the quality of atmospheric air will be painting of the warehouses. Due to the fact that during the operation of the UKGFU, LPG/LGC RSST, and PPF, facilities located in Zone 2 there will be practically no emissions similar in composition to emissions resulting from painting work, and, therefore, no cumulative effect is expected from xylene, toluene, and butyl acetate emissions, the concentrations of those substances at the SPZ boundary of Zone 2 will not exceed 0.1 MAC.

9.1.3 Air quality impact during the operation phase

Sources of pollutant emissions

During the operation of the PPF air emissions result from the following process equipment:

- ethylene production units;
- polyethylene production units;
- butene-1 production units.

As regards the plant's offsite facilities, the main sources of emissions are boiler houses, flare units, tank farms, chemical plant and wastewater treatment plants, including a waste incinerator.

Pollutants are emitted by sources of controlled and fugitive emissions.

Point sources include stacks of the cracking furnaces of the ethylene production unit and the butene-1 production unit, steam boilers, boiler houses (Zone 1 and Zone 2), flare stacks and the waste incinerator stack.

The cracking furnaces of the ethylene and butene-1 production units run on fuel gas, which is a mixture of hydrogen-containing flue gas, flue gas (methane) from the demethanizer, and imported fuel gas.

High-pressure steam boilers run on C5+ fraction fuel gas coming from the ethylene production unit and on C6+ fraction coming from the butene-1 production unit.

Under normal operating conditions, the mass of pollutant emissions from controlled emission sources will constitute 95% of the total mass of emissions. Based on analogous projects, the total mass of emissions

[223] $MAC_{ot.max}$ - Maximum one-time maximum allowable concentrations of pollutants in the air of residential areas

from the operation of an ethylene production unit with a capacity of 600,000 tons per year is approximately 2600 tons/year, including:

NOx - 650 tons/year;

CO - 1800 tons/year.

Under normal operating conditions, the main equipment operates under high pressure and temperature, with virtually no possibility of fugitive emissions of volatile organic compounds (VOCs) through equipment leaks.

The project provides for technical solutions aimed at reducing VOC emissions during normal operation of the equipment through their entrapment and combustion at high- and low-pressure flares.

The flare system of the polymer production facility is designed to burn combustible hydrocarbon gases and vapors generated in emergency situations, at the time of starting up the process equipment and shutting it down for repair, and at the time of setting the process parameters.

There are no continuous discharges into the flare system from the process equipment and offsite plant facilities. As designed, the flare system is common for the entire project, since it deals with discharges from all the project's process units and offsite facilities, which cannot be shut down simultaneously.

The flare system's performance rate (throughput) is calculated based on the maximum emergency discharge from the ethylene production unit, taken with a coefficient of 1.5, and is 585,000 kg/h.

The height of the flare stack is 120 m, smokeless combustion of waste gases is achieved by supplying water vapor to the flare tip.

High pressure flare headers receive discharges from:

- ethylene, butene-1 and polyethylene production units;
- industrial park No. 1 and its pumping station;
- industrial park number 2;
- liquid ethane and ethylene evaporation unit;
- ethane and ethylene storage pumping station;
- ethane and ethylene storage depot;
- gaseous ethane tanks.

Periodic and emergency discharges from the polyethylene production unit are sent to the low-pressure flare header.

The flare system is equipped with a control and automation system, which:

- controls the flow rate of flare discharge and natural gas supplied to the pilot burners and to the gas seal;
- controls pressure in the flare header and at the base of the flare stack;
- ensures level control in the flare separator and the condensate collecting tank;
- controls the minimum allowable pressure of natural gas in the pilot burners;
- controls the minimum allowable flow rate of purge gas to the gas seal.

Hexene-1, isopentane, cyclohexane and ethylene glycol are stored at the tank farm under a nitrogen blanket.

The storage tanks for propane and isopentane are interconnected in gas space by individual gas equalization lines to reduce pressure drops in a separate tank during reception and distribution operations.

For protection against overpressure, the tanks are equipped with working and standby safety valves. When the safety valves are triggered discharges are sent to the IPP's high-pressure flare header and then into the flare system for combustion.

Ethane and ethylene are stored in tanks under the pressure of their own vapor. The vapor–gas phase, which is formed in the ethane storage tanks due to the ambient heat, is directed through a regulating valve to the flow of ethane feedstock from the GFU. The vapor–gas phase, which is formed in ethylene storage tanks due to the ambient heat, is sent to the vapor cooling unit for condensation followed by the return of liquefied ethylene to the storage tank.

To reduce pressure drops in a separate tank when conducting reception and distribution operations, all storage tanks are interconnected in gas space by gas equalization lines. The process schematics provides for two gas equalization lines, separately for ethane and ethylene.

Flare discharges from the ethane and ethylene storage park are sent to the high-pressure flare separator and then to flare for combustion.

Butene-1 storage tanks are interconnected in gas space by a gas equalization line to reduce pressure drops in a separate tank when conducting reception and distribution operations. When pressure in the tanks drops, nitrogen is supplied to the gas equalization line; if pressure is excessive, a discharge is sent to the flare.

Regulations applicable to pollutant emissions

At present, Russia regulates pollutant emissions from enterprises with category 1 adverse environmental impact based on the following two principles:

1. Pollutant emissions regulation based on pollutant dispersion in near-ground air (for each emission source, prescribed emission rate is expressed in g/s (t/year));
2. Pollutant emissions regulation based on best available technologies indicators, normally expressed in g/ton of product, for the enterprise as a whole.

Pollutant emissions regulation based on pollutant dispersion

In order to regulate emissions of pollutants based on the dispersion of pollutants in near-ground air, maximum allowable emissions should be determined for each source and for the enterprise as a whole in such a way to make sure that the $MAC_{ot.max}$ values for air in populated areas at the SPZ boundary or at the borders of residential areas are not exceeded.

AS regards the PPF, the calculation of dispersion should be carried out taking into account pollutant emissions from the IGCP, because:

- the industrial sites of the two enterprises are located in close proximity to each other;
- the project provides for a common flare system for the two enterprises;
- most of the offsite plant facilities are designed to support the operation of both enterprises.

Due to the lack of necessary information on the pollutant emission parameters for both the Polymer Production Facility and the IGCP, it is not possible to calculate pollutant emissions at this stage of the assessment.

The assessment of compliance with the requirement “not to exceed the $MAC_{ot.max}$ values at the SPZ boundaries” is based on the information on the character and the extent of emissions and is approximate. A more accurate assessment will be carried out in the course of the development of the project documentation based on detailed information regarding the parameters of pollutant emissions during the operation of the Polymer Production Facility.

Pollutant emissions regulation based on best available technologies indicators

Since January 1, 2019 enterprises with category 1 adverse environmental impact should regulate their emissions based on technological indicators of best available technologies and should obtain integrated environmental permits which contain technological norms and allowable values for emissions, discharges, waste generation, etc.

Technological norms are established by the Ministry of Natural Resources of the Russian Federation which issues orders approving the Regulations on environmental protection, "Technological indicators of best available technologies", for various industries and technologies.

Currently, no technological norms have been set in Russia for the production of ethylene, butene-1 and polyethylene.

At the same time, the technical guide[224] defines technological parameters of emissions from ethylene, butene-1 and polyethylene production which can be applied as approximate emission targets for the PPF's ethylene, butene-1 and polyethylene production units. These parameters should be updated after the official publication of the regulatory document of the Ministry of Natural Resources of the Russian Federation.

Thus, for the production of ethylene, the technological parameters of emissions for NOx, CO, and total hydrocarbons (without methane) are as follows:

Emitted pollutants	kg/t
NOx	1.6 or below
CO	0.5 or below
Total hydrocarbons (without methane)	1.7 or below

During the production of C4 a-olefins, including butene-1, emissions should not exceed the following values[225]:

Emitted pollutants	kg/t
Nitrogen dioxide	5.85 or below
Nitrogen oxide	0.95 or below
Sulfur dioxide	0.0375 or below
Carbon oxide	11.11 or below

During the production of polyethylene based on gas-phase technology emissions should not exceed the following values[226]:

Emitted pollutants	kg/t
Nitrogen dioxide	0.25 or below
Nitrogen oxide	0.08 or below
Carbon oxide	2.04 or below
Acetaldehyde	0.002 or below
Ethylene	3.33 or below

The project provides for the construction of a wastewater treatment plant intended for treating wastewater, with a local waste incinerator to be operated on its site.

The technological norms for emissions from waste incineration units determine the concentrations of pollutants in the waste incinerator's flue gas; they are given in Table 9.1.1 below.

Table 9.1.1: Technological indicators of air emissions from waste incineration corresponding to best available technologies[227]

Pollutant description	Unit of measurement	Value
NOx	mg/m^3	< 200
sulfur dioxide	mg/m^3	< 50
carbon oxide	mg/m^3	< 50
saturated hydrocarbons C12-C19	mg/m^3	< 10
suspended solids	mg/m^3	< 10
benzapyrene	ng/m^3	< 0.001
hydrogen chloride	mg/m^3	< 10
hydrogen fluoride, soluble fluorides	mg/m^3	< 1

[224] ITS 18-2016. Production of basic organic chemicals - M., Bureau of BAT, 2016

[225] ETS 31 -2017. Production of products of fine organic synthesis, - M., Bureau of BAT, 2017

[226] ETS 32 -2017. Production of polymers, including biodegradable ones, - M., Bureau of BAT, 2017

[227] Regulatory document on environmental protection "Technological indicators of best available technologies for thermal neutralization of wastes (waste incineration)", approved by order No. 270 dated 04.24.2019 of the Ministry of Natural Resources of the Russian Federation.

Pollutant description	Unit of measurement	Value
dioxins	ng/m^3	< 0.1
mercury and its compounds	mg/m^3	< 0.05
cadmium and its compounds	mg/m^3	< 0.05
total heavy metals (barium, vanadium pentoxide , iron trioxide , cobalt, nickel, manganese, copper, arsenic, lead, hexavalent chromium)	mg/m^3	Total < 0,5

The IFC guidelines for the manufacturing of petroleum-based polymers[228] define technological norms for pollutant emissions from polyethylene production, including:

Pollutant emissions	mg/nm^3
NOx	300 or below
LOS	20 or below
Solids	20 or below

Even though the polyethylene production technology adopted for the project is different from the technology discussed by the IFC, the above parameters may be used as recommendations.

Impact of pollutant emissions on air quality

The main industrial site of the Polyethylene Production Facility (Zone 1) is located at a considerable distance (approximately 4 km) from the nearest residential areas.

The experience of other oil and gas chemical enterprises (Nizhnekamskneftekhim and Zapsibneftekhim) has shown that at such a distance from the sources the near-ground concentrations of pollutants will not exceed the air quality values prescribed for populated areas.

The character of the PPF's pollutant emissions makes it possible to assume that at the SPZ boundary, 1000 m from the border of the industrial site of Zone 1 (and taking into account emissions from the IGCP), the near-ground concentrations of priority pollutants (NOx, CO, VOCs) are highly unlikely to exceed the $MAC_{ot.max}$ values for populated areas, because:

- Furnaces running on methane or/or fuel gas have been designed for optimal fuel combustion conditions, in which NOx concentrations in flue gases are minimized, and no possibility exists for incomplete burning of organic substances or soot formation;
- For highly effective emission reduction all gases will be directed to a high-efficiency flare unit;
- Flare units, which are used to burn safety valve blowdowns, emissions from emptying equipment and tail gases, are equipped with smokeless combustion devices; to this end, it is proposed to supply steam to the flares, which will ensure the fullest combustion of hydrocarbons;
- Tanks will be equipped either with floating lids or with valves to minimize evaporation of products into the atmospheric air.
- The height of furnace stacks and flare stacks will be chosen in accordance with industry practice;
- Provision has been made for a waste incinerator to reduce the amount of wastes;
- Installation of sensors on emission sources will ensure continuous monitoring of NOx and CO emissions;
- Fugitive VOC emissions will be prevented through technological solutions, particularly by minimizing the number of flange joints and by using high-quality sealing systems.

The technological solutions adopted for the PPF project comply with Russian and international requirements, including the IFC requirements as defined in IFC Guidelines for similar industries.

[228] The environmental, health and safety guidelines for petroleum-based polymers manufacturing, IFC, 2007.

Based on pollutant emission data from analogous projects, the concentration of NOx at the SPZ boundary will not exceed 0.4-0.5 MAC, and the concentration of CO will not exceed 0.1-0.2 MAC. Near-ground concentrations of other pollutants will be less than 0.1 MAC.

9.1.4 Conclusions

Analysis of the project documentation provided by INK, pollutant emission data from analogous projects, and regulatory requirements for process emissions suggests that during the construction and operation of the PPF the quality of atmospheric air within the enterprise’s zone of influence will be in accordance with the hygienic standards.

The most significant air impact is caused by emissions of nitrogen dioxide, carbon monoxide and combined effect groups which include those substances.

For a more accurate assessment of the air impact from the proposed polymer production facility the following steps are recommended for the subsequent phases:

- specify the parameters of all pollutant emission sources at the main production facility and at auxiliary installations;
- obtain more detailed information on background air pollution, especially within the area of influence of pollutant emissions from the sawmill residue disposal site;
- calculate dispersion of pollutant emissions taking into account the detailed information relating to the parameters of the emission sources, and background air pollution;
- determine the annual amount of pollutant emissions taking into account the adopted design solutions.

Table 9.1.2: Overview of air quality impacts and mitigation actions

Impact	Direction	Receptor	Receptor sensitivity	Phase	Impact significance	Risk	Mitigation action	Residual impact
Air pollution	N	Personnel Local population Natural environment	**M**	**C**	**M**	-	Implement dust suppression measures when loading/unloading loose materials and performing earthworks; Prevent soil erosion and soil being carried away from the site by wheels of motor vehicles; Perform regular maintenance of construction machinery and motor vehicles engines	L
Air pollution	N	Personnel Local population Natural environment	**M**	**O**	**M**	-	The project has adopted a number of technological solutions aimed at reducing pollutant emissions: • Furnaces running on methane or/or fuel gas have been designed for optimal fuel combustion conditions, in which NOx concentrations in flue gases are minimized, and no possibility exists for incomplete burning of organic substances or soot formation; • For highly effective emission reduction all gases will be directed to a high-efficiency flare unit; • Flare units, which are used to burn safety valve blowdowns, emissions from emptying equipment and tail gases, are equipped with smokeless combustion devices; to this end, it is proposed to supply steam to the flares, which will ensure the fullest combustion of hydrocarbons; • Tanks will be equipped either with floating lids or with valves to minimize evaporation of products into the atmospheric air. • The height of furnace stacks and flare stacks will be chosen in accordance with industry practice; • Provision has been made for a waste incinerator to reduce the amount of wastes; • Installation of sensors on emission sources will ensure continuous monitoring of NOx and CO emissions; • Fugitive VOC emissions will be prevented through technological solutions, particularly by minimizing the number of flange joints and by using high-quality sealing systems	L

9.2 Harmful Physical Impacts

Noise and vibration will occur throughout the Project's lifetime, including construction, commissioning, operation, and decommissioning phases. Environmental impacts from noise and vibration at each Project phase will vary in the duration, extent and amplitude.

The following receptors will be potentially affected by noise:

- Project personnel both during construction and operation of the facilities and during their off-duty hours in rotation camps. Such impacts will include:
    - Noise in the workplace,
    - Noise impact in construction camps (construction and operation phases);
- People in nearby population centers, and those living near motor roads and railways intended for cargo and equipment transportation during construction;
- Terrestrial fauna species, including birds and animals, due to the propagation of noise across their habitats.

Noise impact on people will be assessed by comparison against the requirements applicable to the project (see Chapter 2 of the ESIA). Additionally, the extent of noise impact will be assessed within the SPZ set up around the project's main industrial facilities.

It is assumed that the only sources of vibration potentially significant for people living near the Project site are associated with piling operations and heavy equipment installation during the construction phase. These impacts have been assessed as barely significant in view of the location of the Project site in relation to the nearest residential areas. Notably, no sources exist capable of inducing soil vibration to the extent sufficient for causing material damage and, therefore, such sources will not be hereinafter discussed.

The description of physical factors and the assessment of their impact on receptors given below are based on the professional experience of Ramboll experts and the review of available materials on analogous sites.

9.2.1 Construction-phase physical impacts at the PPF

Noise impact during project construction will be associated with the operation of machinery and mechanisms while performing the following types of work:

- construction site clearing, excavation and pile driving;
- delivery and handling of building materials;
- construction of buildings and infrastructure facilities, installation of equipment

Main noise and vibration sources during the construction phase will be as follows:

- motor vehicles;
- mobile and stationary construction machinery;
- diesel power plants.

Pursuant to safety regulations, various steps will be taken in the course of work to minimize impact on human health, e.g. workers will be required to use personal protective equipment.

The main noise reduction methods will be as follows:

- preferred use of low-noise machinery and equipment;
- install equipment on vibration isolation platforms and in protective enclosures;
- inspect machinery and equipment for failures on a daily basis prior to the commencement of work; prevent operation of defective equipment;
- shut down any equipment or machines that are not in use;
- conduct noisy construction work during daytime working hours, if possible;
- coordinate construction machinery operation schedule in such a way as to prevent simultaneous operation of equipment causing high levels of noise/vibration;
- instruct construction workers to minimize noise/vibration.

Traffic of motor vehicles and machinery during construction can be reduced by taking the following steps:

- impose speed limitation of vehicle traffic within the construction area;
- manage traffic to avoid congestion and idle time with engine running;
- maintain road surfaces within the construction site in good repair to prevent noise caused by passage of heavy trucks.

Those measures shall be considered in preparing the Project documentation and subsequently in the course of construction work. If the measures are implemented, noise and vibration impact during the construction phase is expected to be of low significance since the nearest residential areas are located at a distance of more than 4 km from the construction site.

9.2.2 *Operation-phase physical impacts at the PPF*

Constant noise impact is expected in connection with the operation of the following facilities and equipment within the PPF:

- Ethylene production unit;
- Polyethylene production unit;
- Alfa-olefin production unit;
- Ventilation units, compressors and pumps;
- Modular complete transformer substations.

Roof fans, air conditioners for heated parking lots for buses, cars, trucks and special-purpose vehicles, and storage yards may be considered as sources of periodic noise.

To minimize noise and vibration impact during the operation phase the following technological solutions and management actions should be provided for in the project documentation and subsequently implemented:

Some of the noise sources are located outside the production premises, and some inside the premises.

The storage area for commercial products intended for receiving products via a pipeline from the process units, storing inventory on hand, and shipping by rail or truck has the following noise sources: pumping station consisting of four pumps.

Roof fans, air conditioners for heated parking lots for buses, cars, trucks, special-purpose vehicles, and rail cars may be considered as sources of periodic noise.

To minimize noise and vibration impact during the operation phase the following technological solutions and management actions have been provided for:

- use equipment conforming to the applicable sanitary noise and vibration norms;
- connect intake and exhaust pipes of fans to air vents via flexible connectors;
- insulate fan units using spring vibration isolators;
- make sure that fans operate at maximum efficiency without creating overpressure;
- make sure that air velocity in air ducts, distributors and grills is kept within allowable range;
- install enclosures for compressor units;
- install noise suppressors on outdoor pipe outlets;
- perform regular technical inspections of vehicles and equipment;
- provide soundproofing for working premises, control rooms and other premises with communications equipment; provide sound insulation and sound absorbing measures for buildings, including soundproof doors, windows and sound-absorbing materials, thanks to which indoor noise levels will conform to the applicable standards;
- supply the Company’s and the contractors’ personnel with personal protective equipment.

If those measures are implemented, the noise level will be below 85 dBA at the distance of 1 m from equipment, the significance of residual impacts is expected to be low.

The impact of noise from the noise sources located at the main IGCP site during the operation phase on the population living in the nearest residential areas will be low due to the fact that the nearest residential area is located more than 4 km away, and the land between the residential areas and the industrial site has a low-hill forested terrain.

The level of noise impact from the equipment located on the site of commercial product tank farm which is situated at the LPG/LGC Reception Storage and Shipment Terminal will not exceed the prescribed levels at the boundary of the common SPZ of the UKGFUB and the LPG/LGC RSST (1000 m from the Terminal borders) or at the border of the nearest residential area.

9.2.3 Operation-phase physical impacts at the project facilities

Constant noise impact is expected in connection with the operation of the following facilities and equipment within Zone 1 of the PPF project:

- Ethylene production unit;
- Polyethylene production unit;
- Alfa-olefin production unit;
- Ventilation units, compressors and pumps;
- Modular complete transformer substations.

Roof fans, air conditioners for heated parking lots for buses, cars, trucks and special-purpose vehicles, and storage yards may be considered as sources of periodic noise.

To minimize noise and vibration impact during the operation phase the following technological solutions and management actions should be provided for in the project documentation and subsequently implemented:

- use equipment conforming to the applicable sanitary noise and vibration norms;
- install especially noisy mechanisms in enclosed spaces;
- connect intake and exhaust pipes of fans to air vents via flexible connectors;
- insulate fan units using spring vibration isolators;
- install enclosures for compressor units;
- perform regular technical inspections of vehicles and equipment;
- make sure that vehicle traffic speed limits are observed;
- supply the Company’s and the contractors’ personnel with personal protective equipment

If those measures are implemented, the noise level will be below 85 dBA at the distance of 1 m from equipment, the significance of residual impacts is expected to be low.

The impact of noise from the noise sources located at the main PPF site during the operation phase on the population living in the nearest residential areas will be low due to the fact that the nearest residential area is located more than 4 km away, and the land between the residential areas and the industrial site has a low-hill forested terrain.

The level of noise impact from the equipment located on the shipment site (warehouse for reception, storage and shipment of polyethylene; terminal for reception of chemicals and catalyzers, etc.), which is situated at the LPG/LGC Reception Storage and Shipment Terminal will not exceed the prescribed levels at the boundary of the common SPZ of the UKGFUB and the LPG/LGC RSST (1000 m from the Terminal borders) or at the border of the nearest residential area.

9.3 Geological Environment

9.3.1 Main factors of stability and vulnerability of the geological environment with regard to expected impacts

As follows from the information presented in Section 7.4, the geological setting of the area selected for the proposed polymer plant and its associated facilities has the following specific features essential for the proposed activity.

1. The gently sloping upland areas of the bedrock ridge which will be occupied by process zone #1 (PPF Zone 1) are characterized by the most stable and favorable conditions for construction: the latter are classified as being simple or of moderately complexity, not requiring complex engineering preparations. Exogenous geological processes (EGP) typical for those areas include weathering of the bedrock composed of dolomitic limestone of the Ust-Kut suite of the Lower Ordovician; therefore the recommendations for the construction on top of the ridge and on the adjacent gentle slopes include building foundations on natural footing, minor vertical grading, setting up a surface runoff drainage system and protecting the bedrock against weathering processes.

2. The eroded slopes around the summit with an incline of 12 to 25 degrees are composed of coarse detrital colluvial and clayey eluvial-deluvial deposits and are considered unsuitable for the construction of major facilities in the absence of complex engineering preparations. Those slopes, while relatively stable under natural conditions, are likely to become unstable as a result of cuts or construction of benches needed for the installation of utility corridors between PPF process zones 1 and 2. A secondary exogenous geological process (EGP) that can be triggered by construction is intensive weathering of the bedrock composed of fissured and calcareous rocks. Recommendations as to the engineering preparation of steep slopes are the same as in section 1 above, except that more vertical grading of surfaces is required.

3. Gentle slopes composed of deluvial detrital deposits with an incline of 6-12 degrees are also unsuitable for construction in the absence of complex engineering preparations due to anticipated loss of stability and development of weathering process as a result of earthmoving, piling and other construction operations. The abovementioned EGPs in such areas are aggravated by surface erosion. Recommended measures for preventing technogenic EGPs are the same as for the ridge summit and steep slopes (see section 1 above). Adequate surface runoff drainage especially important is in this case because the local soil is prone to swelling and softening if subjected to moisture.

4. The Lena floodplain has specific engineering geological conditions with typical seasonal flooding of different periodicity, potential washout of loose ground and accumulation of gravel, pebble and sand material transported by the river. The shipping zone (PPF zone 2) will be associated with the Lena's floodplain and first terrace, which were previously transformed by the construction of the transport facilities, the LPG/LGC RSST, and the temporary construction facilities.

5. The utility corridors connecting the "upper" and "lower" industrial zones will cross the eroded valley slopes on the eastern and western sides of Cape Tolstyi: the first one, intended for the process pipelines, will be installed mostly alongside the existing LPG pipeline, the second one (the inter-site motor road) will pass along the Gremyachiy stream valley and join Federal Highway A-331 "Vilyui".

5. Common for the entire area is the absence of permafrost and seasonal freezing depths ranging from 1.5m to 3.7m; the topmost groundwater horizon is sporadically spread may occur locally at the depths ranging between 5 and 6 m; laterally consistent aquifers occur much deeper in interfluve areas and on valley slopes with highly permeable loose deposits and the mantle of weathering and highly fissured underlying bedrock. Surveys in the adjacent areas established the presence of frozen soils of variable thickness in the areas which had been previously prepared for the construction of the GFU; it means there's a risk of technogenic permafrost being formed in backfilled soils or in the upper geological strata exposed after the topsoil and vegetation layers, which served as thermal insulation, have been stripped.

6. Because the area in question is located far from the Baikal rift zone, its seismic potential is low, with the maximum estimated earthquake intensity being 5 for mass construction, 6 for facilities of special importance, and 7 for highly important facilities (OSR-2016; SP 14.13330.2014). In terms of earthquake frequency, the first one of the three categories corresponds to a period of 500 years (10% probability of

magnitude 5 exceedance in 50 years), the second one to a period of 1000 years (5% probability of magnitude 6 exceedance in 50 years), the third one to a period of 5000 years (1%). Due to a significant number of combustible gases and liquids in use, the Irkutsk polymer plant will include highly hazardous process facilities which should be designed to withstand the highest magnitude earthquake. Based on microseismozoning, the earthquake of magnitude 6 has been chosen as the baseline for the IPP facilities.

7. Based on the information provided by competent authorities, the general plan of the municipality and the surveys data, there are no state-registered explored mineral deposits or specially protected nature areas with specific geological, geomorphologic and hydrogeological properties inside the Project footprint. The nearest subsoil management activities include development of groundwater and construction materials (limestone) deposits. Overall, the area in question is characterized by variable chemical composition of groundwaters and the latter's elevated radon activity level. According to the Report of the Federal Agency for Subsoil Resources Management (see section 7.4.7), the proposed construction can potentially affect the groundwater aquifers exploited by subsoil users in the nearby areas, and therefore certain actions need to be developed to prevent such impacts.

Under the given conditions, the stability of the geological environment in relation to technogenic impacts is dependent to a certain degree on the risk of development of adverse EGP and the degree of protection of the exploited aquifers from pollution.

The hydrogeological well nearest the Project footprint was drilled by Razdolye, a limited liability company, on the site of INK's LPG Terminal. The exploited water-bearing horizon belongs to the Upper Lena suite of the Middle and Upper Cambrian System. Its true piezometric level is 73.4 m; water pressure 0.6 m. In terms of the degree of natural protection, the aquifer is classified as 'reliably protected', because it is overlain by clayey deposits of a considerable thickness (approximately 70m). The sizes of sanitary protection belts have not been calculated because the aquifer is recommended as a technical water supply source only. The radius of a buffer zone for industrial water intake facilities is 30 m.

The degree of natural protection of the topmost groundwater horizon has not been assessed in the survey documentation. Based on the conditions of its occurrence, its degree of protection can be classified as Category I (according to V.M. Goldberg's terminology[229]) for the Lena floodplain and Category II for the rest of the area in question, which makes the aquifer different from the more protected Upper Lena aquifer because of their higher vulnerability to chemical pollution coming from the surface. Highly permeable gravelly, gravel-pebble and other deposits dominate the Quaternary rocks profile, while clays and sandy silts are common only in certain locations and do not provide a barrier for downward water infiltration in geological strata. This should be taken into consideration when designing surface runoff collection and drainage systems, constructing storage areas for reagents and wastes, installing water supply and wastewater removal pipelines and sewer networks. Prevention of instantaneous releases or continuous leaks of liquids and formation of water infiltration zones within geological strata (considering that surface runoff streams are rerouted as a result of the Project's hard surfaces and installations) is especially important due to the prevalence of dissoluble calcareous rocks on bedrock slopes and in interfluve areas.

One of the Project's associated facilities is the groundwater intake facility for supplying potable water. The location of its site to the north of the PPF process site on the opposite bank of the Polovinnaya river renders the exploited aquifer barely vulnerable (or practically invulnerable) to impacts from the proposed activity. The corresponding sanitary protection zone will extend away from the plant, and its territory will not be affected by the Project or any other third-party activity.

9.3.2 Main types of impacts and mitigation actions

9.3.2.1 Construction phase

Most of the Project's inevitable impact on the geological environment will be felt during the construction phase in connection with drilling, earthmoving, piling and other operations:

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[229] Goldberg V. M. and Gazda S. Hydrogeological Principles of Underground Water Protection from Contamination. Moscow, Nedra Publishing House, 1984, 266 pages.

- direct physical and mechanical disturbance of soils and aquifers;
- a set of complex static and dynamic loads on soils;
- transformation of topography;
- removal of some of the local soils and their replacement with imported soils;
- colmatation and compaction of soils by heavy construction machinery, buildings, structures and hard surfaces;
- rerouting of surface and subsoil runoff flows, including barrage and drainage effects.

Most of the impacts on the geological environment will be of physical and mechanical character and will facilitate development of exogenous geological processes. Especially dangerous for the area in question are weathering and seasonal cryogenesis (across the whole area), surface erosion (on slopes composed of sandy silt/clayey deluvial material), gully erosion (locally, in areas with significant thickness of sandy silt/clayey deposits and particular slope angles), waterlogging and flooding (floodplains of the Lena and its tributaries, especially near the estuary). Furthermore, karst/suffusion and other engineering processes may develop locally inside the footprint of the proposed earth structures and excavations.

In addition, the construction and subsequent operation of the proposed facilities will affect the thermal regime of soils: despite the absence of permafrost within the area, seasonal cryogenesis of soils stripped of their thermal insulating topsoil and vegetation layer may lead to the formation of technogenic permafrost which can persist for years with favorable weather conditions or, should the conditions change, degrade triggering a series of dangerous exogenous geological processes.

Particular deviations from the design solutions (i.e. impacts resulting from abnormal situations or emergencies) may be of adverse character and require intervention:

1) spills and leaks of fuel, lubricants, paints or any process fluids and their ingress into the geological environment leading to the formation of bodies of infiltrate and groundwater pollution;
2) unauthorized burial of construction waste and debris inside the geological environment;
3) use of polluted soils to create technogenic landforms;
4) infiltration of polluted surface runoff (stormwater and snowmelt water) into the ground;
5) replenishment of aquifers with leaks from water pipelines and through reduced transpiration caused by vegetation removal;
6) secondary intensification of dangerous exogenous geological processes and hydrological phenomena, the most important of which for the polymer plant sites are slope processes, different forms of weathering and waterlogging (primarily for the shipping zone facilities and other installations located on the Lena floodplain and terraces), frost heave of cohesive soils within the zone of seasonal freezing;
7) groundwater pollution caused by rising groundwater levels (waterlogging) and groundwater contact with construction materials, structures and construction debris located on the surface.

The above-referenced impacts on the geological environment and DEGP&HP should be taken into consideration in the process of planning environmental protection measures, most of which have only indirect relation to the geological strata and concern the adjacent soil and vegetation layer, surface water bodies and constructed facilities.

By the time of finalization of this document, designs have been completed for several IPP facilities including the interfacility road, OHTL 220 kV, substation PS-500/220kV, and the berth. Relocation of the PPF main process area from Cape Tolsty (valley slopes) to the gently sloping interfluve area means that the planned operations will have a significantly weaker potential for re-activation of dangerous exogenous processes and hydrologic phenomena (DEGP&HP). Particularly, the need for extensive transformation of the natural surface (construction of terraces, "shelves", long slopes, winding roads, retaining walls, and other artificial surface elements) will be avoided. On the other hand, few infrastructure elements will be routed through terrain slopes and other areas which, according to the survey results, are prone to DEGP&HP.

The longest of the above elements (1613 m) is the interfacility road. On its route the road will run through areas with surface slope sometimes as steep as 10-15 deg, between the absolute altitudes of

310 m (connection to the "Vilyui" A-331 road) and 595 m (checkpoint at the IPP main process area). Therefore, development of erosion control and other measures for prevention of DEGP&HP is a critical element at the stage of preparation for construction of the road.

Freight-hauling direction (from the plant toward the "Vilyui" road) in most part of the road will be on down grade, with maximum design slope of the road surface 6%, i.e. 6 m per 100 m of linear length. The width of right-of-way varies between 25 m and 35 m depending on surface conditions, and size of the area to be acquired for perpetual use is about 43 ha (further 1.4 ha that will be acquired for the period of construction, will be returned to the lessor after reclamation at the end of the road construction).

The selected configuration of the road is longer but offers certain environmental benefits compared to the option considered in 2017. In particular, using the route around the north-eastern foot of Cape Tolsty instead the shortest line means that the winding road on steep-sloped terrain is substituted with a much gentler alternative. The resulting benefits include minimisation of overall scope for earth works, relatively high static and dynamic stability of the base rock and loose deposits, as well as the road subgrade, minimisation of the risk of re-activation of dangerous exogenous processes and hydrologic phenomena within the road corridor during the construction and operation.

Despite the relative benefits of the selected alternative route in terms of geomorphology, grading of the natural ground surface in the road construction area requires making excavations to the maximum depth of 13.5 m and filling to the height up to 7.3 m. Estimated total volume of the earth works is 1.3 million m^3.

Material for the banks filling will be sourced from the excavations - detrital ground with sand-clay aggregate, limestone and sandstone boulders, mudstone and siltstone, sandy loam soil, slightly weathered sandstone. The capping (top) layer of the banks will consist of medium strength sandstone, limestone and sandstone boulders, and medium strength limestone. It is likely that quantity of excavated ground will be larger than needed for filling, however exact estimation of the surplus volume will be possible only at further stages of the design development. According to the design, all excess soil will be removed for utilization at other sites within the Ust-Kut industrial area of INK.

The following measures are designed to ensure structural reliability of the 12-m wide subgrade belt:

- Compaction to achieve ground density standards in the banks and under the main site, in excavations and at zero level;
- Only non-heaving soil will be used for the capping layer;
- Drainage of surface and ground water from subgrade structures;
- Cutting steps at the foot of road embankment in the areas with slopes 1:3-1:5;
- Provision of tooth (teeth) at the foot of road embankment in the areas with slopes steeper than 1:3;
- Subgrade slopes reinforcement with gabions (Reno mattress) and geotextile (specific elements and combinations depend on local site conditions);
- Provision of water pass-ways: a) for road sections with slope steeper than 3% - 0.5 m wide gutters of asphalt concrete along the trafficway edges, to prevent erosion of roadsides and subgrade slopes; b) at the interfacility road connection to the "Vilyui" A-331 road - Betomax concrete gutters with grit catchers, for removal of rain and melt water; c) along all embankments - drainage ditches; d) along all excavations - roadside ditches or interception channels. The above facilities will transport melt and rain water to the nearest culvert, or to nearby terrain depressions.

The culverts design provides for the following:

- Sufficient number of culvert facilities (current design provides for construction of 9 culverts) to prevent accumulation of rain and melt water higher on the slope;
- Culverts are positioned with due consideration to the terrain surface and runoff conditions, to achieve maximum efficiency of the structures'

- Corrosion protection coating of pipes and wrapping with geotextile "Dornit" 500 g/m^2;
- Construction or rock mattress to dampen the flow and prevent erosion of loose underlying soil;
- Provision of base under pipes and backfilling with layer-by-layer compaction k-0.95 to achieve maximum standard density at the minimum modulus of deformation of the fill ground of 30 MPa for corrugated pipes 130x32.5 mm; for avoidance of damage, soil compaction close by the pipe walls will be performed using hand-operated vibrating tamper, with regular spading;
- Simultaneous backfilling on both sides of installed pipes to a minimum height of 0.5 m above crest;
- Provision of impervious cement-ground diaphragms and geo-membranes around portals of water passage pipes in the embankment mass;
- Reinforcement of the embankment slopes: a) at the locations of inlets of water passage pipes - 45 cm or thicker rockfill blanket, gabions (Reno mattresses), or in-situ concrete (depending on local site conditions); b) at the locations of outlets of water passage pipes 0 gabions (Reno mattresses) at low flow velocities, or in-situ concrete in case of high flow velocities; c) generally - perennial grass seeding on fertile soil layer.

The HDPE impermeable geo-membranes being a key element of erosion control system within the road corridor are selected to meet the requirements of TU2246-001-56910145 (manufacturer - CJSC "TechPolymer", Krasnoyarsk). Geo-membranes will be lap spliced to provide a minimum 10 cm overlap, and welded with double seam or fusion-bonded. Base preparation near installed geo-membranes will be conducted manually, to prevent mechanical damage of the impermeable material.

Manual earth works will be required for construction of foundations for supports of certain linear facilities, including the overhead transmission line OHTL 220 kV. The construction design provides for the following measures to prevent development of dangerous exogenous processes and hydrologic phenomena within the OHTL right-of-way:

- Storage of excavated ground strictly within the right-of-way boundaries, and subsequent removal of surplus ground by dump trucks to other industrial sites within the Ust-Kut industrial area of INK;
- Reclamation of land disturbed by the construction, including seeding of perennial grass (re-forestation is precluded by the requirements for maintenance of OHTL corridor);
- Preventive measures to protect natural structure of underlying soil (soil will be excavated to the depth 100-200 mm above the design level; accidental overdigs will be backfilled with sand, gravel or crushed stone, and thoroughly compacted; the remaining soil will be manually excavated to the design depth immediately before installation of foundation);
- Minimization of time interval between the earth works and construction, to avoid accumulation of rain, ground or melt water in pits;
- Provision of diversion channels or bunding as appropriate (depending on season) to prevent inflow of runoff water into pits;
- Where pit slopes need protection against runoff water, sheet pile walls of wooden boards will be constructed;
- For working conditions with prevailing air and soil temperatures below zero - use of attachable equipment to break frozen soil, and taking measures to prevent soil freezing at the pit bottom;
- Backfilling pole foundation cavities immediately after installation, and adjustment of foundation in place, with gradual compaction of soil to 1.6 t/m^3 in 30-40 cm layers, using electric-driven compactors IE-4502A;
- Prohibition of backfilling with frozen soil or soil mixed with snow, topsoil material, high-plastic clay and water-logged ground.

For all other site and linear facilities for which designs have not been completed by now, the following general measures shall be adopted to prevent or minimize the impact on geological environment:

- perform work only inside the Project footprint, ensure sustainable management of land and soil resources;
- observe construction schedule with due regard for the seasonal character of certain types of work;

- use only environmentally safe drilling muds made of clay powder and water, use pitless drilling waste handling techniques;
- comply with the applicable RF regulations on handling construction materials, fuel, lubricants, paints and wastes;
- implement a set of measures to prevent erosion (slope reinforcement) and ensure surface runoff removal (drainage channels, stormwater sewers, stormwater treatment);
- set up a sanitary protection zone for the groundwater source consisting of three belts where prescribed sanitary measures will be implemented;
- carry out technical and biological remediation of lands leased on a short-term basis once the construction is completed, with land improvement and greenery planting in the industrial zones outside of the buildings and installations sites;
- monitor the status of the geological environment and the forms and factors of its degradation as part of the overall industrial environmental monitoring and control (IEMC) program for the construction and operation phases of the polymer plant facilities (it appears best to develop a comprehensive IEMC program for the construction and operation phases of all the facilities in INK's Ust-Kut industrial district).

9.3.2.2 Operation phase

During the polymer plant's operation phase, certain unavoidable changes and trends will take shape in the geological environment due to the following factors:

- water being abstracted from the groundwater aquifer exploited at the neighboring LPG Terminal site of the LHG Complex;
- surface runoff and subsoil water flows being rerouted around the existing buildings, structures and hard surfaces;
- barrage and permeability effects of technogenic earth structures and other installations, especially linear facilities and various kinds of boreholes.

Amid those changes, emergencies and accidents may arise as per subsections 1, 4, 5 and 7 of the construction-period impacts list. The consequences of such events for the geological environment should be subject to industrial environmental monitoring and control (IEMC) during the operation phase.

The calculations for the aquifer exploited by the LPG RSST confirm that the proposed water abstraction at a rate of approximately 500 m3/day will have no noticeable effect on groundwater because it will not exceed the natural rate of resource replenishment and the rate of depletion of the so-called elastic groundwater reserves. Therefore, a continuous 27-year operation of the wells will be possible. Any measures to be implemented for subsoil resources protection in connection with the operation of the water intake facilities at the neighboring sites (LPG Terminal, Alrosa Terminal berths) may be preventive in character:

- systematically monitor the level and the chemical composition of groundwater to promptly identify depletion and/or pollution risks in the exploited aquifer:
- implement measures to protect groundwater from pollution (as listed above);
- monitor areas adjacent to the wells or located upslope to promptly identify and eliminate sources and foci of chemical and biological pollution.

9.3.3 Residual impacts and monitoring of the geological environment

Most of the expected impacts from the construction and operation of the polymer plant on the geological environment will be felt locally, i.e. directly associated with the corresponding sites and ROWs, and will be of low significance on a scale of the entire geological district and sub-district. A description of the impacts and the objects to be monitored is given in Table 9.3.1, and the corresponding mitigation actions are described in Chapter 15.

Table 9.3.1: Estimated significance of residual impacts from the construction and operation of the polymer plant facilities on the geological environment

<table>
<tr><th colspan="3" rowspan="2">Types of impacts and geological reaction</th><th colspan="2">Residual impacts from implementation of proposed mitigation action</th></tr>
<tr><th>Estimated significance and extent</th><th>Objects of monitoring</th></tr>
<tr><td rowspan="6">Physical and mechanical impacts</td><td colspan="2">Areal transformation of the soil strata as a result of earthmoving, excavation and associated operations (including fertile topsoil stripping and technical land remediation)</td><td>Low – for the upper horizons of the geological strata at the level of meso-relief of bedrock slopes and interfluve areas (process zone facilities (zone #1) and, in part, utility corridors);
Moderate – for the shipping zone facilities (zone #2) and the water intake facilities</td><td rowspan="4">Soils in areas stripped of soil cover: physical integrity</td></tr>
<tr><td colspan="2">Vertical transformation of the soil strata as a result of drilling and piling operations</td><td>Negligible – for the polymer plant facilities site in general;
Low to Moderate – for well clusters and pile fields (inside the project footprint)</td></tr>
<tr><td rowspan="2">Pressure on soils</td><td>Static</td><td>Low – for areas occupied by buildings and installations (inside the project footprint)</td></tr>
<tr><td>Dynamic</td><td>Low to moderate – for access roads</td></tr>
<tr><td rowspan="2">Development of dangerous exogenous geological processes and</td><td>Erosion and accretion processes</td><td>Low - for areas occupied by the polymer plant facilities; in areas affected by erosion and accretion processes;
Moderate to high – (at bench foot composed by intensive washed out deposits</td><td rowspan="2">Areas with existing or potential dangerous exogenous geological processes and hydrological phenomena (DEGP&HP).</td></tr>
<tr><td>Weathering and karst/suffusion processes</td><td>Moderate for facilities in No.1 industrial zone and engineering lines corridors;
Low – for facilities in No.1 industrial zone and water abstraction facilities.</td></tr>
</table>

Types of impacts and geological reaction		Residual impacts from implementation of proposed mitigation action: Estimated significance and extent	Objects of monitoring
	hydrological phenomena: Waterlogging and flooding	**Low** – for the polymer plant site in general; **Moderate** - in depressions, along rear joints of above-plain terraces and on the floodplain; **Moderate to high** – along artificial embankments at the level of the Lena floodplain (local with potential expansion beyond the project footprint)	Soils in areas affected by or prone to DEGP&HP.
	Gravitational and other processes	**Moderate** – in areas with technogenic topography and the ones directly adjacent thereto (local with potential expansion beyond the project footprint);	
	Others	**Low** (local)	
Chemical and biological pollution	Pollution of topmost soil layers of the aeration zone, which are in contact with the topsoil layer or are stripped of topsoil, accompanied by the formation of secondary foci and/or bodies of infiltrate.	**Moderate to High** – during the construction phase due to high concentration of construction machinery, vehicles, mobile buildings and structures, materials and technical resources, industrial and domestic wastes coupled with a significant amount of construction work associated with soil destruction or disturbance.	Topsoil
	Pollution of the topmost aquifer	**Moderate to High** due to the low degree of water protection (mainly for the shipping zone facilities). Groundwater may carry pollution from a local source to the underlying aquifers and/or discharge into surface water bodies	Groundwater chemical composition
	Pollution of the topmost but one aquifer	**Low to Moderate** due to the low degree of water protection	
	Pollution of the exploited aquifer	**Low** due to the high degree of water protection	
Thermal impacts	Changes in the seasonal soil freezing/ thawing conditions	**Low** – due to the absence of permafrost soils, with local manifestation of frost heave and the formation of technogenic permafrost caused by topsoil and vegetation stripping	Groundwater temperature, loose soil temperature and moisture content
Exploitation of groundwater aquifers	Depletion of groundwater aquifers exploited at the sites of the technical water intake (LPG RSST) and potable water intake facilities (Polovinnaya river valley)	**Moderate** – due to the possibility of the water-containing structure consisting of a combination of bedded formations fed from a linear tectonic zone.	Static and dynamic groundwater levels, yields of production wells

Unsurprisingly, the most significant will be secondary intensification of dangerous exogenous processes and hydrological phenomena, primarily slope, suffusion and karst processes, plus waterlogging for the shipping zone and the berths. Those processes may affect areas adjacent to the Project footprint. When the development of secondary exogenous processes reaches its maximum their propagation from the construction area in the southern and southeastern directions will be hindered by the Lena river valley, in the northern direction by the upward sloping terrain, in the northeastern direction by the valley of one of the Lena's tributaries (Gremyachiy stream) and in the western and southwestern directions by a set of linear and areal engineering structures and the valley of Sukhoi stream. The lateral component of pollutant migration streams inside the geological strata may be associated with the topmost aquifer which does not stretch unbroken across the interfluve area or on the sides of the valley. On the contrary, in areas located on the lowest terrace and in the high and low floodplains of the Lena river, the presence is assumed of a laterally unbroken aquifer, which is replenished by surface runoff and is hydraulically connected with the Lena's channel through infiltration processes.

9.3.4 *Recommendations as to industrial environmental monitoring of the geological environment*

Industrial environmental monitoring should be the main tool for assessing the status of the geological environment, monitoring its transformation, overseeing the implementation and evaluating the sufficiency of the project design solutions in the field of conservation of subsoil resources during the construction and operation phases of the polymer plant facilities. It can be used for space imagery interpretation, reconnaissance and continuous surveys at the sites of wells intended for monitoring hydrological regime. The work can be performed by developers, contractors or specialist organizations hired on a contractual basis, which have appropriate equipment, skilled personnel and accredited analytical laboratories.

At the initial stage, an industrial environmental monitoring and control program should be developed based on the project's design solutions and the relevant technical regulations: SP 115.3330.2011 (an updated version of SNiP 22-01-95 "Geophysics of dangerous environmental impacts"), SP 47.13330.2012 "Engineering surveys for construction. Basic provisions"; SP 11-105-97 "Engineering surveys for construction" (Part I "General regulations for performance of work ", Part II "Regulations for performance of work in areas with dangerous geological and engineering-geological processes"); SP 11-104-97 "Geodetic surveys for construction"; SNiP SP 116.13330.2012 "Code of Rules. Engineering protection of territories, buildings and installations from dangerous geological processes. General provisions. An updated version of SNiP 22-02-2003"; GOST R 22.1.06-99 "Monitoring and prediction of dangerous geological phenomena and processes".

The main goals of local monitoring of the geological environment at the polymer plant site will be as follows:

- assessing the efficiency of measures implemented to ensure the facility's engineering protection and overall environmental safety;
- assessing the development and behavior of geological processes;
- collecting information for decision-making to ensure timely engineering and environmental protection actions.

The main goals of the local monitoring of the geological environment will be as follows:

- observing the status of the geological environment and the development of dangerous geological processes, both those that are already underway and those triggered by construction operations in the area where the facility comes into contact with the geological environment;
- analyzing, processing and storing collected data;
- developing recommendations as to protection and sustainable use of the geological environment and protection of the facilities against DEGP&HP;
- streamlining the monitoring network.

As regards remote sensing and reconnaissance surveys, the monitoring footprint should extend at least 100 m beyond the temporary or permanent project footprint. Imagery obtained in spring (May, early June) or in autumn (September, early October) on cloudless or almost cloudless days should be used for best possible identification of DEGP&HP manifestation boundaries. The following characteristics should be used for qualitative and quantitative assessment of geological processes:

- process scale and rate of development (the area and the character of DEGP&HP);
- part of area affected, in % or km^2;
- planned outline and size of the source of process development;
- separating distances between DEGP&HP and buildings and installations;
- visual clues of process manifestation.

Thematic maps are to be plotted based on the findings of interpretation of the remote sensing data to indicate the zones of dangerous geological processes during the construction and operation of the plant facilities.

The goal of reconnaissance surveys during the initial field stage of an industrial environmental monitoring and control program consists in land-based development of space imagery interpretation skills with a follow-up on-site verification of remote sensing data in areas with previously identified DEGP&HP. Surveys of ROWs should be performed along the full length of the route for a corridor at least 50 or 100 m wide. In the course of reconnaissance surveys all DEGP&HP manifestation should be recorded using field navigation devices, photographed and registered in a field log based on the abovementioned characteristics.

Operating and stand-by wells at the water intake facility site should be used for monitoring groundwater levels and for making predictions for processes associated with changes in the groundwater regime; if necessary, additional hydrological monitoring wells should be drilled for the most informative areas (waterlogged or swampy areas, areas with high groundwater levels, etc.). Those wells can be used for determining groundwater levels, changes in water temperature and chemical composition.

9.4 Impacts on Land, Soils, and Landscapes

9.4.1 Transformation of land use conditions and land resources caused by the proposed construction of polymer plant facilities

INK's Ust-Kut industrial area as part of the municipality's functional zoning system

All the proposed facilities will be located within the Ust-Kut municipality (urban settlement) which is divided into the following zones according to its territorial planning documents[230]:

- territory of the population center "the city of Ust-Kut";
- nature territory.

The corresponding lands consist of lands of settlements, in the first instance, and of forest lands, in the second, the management of forest lands being regulated by both land management and forestry laws of the Russian Federation. In particular, the basic territorial unit of forest management in Russia is a forestry, which, itself, is further divided into districts and compartments. The territory of INK's Ust-Kut industrial dis-trict encroaches upon the lands of the Osetrovsky forest district (with the area of 193,675 hectares), a part of the district forestry of the same name (421,005 ha), which is itself a part of the Ust-Kut forestry (4,535,060 ha).

The division into urban lands and nature territories has been taken into account when designing the functional zones of the municipality. The functional zone of *nature territories,* which occupy more than 90% of the total area of the municipality (see the sidebar and the green areas on the main map in Figure 9.4.1), is relatively homogeneous and consists mainly of forest lands managed by the Ust-Kut forestry administration. The forest cover of the Ust-Kut district is estimated at 95.9% (Forest Area Field Inspection Certificate dated November 21, 2018 approved by A.Yu. Stupin, Deputy Minister of the Forest Complex of the Irkutsk Region), which is a high forest/land ratio.

The *city of Ust-Kut* stretches 40 km along the banks of the Lena river and occupies an area of approximately 5,600 hectares, which results, on the one hand, from its dominant historical and current function as a transport hub, and on the other, from its geographical location in a large river valley surrounded by hills with rugged terrain that limit the development of the city in the north and in the south.

The area's three main transport arteries – the navigable section of the Lena river, the Baikal-Amur Railway and Federal Highway A-331 "Vilyui" – cross the city line from west to east and are mostly parallel to each other, which results in ribbon development.

[230] General layout plan of the Ust-Kut municipality (urban settlement). Substantiating materials. – Grad Institute of Territorial Planning, 2015.

Amendments to the Land Use and Development Regulations of the Ust-Kut Municipality (Urban Settlement) - Master Plan Studio LLC, 2015.

Land use and development rules of the inter-settlement territory of the Ust-Kut municipality. - Design and Planning Studio Master Plan LLC, 2016.

Urban development zoning map. - Amendments to the land use and development regulations of the Ust-Kut municipality (urban settlement), Irkutsk region, as regards areas located outside the city of Ust-Kut. - Omsk: Omsk Center for Technical Inventorying and Land Management, 2016.

Land Use and Development Regulations. Urban Planning Regulations. - Ust-Kut: Administration of the Ust-Kut Municipality (urban settlement), 2018

Figure 9.4.1: Proposed facilities within the Ust-Kut municipality and the city of Ust-Kut

Industrial, communal storage, utilities and transport infrastructure zones are predominant in the eastern part of the city affected by the Project (Figure 9.4.1). The residential areas nearest the Project boundaries gravitate towards the railway bridge across the Lena (Mostootryad and Yakurim micro-districts); recreation facilities consist of the gardening partnerships Kedr 2 and Lugovoye; the only rural settlement, the village of Polovinka, is located on the bank of the Lena river near the north-eastern border between the urban settlement and another municipality, the rural settlement of Podymakhinskoye, Ust-Kut municipal district. A detailed schematic layout of INK’s Ust-Kut industrial district facilities under design, construction and in operation, specifying third-party facilities and the municipality’s functional zones, is given in Appendix 4.

Historically, woodworking enterprises and associated transport infrastructure for raw timber, finished products and wastes formed the functional backbone of that part of the city. INK’s Ust-Kut industrial district is gradually emerging as the second largest complex of production facilities, which includes enterprises, both operating and under construction, for receiving, processing, storing and shipping hydrocarbon mixtures coming from the fields of the Irkutsk Oil Company (INK).

The layout of the area, which is also referred to as the Ust-Kut site in the Company's documents, is schematically shown in Figure 1.2 of Chapter 1, and as a map, in Figure 9.4.2. The area is a site of compact placement of INK’s gas program facilities, whether existing, under construction or prospective, the largest part of which is located within the nature zone of the Ust-Kut municipality (urban settlement), and the remainder (the southern and south-eastern part) within the Ust-Kut city limits.

The footprint of the INK facilities, both existing and under construction, within the Ust-Kut industrial district is estimated at approximately 440 hectares, of which 210 hectares (the southern part) are located within the city of Ust-Kut. The area is associated with the terminal point of the pipeline system designed and built in 2014-2017 for the delivery of hydrocarbons (LPG, prospectively NGLs) from the Yarakta and Markovo OGKF in the vicinity of Ust-Kut, and consists of a number of sites connected with one another and with the existing transport and utilities infrastructure of the Ust-Kut district by utility corridors.

Table 9.4.1 contains detailed information on land resources formed or being formed to house the Ust-Kut site facilities, including the proposed IPP facilities. The facilities are indexed according to Table 5.20 of Chapter 5 (“Designed facilities included in the INK Gas Program, and how they meet the IFC association criteria with regard to PPF) and Figure 9.4.2.

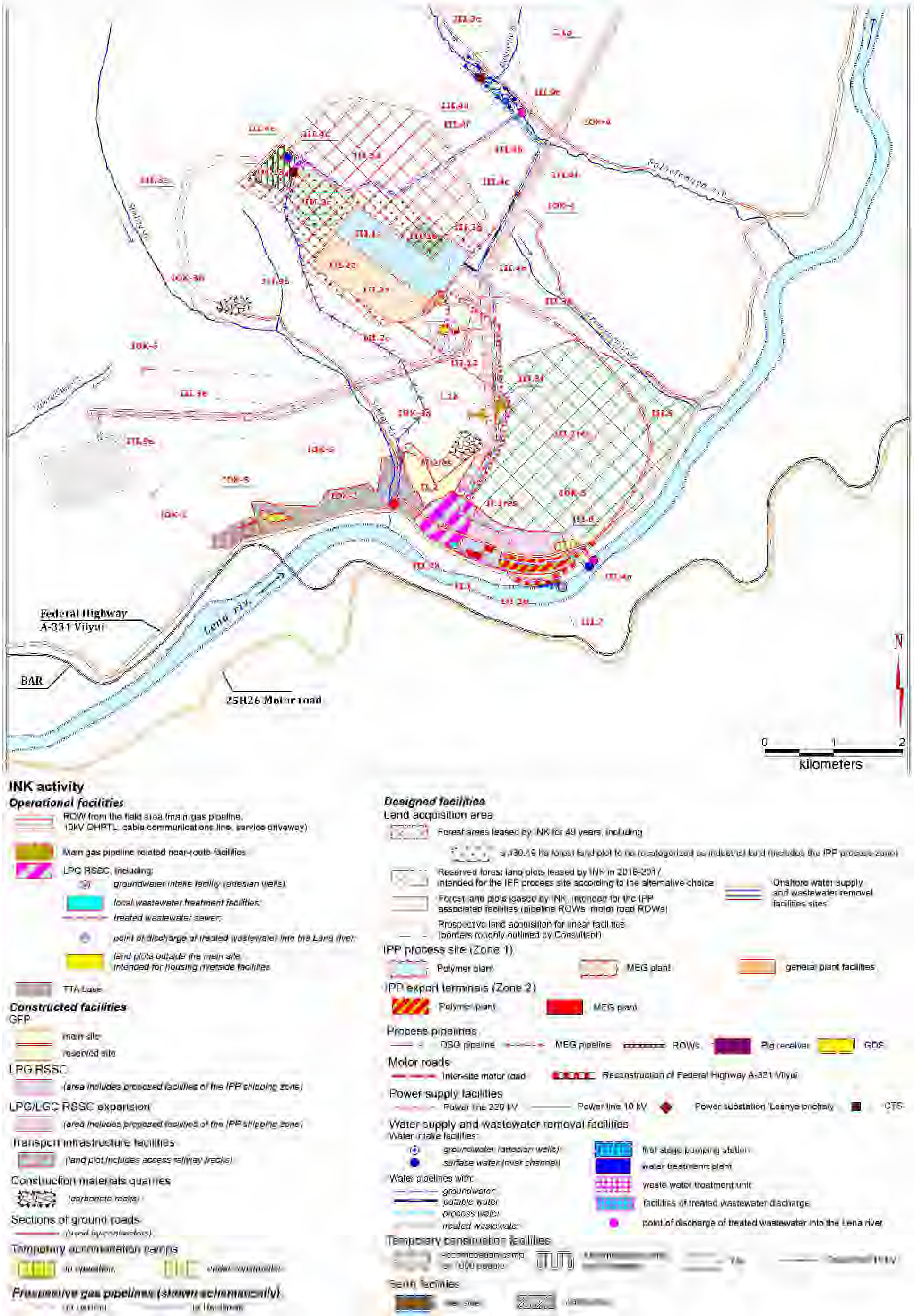

Figure 9.4.2: INK's Ust-Kut industrial district: facilities under design, construction and in operation (layout scheme indexing according to Table 9.4.1)

Table 9.4.1: Land resources of INK's Ust-Kut industrial district[231]

<table>
<tr><th>Index</th><th colspan="2">INK facilities and activities</th><th>Land resources</th></tr>
<tr><td colspan="4">INK LLC Gas Program facilities under design, construction, and in operation</td></tr>
<tr><td>I.1a</td><td rowspan="2">Pipeline system for the transportation of natural and associated petroleum gas processing products from the Yarakta OGCF, the Markovo OGCF to Ust-Kut</td><td>Linear section</td><td>A 130-meter-wide ROW consists of land plot 38:18:000000:1322. The LPG pipeline and its service driveway, the cable communications line, and the 10kV overhead power transmission line use the same corridor. Besides, a brand-new facility, III.12, is being designed in the same corridor (a dry stripped gas (DSG) pipeline)</td></tr>
<tr><td>I.1b</td><td>Near-route installations</td><td>Within the borders of the Ust-Kut industrial district, there are two sites for near-route installations: 1) a hookup/pig receiver site at kilometer post (PK) 932 + 99, with the area of approximately 2.8 hectares; 2) a site for power plant intended for linear installations, with the area of approximately 1.8 hectares. Corresponding land plots have not been formed. Both sites can be used for housing near-route installations of Facility III.12 (a DSG pipeline)</td></tr>
<tr><td>I.2</td><td colspan="2">LPG reception, storage and shipment terminal</td><td>Located across six adjacent land plots, cadastral numbers 38:18:080101:176, :185, :175, :570(2), :47, :73, :1344, and :1279, with a total area of 48.6513 ha. It has a common border with Facilities I.1 and II.2.</td></tr>
<tr><td>II.1</td><td colspan="2">LPG reception, storage and shipment complex (expansion). LGC reception, storage and shipment terminal</td><td>Located across two land plots, cadastral numbers 38:18:080101:43 and :25, with a total area of 22.4089 hectares. It has a common border with Facility I.2</td></tr>
<tr><td>II.1res</td><td colspan="3">Reserved (additional) land plots, cadastral numbers 38:18:080101:191, :1378, :1570, :188, :190, and :189, with a total area of 73.5947 hectares, adjacent to Facilities I.2 and II.1 and intended for expanding INK's Ust-Kut industrial hub, which border on the LPG RSST and the LGC RSST and are also part of the industrial complex. Approximately 40% of the area is already being used by the Company, particularly for housing temporary construction facilities. The same area will be used for the export terminal (Zone 2) of the IPP (Phases 1 and 2) with utility corridors. Plot :190, adjacent to the ROW of Federal Highway A-331 "Vilyui", was previously formed to provide a rest area for transit vehicles.</td></tr>
<tr><td>II.2</td><td colspan="2">Ust-Kut GFU</td><td>The footprint includes adjacent land plots with the cadastral numbers 38:18:080101:39, :204 and :1619 and the total area of 29.6237 ha</td></tr>
<tr><td>II.2res</td><td colspan="3">Reserved (additional) land plots, cadastral numbers 38:18:080101:1742, and :1487, with a total area of 14.6878 ha, adjacent to Facility II.2. They border on INK's limestone quarry from the north (the quarry plot is not formed; the quarry and the mining allotment areas may overlap with the II.2res plots)</td></tr>
<tr><td>III.1res</td><td colspan="3">Reserved forest fund plots with a total area of 644.2813 ha, leased by INK until 2017 for a period of 49 years (cadastral numbers: 38:18:000000:1623, :1634, :1624, :1625, :1435, :1430, :1405, :1571) for constructing the IPP facilities and utility corridors as originally planned (Cape Tolstyi, spawn protection forests). Mostly unused (the southern part of plot :1623 is used to accommodate temporary construction facilities). The approved location of the IPP site eliminates the need for constructing areal facilities on those plots; at the same time, the plots will be crossed by utility corridors (an inter-site highway, a gas pipeline, and other utilities)</td></tr>
<tr><td>III.1a</td><td rowspan="2">Irkutsk Polymer Plant. Phase 1: Polymer Production Facility (PPF)</td><td>Zone 1: process site</td><td>A land plot with an area of approximately 110 ha adjacent to plot III.2a, bounded by cadastral plot No. 38:18:000010:1438 (leased by INK for the period of 49 years, i.e. until 2066, under Contract No. 91-163/17 dated June 26, 2017). A part of the "Option 1" site with the area of 430.4900 hectares, chosen for recategorizing forest lands as industrial lands (Forest Land Plot 86 Selection Certificate dated November 12, 2018, approved by Directive No. 3924-mr dated November 19,2018 of the Ministry of Forestry of the Irkutsk Region)</td></tr>
<tr><td>III.1b</td><td>Zone 2: export terminal</td><td>A land plot with an area of approximately 20 hectares within the borders previously established to accommodate the LGC RSST (II.1) and the LPG RSST expansion (II.1res)</td></tr>
<tr><td>III.2a</td><td>Irkutsk Polymer Plant. Phase 2: MEG Terminal (IGCP)</td><td>Zone 1: process site</td><td>A land plot with an area of approximately 94 hectares adjacent to plot III.1a, bounded by cadastral plots Nos. 38:18:000010:1438 (see pos. III.1a) and :1624 (formed to accommodate linear facilities). A part of the "Option 1" site with an area of 430.4900 hectares, chosen for recategorizing forest lands as industrial lands (Forest Land Plot 86 Selection Certificate dated November 12, 2018, approved by Directive No. 3924-mr dated November 19,2018 of the Ministry of Forestry of the Irkutsk Region)</td></tr>
</table>

[231] Indexed according to designations in Figure 9.4.2 and in Table 5.20. Appendix 7 contains an expanded version of this table with additional information on land use limitations for areas adjacent to INK's facilities, whether existing or under design or construction

Index	INK facilities and activities		Land resources
III.2b		Zone 2: export terminal	Two plots with a total area of approximately **3.4 hectares** inside the II.1 footprint
III.2c		MEG process pipeline between Zone 1 and Zone 2	No plots have been formed. The length of the pipeline between IGCP Zones 1 and 2 is **4730 m**, the off-site segment length is approximately **3600 m** (part of the pipeline will pass through the LPG/LGC RSST site). The size of the ROW will be determined by the project documentation and can be approximately assumed to be **20 m** (the minimum width of a trunk pipeline ROW on forest lands), which corresponds to a land plot of **7.2 hectares.** Excluding the areas already included in INK's existing utility corridors, an additional 2.4 ha of land should be allocated according to Consultant's preliminary estimate.
IIII.3a	Construction of plant facilities and an accommodation camp at the Irkutsk Polymer Plant, and streamlining of communication links between INK's enterprises in the Ust-Kut industrial district	Plant facilities area	A land plot with an area of approximately **4 hectares**, adjacent to plots III.1a and III.2a, allocated to accommodate the plant facilities area common to the PPF and the IGCP. Adjacent to the IPP process site (PPF Zone 1 and IGCP)
III.3b		Rotational accommodation camp (RAC) for 7,000 people.	A land plot with an area of **approximately 16.4 hectares** adjacent to the PPF process zone from the north.
III.3c		Temporary buildings and installations (TBI) site	A land plot with an area of **approximately 15 hectares** adjacent to the PPF process zone from the northwest.
III.3d		Reserved area adjacent to the IPP process site	Formed by the parts of four cadastral plots, Nos. 38:18:000010:1438, :1488, :1489, which are not occupied by the IPP process site (735.8274 hectares minus the area occupied by the IPP process site and IPP plant facilities, approximately **514 hectares**). The plots with cadastral numbers :1488 and :1489 are leased for the period of 49 years (until 2067) under Contract No. 91-212/18 dated April 16, 2018. A part of this forest land has been approved for recategorization as industrial land (Forest Land Plot 86 Selection Certificate dated November 12, 2018, approved by Directive No. 3924-mr dated November 19,2018 of the Ministry of Forestry of the Irkutsk Region)
III.3e		Sites for the proposed linear infrastructure facilities associated with the IPP process site	Formed by cadastral plots Nos. 38:18:000010:1513 (36.8540 hectares), :1509 (6.4021 hectares), :1511 (56.4508 hectares), :1510 (15.4047 hectares), and also by 4 plots with registered borders but without any numbers or attributes being assigned. The total area of the plots, **263 ha,** is preliminary since the formation process has not been completed. According to the Consultant's preliminary estimates, the minimum area of land plots which are necessary in addition to the ones already formed for the construction of INK's linear facilities (pos. III.3f, III.3g, III.4b, III.4g, III.5, III.9, III.12) is 54 ha, and the total area for that position is 317 ha. Unlike the process sites, those plots will not be used in their entirety for the construction of any facilities. Their borders have been set in view of possible rerouting of the corresponding linear facilities during the design phase and will include a ROW for the construction of facilities and areas permanently allocated for the construction of above-ground installations (OHPTL towers, inspection manholes for water conduits and sewers, signage for all categories of underground pipelines, etc.)
III.3f		The ROW between the GFU and the IPP Zone 1 sites for the installation of process pipelines (including an ethane/propane mixture pipeline for the PPF) and other linear facilities	No plots have been formed. The length of the off-site segment of the corridor is **3700 m** (a part of the pipeline will pass through the LPG RSST site). The size of the ROW will be determined by the project documentation and can be approximately assumed to be **20 m** (the minimum width of the ROW of a trunk gas pipeline on forest lands), which corresponds to the land plot area of **7. 4 hectares**

Index	INK facilities and activities		Land resources
III.3g		The ROW between the GDS and the IPP Zone 1 sites for the installation of process pipelines (including a fuel gas pipeline) and other linear facilities	The length of the off-site segment of the ROW is approximately **500 m**. The size of the ROW will be determined by the project documentation and can be approximately assumed to be **20 m** (the minimum width of the ROW of a trunk gas pipeline on forest lands), which corresponds to the land plot area of **1.0 ha.** The corridor fully fits inside the borders of the previously allocated land plots (pos. III.3e), so there’s no need for additional land allocation.
III.4a	Construction of water supply and wastewater removal facilities at the Irkutsk Polymer Plant, an accommodation camp and a residential compound for Irkutsk Oil Company LLC		Land plot 38:18:000000:2151 (a 4-contour plot with a total area of **0.9371 hectares**) is formed for the installation of a technical water conduit and a treated wastewater sewer via two parallel corridors from the Lena river waterline to the IPP Zone 2 (pos. III.1b), which will cross Federal Highway A-331 "Vilyui" and the access railway tracks to the Alrosa facilities.
III.4b			Off-site segment of the ROW of water-carrying utilities (technical water and treated wastewater) from the LPG RSST border (pos. I.2) to the IPP process zone border (pos. III.1) with the length of **approximately 4 km**. No land plots have been formed for the utilities, including near-route installations. A twin-pipeline underground water conduit with the pipe diameter of 600 mm requires a **26 m** wide ROW which is equivalent to a land plot with the area of **10.4 hectares**; a treated wastewater sewer (400 mm diameter single-line gravity/pressure sewer) requires a **20 m wide ROW** and a **8 ha** land plot. Since the water conduits and the sewer will be installed in the same ROW as the gas pipelines, the additional land areas required for Facilities III.4b and III.3f are tentatively estimated at **36.4 ha** by the Consultant
III.4c			Local wastewater treatment facilities: will be constructed within the borders of the IPP process site without the need for additional land acquisition.
III.4g			Groundwater intake facilities near the Polovinka lodge, water purification plant, and water conduits that connect those facilities to the IPP process zone will be located on land plots 38:18:000010:1513 (36.8540 ha), :1509 (6.4021 ha), and :1511 (56.4508 ha), but will not occupy the whole area. The sizes of the areal installations and water pipelines ROWs have not been determined at this time.
III.5	Inter-site motor road		A linear facility with an axial length of approximately **5.8 km** (as designed), which connects the IPP’s Zone 1 with Federal Highway A-331 “Vilyui”. The design width of the Federal Highway roadway is 8 m. The average land acquisition requirement for a Category IV road with cross slopes ranging from 1:20 to 1:10 is 3.6 hectares per road kilometer, if acquired for permanent use, and 2.0 hectares per kilometer, if acquired for temporary use, which corresponds to **21 hectares** of land plots under long-term lease (or a **36 m** wide ROW) and another **12 hectares** of land under short-term lease[232]. Starting from the point when the road joins Federal Highway A-331 “Vilyui” inside its ROW (38:18:080101:84), the inter-site motor road will successively cross land plots Nos. :1570, :1571, :1634, :1430, :1624, :1625 (formed for the construction of INK’s Ust-Kut Industrial hub facilities), :779, :777 (forest fund), :1322, :1510, and :1511. The location of the central axis of the motor road has been adjusted by the Consultant to conform to the borders of the formed land plot (near the point of intersection with the gas transportation system, Facility I.1a). With the ROW being 36 m wide, an additional 13.6 ha of land will be needed on top of the available land plots

[232] The proposed inter-site motor road has been tentatively categorized as a category IV road with two-lane traffic, intended for rough terrain, to be constructed on embankments with slopes of variable steepness. Further clarifications are required based on the design solutions taking into account the requirements of Article 26 of the Federal Law No. 257-FZ dated November 8, 2007 "On motor roads and road-related activities in the Russian Federation...", and Government Resolution No. 717 dated September 2, 2009

Index	INK facilities and activities	Land resources
III.6	Renovation of a section of the Tulun-Bratsk-Ust-Kut-Mirny-Yakutsk Federal Highway, A-331 "Vilyuy", km19 + 300 - km20 + 500, to ensure transportation of large-sized and heavy equipment to the prospective construction site of the Irkutsk Polymer Plant in Ust-Kut	The axial length of the road section under repair is **1381.6 m**. The ROW is comprised of a land plot of variable width, with a total area of approximately **3 hectares.**
III.7	Berth on the river Lena for unloading large-sized equipment	The onshore part of the berthing facilities includes land plot 38:18:080101:20 (0.4429 hectares) and :6 (0.3072 hectares), as well as the adjacent non-partitioned territory (the total area of the entire onshore portion being **1.8080 hectares**). According to the general plan (022-2018-00-OTR), the size of the adjacent water area of the river Lena is **1.0850 hectares**
III.8	Power supply facilities of the Irkutsk Polymer Plant of Irkutsk Oil Company LLC	Will be constructed within the borders of the IPP process site and other areal installations.
III.9	Power supply facilities of the Irkutsk Polymer Plant	Land acquisition will be required to accommodate twin 220 kV high-voltage overhead power transmission lines to be installed on the stretch of land from the site of the 500/220 kV Ust-Kut substation (No. 38:18:000010:1386) to the border of the IPP (Polymer) main process site; the length of the high-voltage line will be 8.3-8.5 km if constructed according to the materials of preliminary planning of the land plot contained in IGCP's general technical solutions document (volume code 70605-P-000-PZU-TCh), 7.2 km if constructed on the land plot for the OHPTL's ROW, formed and registered in the cadaster, as proposed by Consultant.[233] The prescribed ROW width for the construction of a 220kV overhead power transmission line is 12 to 32 m depending on the type of support towers to be used for the Project. The land plot formed to accommodate the overhead power transmission line has variable width ranging from 100 to 120 m. In addition to the ROW, temporary plots will be allocated to the OHPTL during the construction phase for the installation of towers. The size of such plots for a 220kV OHPTL and steel towers will be 560-700 m^2. The plots allocated for the installation of OHPTL support towers, to be used on a continuous basis and in perpetuity, will be sized from 5.5 to 37 m^2 for intermediate towers, from 5.5 to 446 m^2 for angle anchor towers; the number of towers can be roughly estimated by analogy with the existing 220kV high voltage line (the new line will be constructed side by side with the existing one): approximately 20 intermediate towers and 4 angle anchor towers for each line, i.e. 40 intermediate and 8 angle anchor towers with land plots sized 43 to 220 m^2 for intermediate towers and 289-418 m^2 for angle towers. The average tower land plot sizes of the proposed 220 kV OHPTL being approximately 100 and 300 m^2, respectively, the total area of permanent land acquisition will be **0.64 ha**
III.12	Yarakta OGCF - Markovo OGCF - Ust-Kut gas pipeline (Project Complex No. 1117. Code 1117-PP-001.000.000)	There are 3 main design options, each of which includes a set of linear facilities with service driveways and near-route areal installations. Under any of the options the pipeline will terminate at the gas distribution station (GDS). The main part of the pipeline will be located within the ROW previously formed for Facility I.1 which has the width of **130 m** (lands plot 38:18:000000:1322). The pig receiver site (0.4 ha) and the GDS site (1.6 ha) will be located on the right side of the pipeline ROW based on the direction of gas flow, at the distances of 320 and 500 m from the border of the ROW, respectively; no land plot has been formed for the former; the GDS site, as currently designed, partially falls within the borders of a previously formed land plot, which is still unnumbered. The length of the gas pipeline route passing between the existing ROW (:1322) and the GDS site will be approximately **500 m**

[233] The location of the 220kV OHPTL proposed by the Consultant differs from the one specified in the design documentation but corresponds to the borders of the land plots being formed; it prevents the OHPTL from overlapping with the GDS site and from crossing the gas transportation system (Facility I.1a)

Index	INK facilities and activities	Land resources
III.13	Accommodation camp for 700 people within INK's Ust-Kut industrial district	The exact location and parameters of the land plot are to be determined. It is known it will be located outside the prescribed SPZ of the Irkutsk Polymer Plant and within the borders of the land plots already leased by the Company.
III.14	INK's accommodation camp for 3000 people within the urban settlement of Ust-Kut	The exact location and parameters of the land plot are to be determined. The REB, YaGU and Mostootryad neighborhoods in Ust-Kut are being considered as alternatives.
Other INK facilities and activities		
IOK-1	INK's Technological Transport Administration (TTA) base	The acquired land comprises a large number (more than 20) of cadastral plots. It is roughly shown on schematic maps which combine adjacent parts of the base territory into a common area of approximately **17.3 ha**
IOK -2	Site for construction of access roads and railway tracks to the LPG/LGC RSST and GFU sites and for placement of temporary construction facilities	The acquired land comprises cadastral plots Nos. 38:18:000000:895, 38:18:070101:389, 38:18:080101:184, :186, :194, :200, :201, :202, :203, :204, :205 and others. The total area is approximately **104 ha**
IOK -3	Extraction of limestone in quarries (IOK-3a - north of the II.2res land plots, IOK-3b - west of TSLK's sawmill residue storage site)	The land plot occupied by the IOK-3a quarry has not been formed. The quarry area is approximately **12 ha**. Part of the IOK-3b quarry (with the total area of approximately **8 ha**) is located within the borders of the forest land plot with the cadastral number 38:18:000000:746, the other part is within the contour of a previously formed land plot which has no assigned number or attribute information
IOK -4	Operation of dirt roads connecting the service driveway (plot I.1) with Federal Highway A-331 "Vilyui", and the IOK-3b quarry with plot IOK-2	Roads with a total length of approximately **15 km** cross lands of various categories (industrial, transport, and forest lands), including those leased by INK.
IOK -5	Operation of temporary accommodation camps (TACs)	The TACs are located on the land plots leased by INK. (See pos. INK-2, II.1res and III.1res)
Prospective INK facilities		
IOK -6	Construction of a fuel gas pipeline in the direction of Ust-Kut and Ust-Ilimsk	The exact location and length of gas pipelines are to be determined. Both structures will be installed from the GDS site in the western direction.

9.4.2 Formation of land plots intended for IPP facilities

Initially (in 2016-2017), two possible locations were proposed for the process site of the polymer plant. The first one, which was the most convenient in terms of technology and logistics, required acquisition of a 644-hectare land parcel from the spawning protection forest belt (Table 9.4.1 and Figure 9.4.2, pos. III.1res). The second possible location required moving Process Zone No. 1 up the relief, onto merchantable forest land plots (pos. III.1a, III.2a, III.3a).

The subsequent decision on expanding the IPP process zone to include the MEG Plant rendered the second option, which was better in terms of ecology, the only possible one since under the first option the westward and northward expansion of the plant's footprint was prevented by the proposed construction of a 500kV high-voltage power transmission line with a buffer zone, and the operated gas transportation system with an LPG pipeline and a DSG pipeline being designed within the same ROW (see map in Appendix 4).

As a result, 2 contours of forest plots were formed on merchantable forest lands of the Osetrovsky district forestry:

- outer contour is formed by 4 cadastral plots leased by INK for 49 years, Nos. 38:18:000010:1438 (267.9487 ha, leased by INK for a period of 49 years, i.e. until 2066, under Contract No. 91-163/17 dated June 26, 2017), 38:18:000010:1488 and: 1489 (a total of 433.3287 ha, leased for a period of 49 years, i.e. until 2067, under Contract No. 91-212/18 dated April 16, 2018), and 38:18:000010:1624 (34.5500 hectares, lease information unavailable), with a total area of 735.8274 hectares (contour III.3d on the map in Figure 9.4.2);

- inner contour with the area of 430.4900 ha, a part of the outer contour of leased land which is sought to be recategorized as industrial land[234] (Forest Land Plot 86 Selection Certificate dated November 12, 2018, approved by Directive No. 3924-mr dated November 19,2018 of the Ministry of Forestry of the Irkutsk Region).

The inner contour is the southern part of the outer contour and it has similar south-western, southern and south-eastern borders. The following facilities will be located within its borders:

- process zone (Zone No. 1) of the PPF (land plot III.1a in Table 9.4.1 and in Figure 9.4.2 with the area of 100 hectares);
- plant facilities zone, common for the PPF and the prospective MEG Plant, with an area of about 4 hectares, 75% of which is located within the bounds of land plot 38:18:000010:1438, and the remaining 25% within the bounds of the neighboring plot :1511, formed to house process equipment and an access road;
- accommodation camp (TAC) for 7,000 people, which will be located on a land plot sized approximately 16.4 hectares, its northern side bordering on the PPF process zone;
- temporary buildings and installations (TBI) site on a plot sized approximately 15 hectares, its north-western side bordering on the PPF process zone.

Land resources for constructing the process zone and the plant facilities zone will be acquired for the entire lifecycle of the PPF, while the accommodation camp will be operated until the polymer production plant is commissioned, and the TBI site until the IGCP (MEG Plant) is commissioned. Areas inside the inner and outer contours that are not occupied by the IPP facilities, will fully (inner contour) or partially (outer contour) constitute its buffer and sanitary protection zone and will serve as a land reserve for the future development of the Ust-Kut industrial district.

Any plans to use areas of spawning protection forests previously leased by INK to accommodate the IPP process zone have been canceled. At the same time, those areas (contour III.1 res in Figure 9.4.2 and in Table 9.4.1) will affect a number of permanent structures and temporary construction facilities:

- currently, facilities of one of the contractors' temporary accommodation camps are located in the southern part of land plot No. 38:18:000000: 1623, approximately 2 hectares in size (contour IOK-5 in Figure 9.4.2);
- in perspective, the southeastern, eastern, northeastern, and northern periphery of the spawning protection forest lands leased by INK will be affected by the construction and operation of the inter-site motor road, a linear facility with an axial length of approximately 5.8 km connecting Zone 1 of the PPF with Federal Highway A-331 "Vilyui" (pos. III.5 in Table 9.4.1 and in Figure 9.4.2), as well as by the utilities corridor which will run along the western border of the forest parallel to the existing LPG pipeline ROW (Facilities III.4 b, III.3f).

Until the formation procedure for the land plots intended for the linear facilities listed above is completed, only a rough estimate of the corresponding land requirements is possible: approximately 18 ha for water-carrying services (III.4b), approximately 34 ha for the inter-site motor road (III.5), approximately 7 ha for inter-site pipelines (III.3f).

There are 3 main design options for the dry stripped gas pipeline, DSG being the principal type of fuel gas intended for PPF consumers, each of which includes a set of linear facilities with service driveways and near-route areal installations. Under any of the options the pipeline will terminate at the gas distribution station (GDS). The main part of the pipeline will be located within the ROW previously formed for the LPG pipeline (Facility I.1 in Table 9.4.1 and in Figure 9.4.2), which has the width of 130 m (land plot I.1a). The pig receiver/launcher sites (0.4 ha) and the gas distribution station (GDS) site (1.6 ha) will be located on the right side of the pipeline ROW based on the direction of gas flow, at the distances of 320 and 500 m from the border of the ROW, respectively; no land plot has been formed for the former; the GDS site, as currently designed, partially falls within the borders of a previously formed land

[234] The full name of the category according to the terminology of the Land Code of the Russian Federation is "lands of industry, energy sector, transport, communications, radio broadcasting, television, informatics, lands for ensuring space research activities, lands for defense, security and other special purposes".

plot, which is still unnumbered. The length of the gas pipeline route passing between the existing ROW (38:18:000000:1322) and the GDS site will be approximately 500 m. So far, no decisions have been made on the volume of gas to be transported and, accordingly, on the pipeline diameter. Those parameters will determine the width of the ROW, and therefore a possibility exists no additional lands will need to be added to the existing ROW of Facility I.1. The proposed Class I gas pipeline (for DSG transportation) will have a 25 m wide buffer zone; a 100 m wide buffer zone will be set up around the near-route installations (see pos. I.1). The minimum width of the restricted development zone will depend on the diameter of the pipeline, and for the range between DN 300 ÷ 600 mm it will be 50/20 m for coniferous/deciduous forests, and up to 500 m for industrial enterprises.

To supply electric power to the IPP process zone, twin 220 kV high-voltage overhead power transmission lines will be installed, connecting the 220kV Polymer substation with the 500/220kV Ust-Kut substation[235]. The OHPTL route has not been chosen as yet, therefore the Consultant has made a rough estimate of its land requirements: with the total length of the route being 7.2 km (if constructed within the bounds of the land plot formed and registered in the cadaster for the power transmission line's ROW as proposed by the Consultant[236]) the prescribed ROW width will be 12 to 32 m depending on the type of support towers to be used for the Project. The land plot formed to accommodate the overhead power transmission line has variable width ranging from 100 to 120 m. In addition to the ROW, temporary plots will be allocated to the OHPTL during the construction phase for the installation of towers. The size of such plots for a 220kV OHPTL and steel towers will be 560-700 m^2. The plots allocated for the installation of OHPTL support towers, to be used on a continuous basis and in perpetuity, will be sized from 5.5 to 37 m^2 for intermediate towers, from 5.5 to 446 m^2 for angle anchor towers; the number of towers can be roughly estimated by analogy with the existing 220kV high voltage line (the new line will be constructed side by side with the existing one): approximately 20 intermediate towers and 4 angle anchor towers for each line, i.e. 40 intermediate and 8 angle anchor towers with land plots sized 43 to 220 m^2 for intermediate towers and 289-418 m^2 for angle towers. The average tower land plot sizes of the proposed 220 kV OHPTL being approximately 100 and 300 m^2, respectively, the total area of permanent land acquisition will be 0.64 ha.

The PPF export terminal facilities with the area of approximately 20 ha will be located within the existing production area of INK's Ust-Kut industrial district's "lower" zone, which also includes the LPG/LGC RSST, the Gas Fractionating Unit, the Technological Transport Administration site and the connecting transport corridors.

The renovation of the segment of Federal Highway A-331 "Vilyui" between the points of junction with the access roads to IPP's lower zone (including a temporary berth) and upper zone associated with the Project will be performed within the existing ROW of the federal highway and will not result in any additional land acquisition, particularly for temporary use.

The PPF Project's total land requirements are estimated at **486.2 ha** (100%), of which process sites account for **134.0 ha** (28%, fully within the merchantable forests), linear facilities sites account for **317.9 ha** (65%, half of which are spawning protection forests and the other half are merchantable forests), and temporary construction projects account for **34.3 ha** (7%, which are merchantable forests excluding a 1.8 hectare berthing area).

9.4.3 Changes in landscape structure and appearance

The project area belongs to the Middle Siberian taiga territory (or, more precisely, Lena-Angara taiga province of the Baikal-Djugdjur Mountain and Taiga province[237]) dominated by forest landscapes with a characteristic combination of coniferous and, to a lesser extent, deciduous tree species. Visually, the

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[235] The substation is being constructed as part of Phase 1 of the Energy Infrastructure Development Project for BAM and Transsib; prospectively, it will become a power supply center for an energy bridge to Buryatiya. The Ust-Ilimsk hydroelectric station will serve as the power source.

[236] The location of the 220kV OHPTL proposed by the Consultant differs from the one specified in the design documentation (8.3-8.5 km according to the materials of preliminary planning of the land plot contained in IGCP's general technical solutions document (volume code 70605-P-000-PZU-TCh)) but corresponds to the borders of the land plots being formed; it prevents the OHPTL from overlapping with the GDS site and from crossing the gas transportation system (Facility I.1a)

[237] Atlas of Irkutsk region: Environmental conditions of development. – Moscow-Irkutsk, 2004, 142 p. Webpage: http://irkipedia.ru/content/geobotanicheskoe_rayonirovanie_irkutskoy_oblasti_atlas_2004_g

landscapes within the Ust-Kut municipality's nature territory are associated with a large river valley with its terraced floodplains rising to form erosion-prone slopes and elevated interfluvial surfaces.

Forest landscapes directly affected by the Project are not unique or indigenous, they are not subject to conservation (with the exception of relatively small areas of sparse spawning protection forests, whose fragmentation will result from the construction of linear facilities[238]) and lack any special aesthetic value. Their attractiveness, defined by the terrain and the presence of the valley of a large river, has already become mostly nonexistent within the area of the proposed PPF facilities due to the presence of numerous industrial, transport and storage facilities, roads and railways. Nevertheless, this section provides an estimation of how the receptors' perception of local landscapes may be expected to change as a result of the planned activities.

The main types of impacts on the natural environment within the site of the PPF and its associated facilities which are likely to have the greatest visual effect are as follows:

- development of a large area near the summit of Cape Tolstyi resulting in the construction of a series of buildings and structures that are dissonant against the wooded landscape of the Angara-Lena plateau;
- localized destruction of vegetation within the Project footprint and damage to vegetation at the project site boundary;
- construction of associated facilities (berth, water intake structure, wastewater discharge structure) on the banks of the Lena river;
- increase in landscape illumination due to the use of artificial lights installed on stationary installations and motor vehicles.

Local forest landmarks will suffer the most: within the Project footprint and its buffer belts and firebreaks they will be wholly replaced with developed areas, constructed surfaces and secondary grasslands. The most affected will be pine forests, pine-larch forests, and secondary coniferous/small-leaved and small-leaved forests on sod-calcareous and sod-podzolic soils will be affected which dominate the terraces, the valley slopes of the Lena river and the interfluvial areas near valleys.

Less significant will be the loss of derivative shrub-herb-grass communities of the floodplains and the low terraces of the Lena river valley. In part, the loss will be compensated for by artificial recreation of grassland communities on lands under short-term lease during their remediation.

[238] The Project will mainly affect merchantable forest lands, which include the land plots that have been formed to accommodate the PPF process zone. Due to the need to set up ROWs between that zone and the PPF export terminal, some of the spawning protection forests which separate one from another will be inevitably disturbed by the construction of the Project's linear facilities.

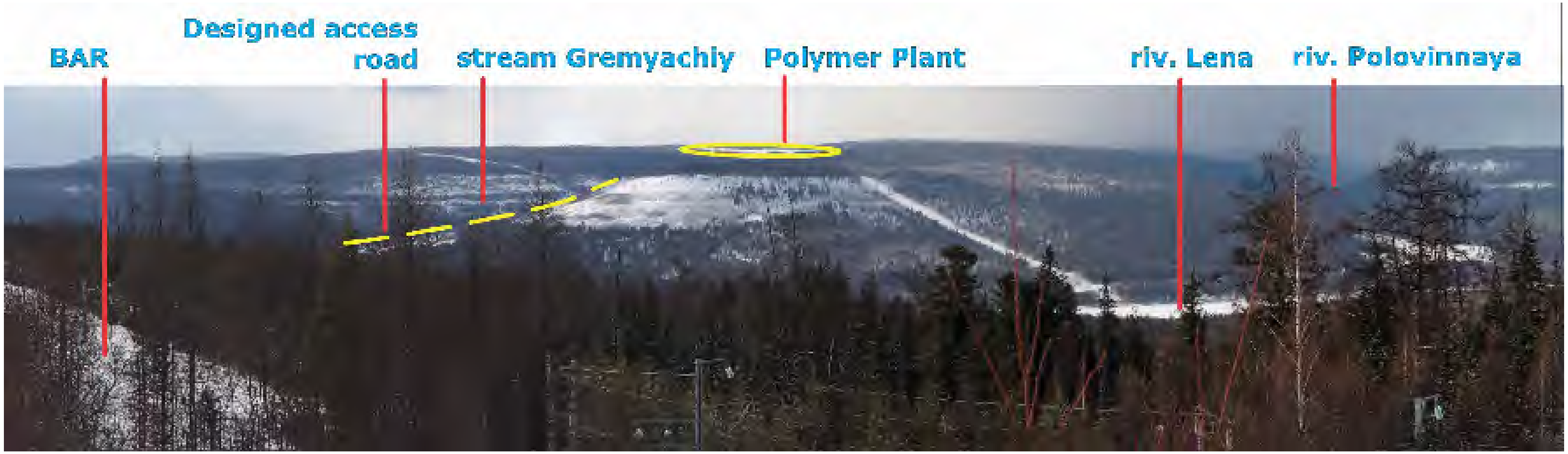

Figure 9.4.3: A view of the PPF site from the right bank of the Lena river

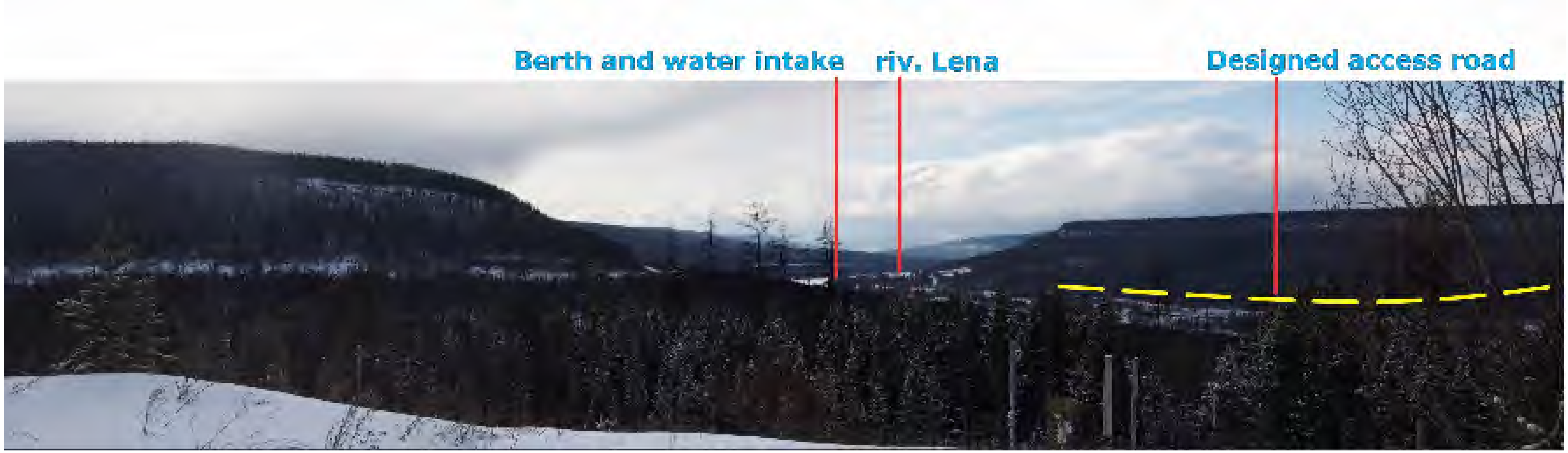

Figure 9.4.4: A view of the PPF associated facilities in the valley of the Lena river

A certain impact is also expected to affect pine-larch forests with spruce and cedar, shrub high-grass stable derivative forests of steep drainage troughs on sod-calcareous and sod-podzolic underdeveloped soils. The impact on those landmarks will mainly result in their fragmentation by utility corridors. The latter may cause local blockage of surface and subsurface runoff and expansion of waterlogged areas, however, given the good drainage conditions within the territory due to fractured basement rocks and inclined terrain, development of human-caused swamping processes is unlikely.

The least affected (mainly by construction of the water intake facilities and the treated wastewater sewer) will be unstable floodplain meadow landmarks on alluvial soils with variable grain size.

The proposed changes in the landscape structure of the left bank of the Lena river in the area between Sukhoy and Gremyachiy streams is not limited to the construction of the polymer plant and its associated facilities: adjacent areas will house numerous linear and areal facilities of the trunk and process gas pipeline and the LPG/LGC terminal, as well as the gas-chemical plant with the GFU which is comparable in size. Some of those facilities will be in direct line of sight of the Mostootryad and Yakurim residential districts of Ust-Kut, and will be mainly responsible for the visual impacts of INK's Ust-Kut industrial district and the loss of aesthetic value of the disturbed valley-forest landscape. The proposed polymer plant, with some of its facilities (including flare units) rising above the forest roof, is also surrounded by a belt of forest landmarks, whose width, given the existing Project footprint, will range from 200 to 1300 m (Figures 9.4.4, 9.4.5).

Figure 9.4.5: Approximate location of the inter-site motor road on the right side of the Gremyachiy stream valley (on the northeastern slope of Cape Tolstyi): a view from the lands of Kedr 2 gardening association.

The results of assessing the visibility of the PPF process zone facilities are illustrated with photographic panoramas and a map in Figure 9.4.4. Most of the proposed structures will not be noticeable from the nearest residential and recreation zones, with the possible exception of flare units and emergency lighting masts, which may be visible, both directly and in the form of an increase in the level of illumination of the near-ground atmosphere, beyond the boundaries indicated in Figure 9.4.4. Thanks to the decision of the Company to move the PPF process zone to a higher elevation, as compared to the 2017 main option, the plant facilities will not be visible for the majority of receptors - the population of Ust-Kut and the Ust-Kut municipality.

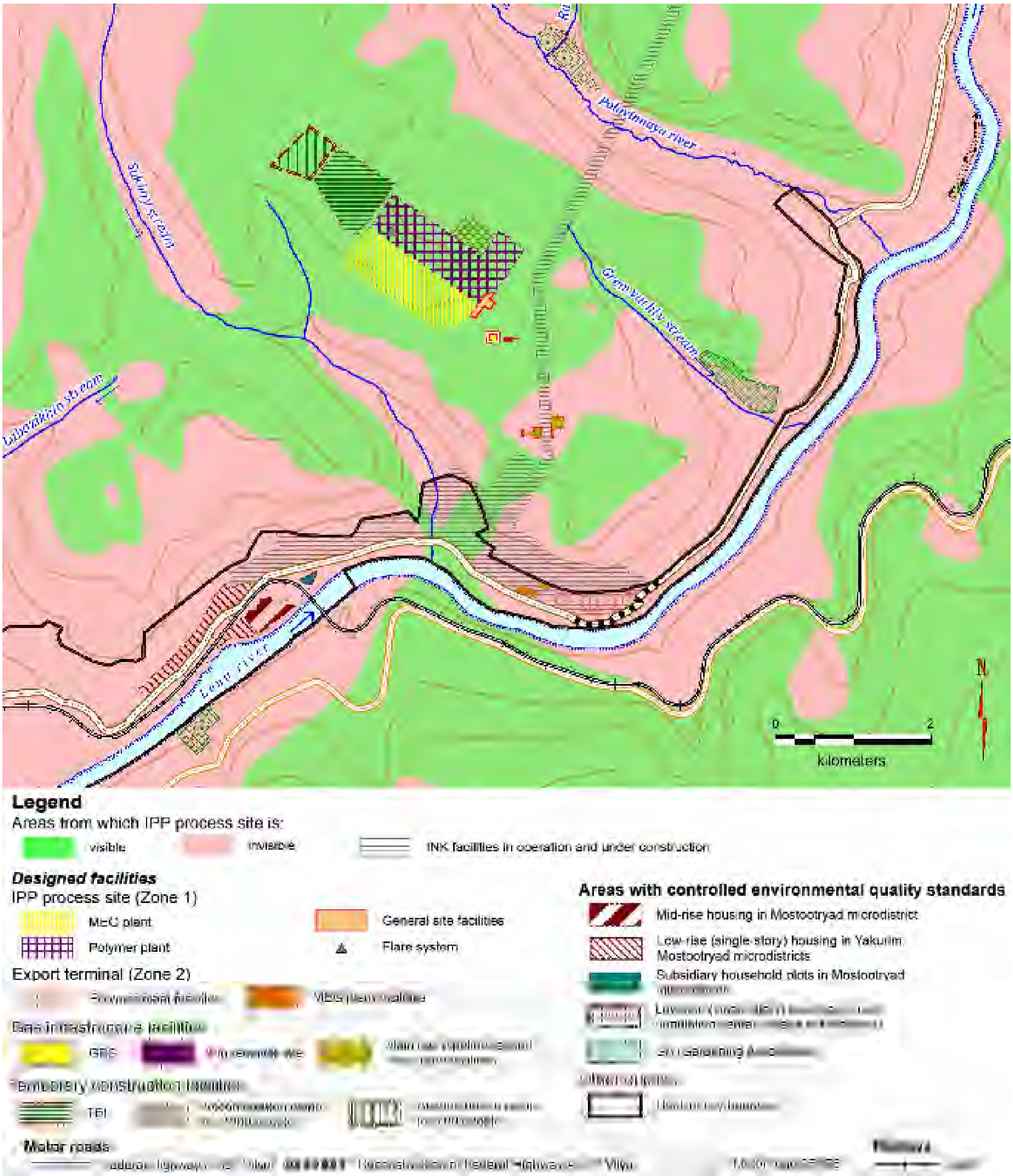

Figure 9.4.6: Estimated visibility of the proposed PPF facilities from the adjacent areas[239]

For the adjacent recreation area, which belongs to the Kedr-2 gardening association, the nearest proposed INK facility will be a category IV inter-site motor road (unpaved, with the roadway width of 8 m), which will pass along the opposite side of the Gremyachiy stream valley, subparallel to the existing road (Figure 9.4.3). As of this writing, there is no information about its exact location or planned freight traffic density, and therefore it is impossible to assess the corresponding impacts on the adjacent territories.

[239] The visibility analysis has been performed using the following software products: MapInfo (version 11.0), QGIS (version 2.17), and Viewshed Analysis based on the SRTM (Shuttle Radar Topography Mission) data; SRTM is an international research project to generate a digital topographic database using a radar system. The visibility of the 120m high flare system (120 m being the maximum height allowed for the proposed plant) the average tree height (10m) and the height of the observers (1.5m) were taken into account.

Short-term (construction period) and long-term negative visual impacts will be insignificant for most of the proposed plant facilities located outside the direct line of sight of the nearest residential and recreation areas. At the same time, the overall shrinkage of forests, the most prominent natural landmarks amid significant fragmentation of the remaining slightly or moderately altered natural landscapes and the emergence of areas with clearly technogenic aspects, will lead to changes in the appearance of the local valley-forest landscape and will trigger mechanisms for its gradual transformation caused by the drastic changes. Most of the effects are already felt as the construction of the gas transportation system, the LPG terminal, the GFU, and the associated facilities is nearing completion.

9.4.4 Soil impacts

9.4.4.1 Assessment of soil vulnerability to impacts from the proposed activity

In the system of geographic soil mapping of the Russian Federation and the Irkutsk Oblast the proposed polymer plant construction site belongs to the northern part of the Lena-Angara mountainous soil province of the Eastern Siberian taiga region of the Boreal Belt; it is located in the vicinity of the boundary to the Angara plain province of podzolic sod soils, calcareous sod soils and taiga sod soils (Kirenga-Lena district of calcareous sod soils and podzolic sod soils with shallow occurrence of calcareous bedrocks). According to the materials of the pre-design surveys at the neighboring LPG Terminal site, it’s those types of thin and poorly developed calcareous and podzolic sod soils that dominate the Project footprint; accompanying intrazonal soils comprise gleyey sod soils; azonal soils consist of various types of alluvial soils with variable grain size.

The low thickness of organogenic and humus-accumulating soil horizons makes them vulnerable in relation to physical and mechanical impacts. The fertile topsoil layer cannot be used in most cases for soil cover restoration, because in the process of topsoil stripping it is blended with the subsoil material. Under such conditions biological land remediation may require using peat and sand mixture or other substitutes for the original fertile topsoil. It is important to take into consideration not only the shortage of fertile soils in the area under review, but also the shortage of potentially fertile soils, whose criteria are met only by a very limited range of deluvial, deluvial-proluvial and alluvial-deluvial sandy silts, as well as ancient sedimentary rocks weathered to a sandy silt condition. The main factors limiting the fertility of local substrates are their high stone content and low organic matter content.

The soils within the Project footprint are also highly vulnerable to forest fires: local soils have formed by accumulation of leaf litter which rapidly burns out in ground fires baring mineral horizons of forest soils. On slopes, such developments can trigger erosion-accumulation processes, increase depth of freezing, and, as a consequence, cause a loss of not only flora but also soil fauna components.

The disturbance of the soil cover within the project area is attributed in the first line to the historic forestry resources development and operation of various technical facilities. No signs of chemical pollution of soils in the areas adjacent to the LPG Terminal site had been detected in the course of the surveys. But at the same time, taking into consideration the shallow location of the detrital mantle of weathering and sedimentary bedrock, it may be expected that a number of trace elements (e.g. barium, strontium, lead, manganese and boron – typical 'satellites' of limestones and dolomites[240]) might have elevated concentrations in the natural lithogeochemical background within the subject area; this fact should be taken into account in the process of monitoring the technogenic soil cover contamination.

9.4.4.2 Types of soil impacts from the proposed activity

All potential soil impacts can be divided into the following three groups:

1. Impact on the area’s soils associated with the acquisition of areas with certain types of soils for the construction of the polymer plant facilities. Prior to the project implementation, the acquired areas had not been used for any commercial purposes (forested areas, sites occupied by technical facilities to be dismantled, etc.), including commercial hunting (see Section 8 for more detail). The economic loss associated with the acquisition of the soil areas for the construction of industrial facilities will be insignificant. To minimize the loss, the fertile topsoil layer will have to be stripped and stockpiled in

[240] Kovda V.A., Yakushevskaya I.V. Trace elements in soils in the Soviet Union. Moscow, Moscow university, 1959, 65 pages

accordance with the applicable regulations. The thickness of the topsoil layer should be assessed in the course of soil investigations within the framework of the engineering surveys to be conducted prior to the project design phase. The areas to be used for TBI on a short-term basis during the construction phase will be subject to land remediation and will be returned to the respective lessors with due consideration of their requirements with regard to the land condition and the planned subsequent land use. The main goal of remediation of the disturbed land within the protection zones of the planned facilities will be conservation of environmental properties. Upon agreement with the lessors, some areas may be subjected to reforestation, construction (i.e. without the biological stage) or sanitary-hygienic remediation (in areas where legacy pollution will be detected).

2. Mechanical disturbance of soils. The soils that are the main component of the biocenosis of the area under review will be impacted in the process of installation of the off-site utilities, road construction, as well as construction of main and auxiliary facilities. The following points should be emphasized in the project design documents:

- controlled soil cover disturbance in the areas leased on a long-term basis in the process of areas facilities construction; disturbance of land areas leased on a short-term basis when excavating trenches and providing terraces for installation of off-site utility lines;
- uncontrolled soil cover disturbance associated, for example, with unauthorized traffic of construction machinery off the specially provided road network or the performance of construction work outside the Project footprint.

Mechanical disturbance of the soil profile may lead to fragmentary destruction of organic and humus-accumulating soil horizons, which determine soil fertility, and the mixing of materials from different soil horizons resulting in a reduction of natural soil fertility. Movements of construction machinery within the ROW may result in partial or complete destruction of the soil cover. Wind and water erosion of soil in disturbed areas may cause loss of fertile soil.

Such impacts will be contained within the Project footprint and will be felt primarily during the construction phase. In the adjacent areas such impacts will be in the form of local physical disturbance of the soil cover, changes in drainage conditions of soils and subsoil horizons, changes in the thermal conductivity, hydrophobic properties of soils, and adverse exogenous processes. Direct physical or mechanical impact of construction activities on the soil cover in the areas adjacent to the construction sites can and should be completely prevented.

3. Soil pollution may be caused by secondary migration of pollutants, already present in the soil and the geological environment, triggered by construction activities or by scattered (along with atmospheric precipitation) or concentrated (spills, leaks, etc.) ingress of pollutants during pre-construction, construction, installation operations and any associated work, as well as during the operation of the polymer plant and its associated facilities.

Based on the available information relating to the character of the planned activities, it may be assumed that the extent of changes in the chemical composition of soils within the area of influence of the proposed facilities will follow the trend and will not exceed the threshold values ensuring conservation of the natural state of local soils. No additional significant impact on the soil cover and the adjacent areas is expected from the construction sites (higher phytotoxicity, release of pollutants into groundwater, etc.). To reduce the corresponding environmental risk the Project documentation should provide for measures aimed at monitoring the compliance with the applicable construction rules and regulations, and the regulations on storage of hazardous materials and wastes, as well as measures for prompt containment of, and elimination of the consequences of, any detected legacy or ongoing accidental pollution. It is also recommended to develop an Environmental and Social Management Plan for the construction phase of the Project.

9.4.5 Soil and land conservation measures

In order to ensure conservation and sustainable use of land and soil resources and to prevent them from being depleted or degraded, the following main requirements should be followed in the course of construction and installation work:

- perform construction work according to schedule and within the Project footprint without claiming extra areas due to construction process mismanagement;
- as regards land plots leased for the duration of the construction period: perform all types of work within the timeframe agreed upon with the land users in order to minimize inflicted damage;
- in areas with tree and shrub vegetation: provide for forest clearing with due consideration of the requirements of the forestry management regulations specified by the Ust-Kut Forestry Administration; remove all logging residue from the project site simultaneously with logging and skidding operations; if required, designate special areas for short-term storage of logging residue, no burning and disposal of logging residue should be allowed within the project site;
- ban all motor vehicle and construction machinery traffic other than via approved transportation routes;
- prevent littering of the construction site with garbage, wastes, insulation and other materials residue, and pollution of construction sites with fuel and lubricants;
- implement erosion prevention measures within the project site, carry out land remediation operations on lands disturbed by construction.

The following organizational measures should be implemented to prevent soil pollution:

- refuel motor vehicles only in designated areas equipped with appropriate containers for collection of waste fuel, lubricants and oily rags;
- refuel construction equipment and machinery at the construction sites and *en route* according to the regulations in such a way as to prevent any releases of fuel and lubricants onto the soil;
- ensure sustainable use of material resources, minimize waste generation, and maximize of waste disposal and decontamination;
- store construction materials and wastes only in designated areas, equipped to prevent pollution and littering of the soil, burning or spontaneous combustion of wastes and other combustible materials.
- develop and implement waste management plans for all types of wastes generated during the construction phase, monitor the implementation;
- store fuel and lubricants only in designated areas, handle fuel and lubricants in accordance with the applicable regulations, both Russian and international;
- storage areas: construct dykes around liquid hydrocarbon storage tanks ensuring 110% capacity of the storage tank (the largest storage tank, if the dyke is to be constructed for a group of tanks);
- use dry transformers; if not feasible, install a tank of adequate capacity for draining transformer oil; handle transformer oil in accordance with the applicable regulations;
- refrain from washing machinery and equipment at construction sites (set up designated wash down areas);
- set up wheel wash stations for vehicles and construction machinery at points of exit from the construction sites;
- ensure that during the construction period surface runoff is collected and removed from the sites and, if necessary, sent to wastewater treatment facilities;
- stabilize any slopes and earth dumps which are expected to remain at the site for over 2 weeks.

One of the most important measures aimed at restoring the soil cover is remediation of lands disturbed by construction for the purpose of:

- maintaining the balance of productive areas by restoring the fertility of disturbed lands;
- restoring lands which were acquired on a temporary basis for the duration of construction;
- limiting the adverse impacts of technogenic processes on land.

Taking into consideration the soil and weather conditions within the construction site and the commercial use of the land, the Project documentation should provide for two-stage remediation of disturbed lands:

- Technical remediation including topsoil stripping and temporary stockpiling prior to the commencement of the construction and installation work with subsequent replacement of the stockpiled soil after the completion of the construction (in areas where surveys confirmed at least 10 cm fertile topsoil layer in accordance with the relevant state standards);
- Biological remediation following the technical remediation stage and aimed at restoring soil fertility by means of adding mineral fertilizers and preparing the land for its intended use.

Technical remediation (removal of construction waste, debris, and logging residue, leveling of the area within the construction corridor) shall be performed by the construction contractor immediately after the completion of the construction and installation work.

Steps to be taken during biological land remediation will depend on the way a particular area is associated with the production zones (site improvement and greenery planting with due regard for the fire safety regulations), buffer zones and firebreaks (grass seeding subject to fire and erosion prevention measures) and forest lands (reforestation). In case of plant sowing, it is recommended to use endemic plant species which do not require additional watering.

The thickness of the fertile topsoil layer is determined depending on the level of soil fertility and, on average, is between 10 and 20cm for full-profile podzolic and calcareous sod soils. Taking into consideration the information presented in Chapter 7 and the pre-design survey materials for the neighboring LPG RSST and GFU sites, the topsoil layer within the main development area is not likely to be stripped away due to any of the factors listed below:

- according to section 1.5 of GOST 17.4.3.02-85 the fertile topsoil layer with the thickness below 10 cm should not be removed in forest areas;
- according to GOST 17.5.1.03-86, the topsoil layer should have the following properties: pH of aqueous suspension from 5.5 to 8.2; humus content more than 1%; physical clay content from 10% to 75%;
- according to section 4 of GOST 17.5.3.06-85, no requirement is specified for topsoil stripping for soils with a high content of gravel, very stony, slightly, moderately and highly washed-out podzolic sod soils;
- according to section 2.6 of GOST 17.5.3.05-84, the topsoil layer should not be polluted or littered with industrial wastes, solid objects, stones, gravel, pebbles or construction wastes or debris.

Nonetheless, if according to engineering survey findings, any areas are identified with the topsoil layer thickness of 10 cm or more, such topsoil should be pre-stripped during the warm season, if possible; the topsoil layer may be stripped in winter subject only to the approval of respective land users and government agencies in charge of land use supervision.

If possible, the topsoil is to be stripped in one pass to its entire depth. Dedicated sites with graded surface should be provided for storage of topsoil material, with adequate precautions to prevent mixing of fertile soil with other ground materials, washing or blowing out, or other loss of the material.

Restoration of the topsoil cover shall be performed during the warm season of the year. The remaining excessive quantity of soil, if any, should be used for the improvement of new sites during the subsequent stages of construction.

By the time of finalization of this report, design development for reclamation of land temporarily acquired for construction of the interfacility road has been completed (CJSC "VOSTSIBTRANSPROEKT", 2019). The design for restoration of soil and vegetation cover is generic and, on the Consultant's opinion, should be elaborated in the working design.

In particular, according to the survey materials for the facility, upper soil layers within the right-of-way feature neutral or slightly alkaline reaction (pH 7.2-7.7), therefore, liming is not needed. Furthermore, the soil reportedly has a relatively high organic content (7.5 to 20-22 %) and variable, sometimes fairly high levels of nutrient minerals (NPK). Therefore, application of lime, organic and mineral fertilizers for land reclamation should be differentiated depending on local site conditions in the areas disturbed by construction, and should not be practiced within the protection zones of water bodies.

Since the designed area subject to reclamation is by an order smaller than the area of the earth works, the lack of topsoil material is unlikely to occur, given the designed quantity of topsoil to be stripped. Survey reports prepared by CJSC "VOSTSIBTRANSPROEKT" do not provide any assessment of the topsoil thickness and available reserves at the sites of the interfacility road. On the other hand, surveys of other sites within the Ust-Kut industrial area of INK demonstrated that most common varieties of local topsoil - sod-calcareous, sod-podzol, sod-gley washed-out / deposited and associated soil types are not subject to stripping and protection, for the following reasons:

- According to Item 1.5 of GOST 17.4.3.02-85, a fertile topsoil layer less than 10 cm thick is not subject to stripping in forest areas;

- According to GOST 17.5.1.03-86, the fertile topsoil layer should have the following characteristics: pH value of water suspension from 5.5 to 8.2; humus content of more than 1%; physical clay content from 10% to 75%;
- According to Item 4 of GOST 17.5.3.06-85, a fertile topsoil layer is not subject to stripping if the soil has a high content of gravel and pebbles;
- According to Item 2.6 of GOST 17.5.3.05-84, a fertile topsoil layer should not be polluted or contaminated with solid objects, stones, gravel, pebble and construction debris.

As was mentioned above, it should be taken into consideration that under the conditions of the subject area there is a shortage of not only fertile and potentially fertile soil (i.e. deluvial, deluvial-proluvial and alluvial-deluvial loams meeting the applicable criteria), but also sedimentary rocks weathered to a condition of sandy silts. The main limiting factor of fertility for local substrates are their high stone content and low organic matter content. Therefore, on the Consultant's opinion, it is likely that the available topsoil material will not fully satisfy the needs of reclamation of land disturbed by construction. To cover the gap, the working design for the respective facilities should identify sources of sand and peat (or other organogenous) soil, methods of preparation of peat-and-sand mixture, its application, addition of deoxidizing agents and fertilizers, seeding perennial grass or planting of young trees. The latter shall be carried out for reclamation of forest land, considering the Forest Management Regulation of Ust-Kut Forestry Department, and the resources available for supply at the forest nurseries in the region.

All types of work during the biological stage of land remediation should be performed in conformity with the Technical Specifications for land remediation (to be preliminarily approved by or agreed upon with the land lessor), the Irkutsk Oblast Forestry Plan and the Forestry Management Regulations (for forest lands) of the Ust-Kut Forestry Administration, and the recommendations of the Irkutsk and Tulun Agrochemical Stations (for areas to be converted into grasslands). Regionally sourced mineral and organic fertilizers, seeds and planting stock should be used whenever possible.

It is required to organize during the construction phase industrial control over the compliance with the requirements applicable to topsoil stripping and stockpiling, the quality of surface leveling, the timeframe and the quality of remediation of disturbed lands.

Upon completion of the construction, remediated land plots used on a short-term basis for the project construction needs shall be returned to the respective land lessors in a condition suitable for their intended commercial use. Remediated land plots should be redelivered upon completion of the construction simultaneously with the commissioning of the main project facilities during a snowless period in accordance with the procedure approved by the Russian Federation Ministry of Natural Resources and the Russian Federation Land Management Committee (Order No.525/67 dated December 22, 1995 "On the approval of basic provisions on land remediation and the removal, conservation and sustainable use of the fertile topsoil layer").

The following improvements should be implemented on land plots leased on a long-term basis and free of process equipment:

- constructing intra-site driveways and passageways;
- spreading fertile topsoil using topsoil dumps or imported material (e.g. peat and sand mixture) across areas free of process equipment and hard surfaces;
- seeding lawns in open soil areas;
- planting trees and shrubs within the auxiliary facilities site.

To prevent soil pollution during the operation phase of the Project the following technical solutions preventing ingress of pollutants onto the soil surface should be applied:

- install main process equipment inside buildings or container blocks;
- install impermeable floors in buildings with valves and compartments for removal and containment of spills;
- provide emergency tanks for collection of accidental spills;
- install underground drainage tanks and emergency tanks in manholes to prevent soil pollution caused by leakages;
- develop and monitor implementation of procedures for handling fuel, lube oils and waste oils in accordance with the policies specified for the construction phase;

- develop and implement a waste management procedure during the operation phase of the Project; monitor implementation;
- install hard waterproof surfaces, dykes around storage tanks ensuring 110% capacity of the largest tank, and a system for collection and removal of surface runoff via stormwater drainage channels with subsequent treatment at the wastewater treatment facilities in all process areas where leaks of process fluids, products, fuel and lubricants are possible;
- inspect and subject to integrity testing tanks and pipelines on a regular basis according to a schedule approved by the plant manager;
- develop and monitor implementation of an emergency response procedure for emergencies that are likely to cause soil pollution.

Table 9.10 contains a summary estimate of the significance of expected impacts on soils and landscapes during the construction and operation phases of the polymer plant along with recommendations for prevention, minimization and monitoring of adverse changes anticipated in connection with the planned activities.

9.4.6 Conclusions

1. The sites for the proposed Polymer Plant and its associated facilities have been chosen by the Irkutsk Oil Company with due regard for the following factors:

- a combination of favorable economic and geographical conditions;
- existing regulatory limitations associated with the location of archeological sites, water conservation zones and riparian buffer belts of surface water bodies, spawning protection forests of the Ust-Kut forestry;
- planned regulatory limitations relating to SLUC zones associated with the gas transportation system and the power grid (including sanitary protection zones, buffer zones, restricted development zones, etc.).

2. An important environmental and landscape feature of the project area is the absence of specially protected nature areas (SPNA) of local, regional or federal significance, or any areas with traditional use of natural resources within the project footprint and in its immediate vicinity.

3. During the previous stages of INK's Gas Program schematic territorial planning maps of the Ust-Kut municipality were updated and adjusted to change the land use conditions within the areas affected by the LPG/LGC Terminal and the GFU to the extent they relate to allocating lands and setting up a prescribed sanitary protection zone.

4. The size of the Polymer Plant footprint was determined by the Irkutsk Oil Company based on the need to minimize the total land acquisition area and optimize the width of the ROW for the linear facilities.

5. An area of approximately 500 ha has been allocated for the construction of the proposed areal and linear polymer plant facilities, of which 430 ha of forest land needs to be recategorized as industrial land. The total forest area controlled by the Ust-Kut Forestry Administration is 4,535,060 ha, of which 4,358,285 ha is the area occupied by forests, and therefore the recategorization of the forest land in question as industrial land and subsequent clearcutting on 40-50% of the area will not result in any noticeable reduction of the forest cover within the district (currently it is estimated at 96%) or in any changes to the forest resources.

6. On the whole, the planned location of the polymer plant facilities appears to be optimal in view of minimization of possible sizes of the SLUC zones associated with the existing or planned facilities, since the proximity of INK's other gas transportation, processing, storage and shipment facilities will enable a reduction in the overall size of areas of influence, which will overlap for the most part.

7. In comparison with the total area of the affected municipalities and the forest area of the Ust-Kut Forestry Administration, the area of the acquired land does not appear to be significant. At the same time, the concentration of industrial and transport facilities is likely to be high, including a trunk gas pipeline and a major gas chemical plant, which will result in a substantial transformation and fragmentation of local landmarks. In the past, the territory was used for extensive logging and wood processing operations, and the baseline status of the landscapes was characterized in the engineering

survey materials as slightly, moderately or highly modified according to the GOST 17.8.1.02-88 terminology. The implementation of the Project will result in the formation of highly modified landscapes within the project footprint and the formation of moderately modified landscapes in the adjacent areas.

8. The land use conditions in forest areas not affected by the construction will change due to the necessity of setting up the sanitary protection zones and other SLUC zones of the Polymer Plant and its associated facilities. The extent of the corresponding limitations is discussed in detail in Section 9.11 of this Chapter. The SPZ regime implies that the concentrations of the pollutants released into the ambient air may exceed the prescribed MAC values and the intensity of harmful physical impact factors (noise, vibration and electromagnetic fields) may exceed the maximum allowable levels applicable in controlled areas.

9. Among local landmarks, the forests will be affected the most: within the project footprint forests will be completely replaced by buildings, constructed surfaces, and secondary grasslands. Unstable landmarks consisting of floodplain osier beds on alluvial grey humus soils with variable particle size will be affected to a lesser degree (mainly by the construction of the water intake facilities and the treated wastewater sewer).

10. The proposed changes in the landscape structure of the left bank of the Lena river in the area between Sukhoy and Gremyachiy streams is not limited to the construction of the polymer plant and its associated facilities: adjacent areas will house numerous linear and areal facilities of the trunk and process gas pipeline and the LPG/LGC terminal, as well as the gas-chemical plant with the GFU which is comparable in size. Some of those facilities will be in direct line of sight of the Mostootryad and Yakurim residential districts of Ust-Kut, and will be mainly responsible for the visual impacts of INK’s Ust-Kut industrial district and the loss of aesthetic value of the disturbed valley-forest landscape. The proposed polymer plant, with some of its facilities (including flare units) rising above the forest roof, is also surrounded by a belt of forest landmarks, whose width, given the existing Project footprint, will range from 200 to 1300 m. For the adjacent recreation area, which belongs to the Kedr-2 gardening association, the width of the remaining forest belt will be 200 m (to be specified at subsequent stages of design).

11. Short-term (construction period) and long-term negative visual impacts will be insignificant for most of the proposed plant facilities located outside the direct line of sight of the nearest residential and recreation areas. At the same time, the overall shrinkage of forests, the most prominent natural landmarks amid significant fragmentation of the remaining slightly or moderately altered natural landscapes and the emergence of areas with clearly technogenic aspects, will lead to changes in the appearance of the local valley-forest landscape and will trigger mechanisms for its gradual transformation caused by the drastic changes. Most of the effects are already felt as the construction of the gas transportation system, the LPG terminal, the GFU, and the associated facilities is nearing completion.

Table 9.4.2: Expected impacts on soils and landscapes and mitigation and monitoring actions during polymer plant facilities construction and operation

Environ-mental aspects	Expected impacts	Phase[241]	Recommended impact mitigation actions	Expected residual impacts	Residual impact significance	Recommended monitoring/control actions
1. Air emissions	Soil pollution caused by precipitation of emitted harmful substances	C,(O)	Conduct regular tests of the composition of exhaust gases from motor vehicles, construction machinery, diesel-driven installations and other equipment utilizing internal combustion engines. Use motor vehicles complying with the applicable air emission standards. Monitor industrial emissions in accordance with the industrial environmental monitoring and control program.	Inevitable pollution of soil with exhaust gas components from motor vehicles, railway cars and river vessels, construction and other special machinery within the limits specified by the applicable technical regulations.	Low significance	Develop and implement an industrial environmental monitoring program with due consideration of the approved SPZ plans, including compliance with the prescribed levels of chemical soil cover pollution in reference areas which should be located with due regard for specific microclimatic features of the project sites, how the pollution sources are located in relation to one another, and the nearest controlled areas. Monitor compliance with the applicable work performance, occupational health and industrial safety regulations and fire safety regulations. Some of these measures should be incorporated in the industrial environmental monitoring program.
	Air pollution caused by dust; precipitation and secondary pollution (caused by finely dispersed particulate matter from road surfaces, construction materials, loose substances, solid wastes, welding aerosols, paint aerosols, etc.)	C,(O)	In summer: periodically spray water over road surfaces as well as over loose substances or other materials stored in open storage yards and being potential sources of dust. Set traffic speed limits. Ensure adequate maintenance of road surfaces (for roads with hard surfaces). Set up wheel washing stations and take other steps to prevent soil entrainment at exits to road sections with hard surfaces; promptly clean such road sections. Reinforce slopes, plant greenery in open soil areas at industrial sites using lawn grass mixtures and other means to curb deflation. Implement a series of measures to prevent fires within the project footprint or to prevent fires from crossing over from adjacent areas (especially from Ind Timber's sawmill residue storage area)	Atmospheric air pollution with dust, precipitation of dust onto the soil (to be minimized as a result of the planned mitigation actions)	Low significance	
2. Storage of raw materials	Areas within the project footprint littered with components of stored materials and wastes. Pollution of affected strata (surface runoff, soils and rocks, ambient air) caused by mobilized components of stored materials and wastes	C,(O)	Store materials and wastes in specially equipped areas to prevent pollution and littering of soil and surface runoff, burning or spontaneous combustion of wastes or other combustible materials.	No significant impacts are expected. Localized soil pollution is possible as a result of infiltration of atmospheric precipitation through storage areas for materials and wastes.		Regular inspections of areas used for storing raw materials, consumables, chemicals and wastes by the Company's HSE service (construction contractor).
3. Waste generation and management		C,(O)	In areas with tree and shrub vegetation: plan forest clearing with due consideration of the forestry management regulations of the Ust-Kut Forestry Administration; remove logging residues from the project footprint simultaneously with logging and skidding operations; if required, designate special areas for short-term storage of logging residue, burning and disposal of which should be strictly prohibited within the project area.			
4. Land use	Land plots acquired on a permanent or temporary basis (during the construction phase). Permanent land plots recategorized as industrial lands.	C,O	Monitor compliance with the Project footprint boundaries and the regime of the adjacent SLUC zones (water conservation zones, riparian buffer belts, buffer zones around archeological heritage sites, etc.) throughout the Project lifecycle. Remediate lands leased on a short-term basis after the construction has been completed and return them to the lessors in accordance with the approved procedures.	Minimize damage to the soil cover by stripping and stockpiling the fertile topsoil layer.		Regularly inspect areas used for stripped topsoil stockpiling. Monitor areas outside the plant footprint and the footprint of the associated facilities to identify physical or mechanical disturbance of the soil. Monitor soils in remediated areas.

[241] C- construction, O – operation, the phase during which less impact is expected is shown in parenthesis

Environ-mental aspects	Expected impacts	Phase[241]	Recommended impact mitigation actions	Expected residual impacts	Residual impact significance	Recommended monitoring/control actions
			Monitor compliance with the regime of the SLUC zones established after the commissioning of the polymer plant (SPZs, buffer zones, forest clearing zones, restricted development zones, special zones boundaries). Perform construction work according to schedule and within the bounds of the Project footprint without using any additional areas because of mismanagement of construction activity. Perform construction work in areas leased only for the duration of the construction phase according to the timeframe agreed upon with the lessors and land users to minimize inflicted damage. No vehicle or construction machinery traffic other than via the approved transportation routes.			
5. Pre-construction, earthmoving, melioration, construction and installation work	The thermal and water regimes and the physical properties of soils changed at industrial sites, in adjacent areas, and in utility corridors. The soil cover partially destroyed. Transformation of topography, development of adverse exogenous geological processes.	C,(O)	Site improvement and greenery planting in areas leased on a permanent basis after the construction and erection completion. Land remediation in all areas used on a short-term basis. Sustainable use of the existing motor roads and other infrastructure facilities. Perform all types of work strictly within the bounds of the Project footprint.			Make sure that measures for regular inspection of site improvement and greenery planting elements and overgrown (unused) areas within the bounds of the Project footprint are included in the industrial environmental monitoring program.
	Areas littered with logging residue, ferrous and nonferrous scrap metal, oily rags, waste tires, fragments of construction materials, etc.	C	Site improvement and greenery planting in areas leased on a permanent basis after completion of construction and installation. Land remediation in all areas used on a short-term basis. Sustainable use of the existing motor roads and other infrastructure facilities. Perform all types of work strictly within the bounds of the Project footprint.	Comply with the applicable construction regulations, equipment maintenance rules and other industry-specific norms; take prompt action to removing litter in order to minimize residual impacts.		Regularly inspect areas designated for short-term waste storage
6. Accidental spills of fuel, lubricants and other process fluids	6.1. Soil polluted by accidental spills of fuel, lubricants and other process fluids	C,(O)	Install main equipment inside buildings with impermeable floors and enclosures for collecting spills, and in container modules. Set up tanks for collecting accidental spills (ensure adequate insulation in case of underground installation). Develop and monitor implementation of procedures for handling fuels and lubricants (including waste fuels and lubricants). In areas where leaks of process fluids, fuels and lubricants are possible install impermeable surfaces and dykes as well as systems for collection, removal and treatment of surface runoff; use containment trays for handling fuel, lubricants and other industrial fluids. Regularly inspect and test the integrity of tanks and pipelines according to the schedule approved by the plant manager. Develop and monitor implementation of emergency response procedures in case of emergencies and accidents that can potentially result in soil pollution.	Comply with the applicable construction regulations, equipment maintenance rules and other industry-specific norms; take prompt action to respond to accidental spills in order to minimize residual impacts.	Moderately high significance	Monitor compliance with work performance, HSE and fire safety regulations. Monitor soil quality in areas where pollution has been detected.

Environ-mental aspects	Expected impacts	Phase[241]	Recommended impact mitigation actions	Expected residual impacts	Residual impact significance	Recommended monitoring/control actions
	6.2. Impact of legacy pollution	C	Surveys at the adjacent LPG/LGC RSST and GFU sites have not identified any legacy soil pollution. Special measures should be considered based on pre-design engineering and geological surveys to be conducted specifically for the PPF		Low significance	Monitor soil quality in reference and baseline areas described in survey materials and the project documentation.
7. Landscape transformation and visual impacts	7.1. Alteration/loss of the landscape's resource-providing and stabilizing function	C,O	Implement measures outlined in pos. 1, 4, and 5 above. Compensatory reforestation, the extent of which should corresponding to the previous withdrawal of buffer (spawning protection) forests. Minimize artificial illumination of PPF industrial facilities at night. When choosing paints and lacquers, give preference to colors which make process facilities stand out as little as possible against the background of the corresponding landscape (subject to the safety regulations)	Residual impacts will be reduced to a bare minimum.	Low significance	No special action required
	7.2. Deterioration of the landscape's visual characteristics	C,O			Low significance	

9.5 Surface Water Impact

9.5.1 Introduction

Surface water bodies in the area of the proposed polymer plant include the Lena River and its tributaries - the rivers of Yakurim and Polovinnaya and the Sukhoy and Gremyachiy creeks. The Project area does not feature any lakes or bogs.

The main impacts on water resource during the polymer plant construction and operation are associated with water abstraction from natural sources and wastewater discharges to surface water bodies.

Construction activities may disturb the natural surface runoff conditions and therefore accelerate the bank erosion processes, due to transport of solid particles from the construction site with melt and storm water flows. Water environment may be further contaminated by runoff water and petroleum, in case of accidental spill due to lack of adequate storage and handling arrangements. Precipitation events during the construction activities may result in uncontrolled discharge of pollutants from the construction sites down the natural slope into roadside ditches or ravines. Construction of the large equipment unloading berth on the Lena River will include earth works causing agitation of the bottom sediments.

When the polymer plant is operational, its environmental impacts may be caused by violation of operation procedures of the water treatment plant, leaks of wastewater and process products from non-tight pipelines and tanks, and discharge of untreated wastewater.

The above impacts are considered in this section below, and appropriate measures are proposed for their minimization.

9.5.2 Construction phase

9.5.2.1 Water

At the construction phase water will be used for the following purposes:

- drinking and domestic needs of construction workforce;
- process needs (preparation of cement mortar and concrete, hydraulic testing of pipelines and vessels).

Potable water supply for the designed facilities will be provided from ground water boreholes in the Polovinnaya River valley. The drinking water of 70 m^3/h (1680 m^3/day) is determined to satisfy the needs of the construction workforce camp (for 7000 persons). Total design capacity of the water wells will be 120 m^3/h.

Water produced from the aquafer does not comply with the sanitary standards applied to potable water (SanPiN 2.1.4.1175-02, GN 2.1.5.1315-03) regarding iron concentration (8.7 MPC). De-ironing is required to bring water from this aquafer to compliance with potable water standards, while standard requirements for all other parameters are met without any further treatment. Construction of the drinking water treatment plant and clear water tanks is planned as part of the preparatory activities for the Project construction, to serve the household water demand of the construction camp and subsequently supply potable water for the Plant operation.

Technical water for the Project will be supplied from water intake facilities on the Lena River comprising the following:

- water intake structure;
- 1st lift pumping station;
- 2nd lift pumping station;
- pressure pipelines.

Water for the process needs will be delivered to the construction site from the technical water tanks in Area 1 intended for storage of water abstracted from the river.

Water demand for preparation of concrete and mortars represents consumptive use. Losses of recycled water during hydraulic tests will be permanent.

Fresh water saving options are being considered, including accumulation of wastewater after hydraulic tests of the first tanks and first sections of pipelines in storage tanks, for subsequent reuse for hydraulic testing of further tanks and pipelines.

9.5.2.2 Wastewater

The Project construction activities will generate:

- domestic wastewater from life activities of construction workforce;
- process wastewater from hydraulic testing of pipelines and tanks.

In accordance with the design documentation, consideration should be given to priority construction of one line of biological treatment facilities at the Plant WWTP, for reception and treatment of domestic wastewater from the temporary accommodation facilities and process wastewater from the construction site. If this scheme is adopted, there will be no need for construction of the temporary wastewater treatment facility for the construction camp and respective treated wastewater discharge to the recipient water body. When the Plant construction is completed, the above biological treatment line will be used for the intended purpose in accordance with the design.

Process wastewater from hydraulic tests will be sent to storm water treatment plant.

Storm water drainage system within the construction site will also collect effluent water from hydraulic tests and transport it to storm water treatment facilities, therefore, discharge of untreated wastewater will be prevented.

9.5.3 Operation phase

9.5.3.1 Water supply

According to the existing design, process water for the Project facilities operation will be provided by means of water abstraction facilities on the Lena River which will supply river water to the site. Maximum design capacity of the 1st lift pumping station is 900 m^3/h and can be further increased to 2500 m^3/h. Water will be pumped to the Plant site (Area 1) via two pipelines discharging to the service water tanks, from where it will be supplied to the looped network of river water, makeup water, and to the fire water system.

As the minimum daily average water flow in the Lena River (99% probability) at the water intake is 37.2 m^3/s, proportion of water abstraction volume will not be more than 2% of the total river flow in the worst case.

A water recycling system (WRS) is provided to minimise abstraction from the Lena River. Recycled water is used for cooling of equipment within the process units and the boiler house, in water coolers, cooling devices within sampling system, for cooling of compressors and oil system coolers. Makeup for the WRS is a mixture of river water from the Lena River (3012 m^3/day) and treated rain water (4392 m^3/day).

Similarly to the construction phase, drinking water supply for the operational activities will be provided from the well in the Polovinnaya River valley. Adequate quality of drinking water will be ensured by using the drinking water system at the site of the polymer production facility. Dedicated pipeline network will be provided for transportation of drinking water to the plant from the drinking water production system. Drinking and domestic water consumption at the operation phase is 33.40 m^3/day.

Demineralized water is needed for production of steam required for the process technology. Demineralized water consumption will be minimized through implementation of a condensate collection and recycling system which will return the resource to the boiler house.

The site fire water system consists of a fire water pumping station, tanks, a foam formation facility, and fire water distribution network. Design water demand for fire suppression will be determined in accordance with the applicable regulatory requirements.

Quantity of water supplied to consumers will be metered.

Considering the insignificant (compared to total river flow) volume of water abstraction from the Lena River, the water recycling arrangement, and the proposed design of the water intake facilities, the impact of water abstraction on the water body and aquatic water systems is assessed as **negligible.**

9.5.3.2 Wastewater discharge

The Project operation will generate domestic wastewater, process-and-storm wastewater, process wastewater, and storm water.

The designed wastewater treatment plant will treat wastewater flows from four different sewerage systems:

- process-and-storm wastewater system - System I;
- process wastewater system - System II;
- storm water system - System III;
- domestic wastewater system - System IV.

Domestic wastewater system

Domestic wastewater from human live activities feature relatively stable volumes, chemical composition and physical properties, and are largely contaminated with organic compounds. Concentrations of pollutants in domestic wastewater at the operation phase are shown in Table 9.5.1. Design flow of domestic wastewater is 10 m^3/h or 90,000 m^3/year.

Table 9.5.1: Domestic wastewater quality

Parameter	Concentration
Particulate matter	200 mg/l, max.
Salt content	about 600 mg/l
BODtot	60.0 mg/l
COD	200 mg/l, max.
Nitrogen ammonia	30 mg/l, max.
Oil products	3 mg/l, max.
pH	about 8.0 mg/l
Hardness	about 8.0 mg/l
Phenol	30 mg/l

Domestic wastewater will be treated at the biological treatment facilities designed as part of the Project's on-site wastewater treatment plant.

Process-and-storm wastewater system

Process and storm wastewater from operational processes, plant testing and washing activities, from flanged or bunded on-site oil and lubricants storage areas is collected by the process-and-storm wastewater system to be provided in Areas 1 and 2.

The following types of process-and-storm wastewater will be generated at the PPF operation:

- oil contaminated storm water and washwater,
- wastewater contaminated with polymers (plant drainage and washing wastewater (in case of general shutdown), leaks / spills from temperature expansion protection devices, blowdown water from the pelletizing water system, spills of powder or pellets during maintenance of such equipment),
- process wastewater without petroleum contamination (from washing of process equipment, river water filters, cooling system of the extrusion sections).

Estimated flow of process-and-storm wastewater is 39 m^3/h or 335,000 m^3/year.

Process-and-storm wastewater from facilities within Area 1 will be treated at the Plant's on-site WWTP designed to serve the four wastewater systems.

From Area 2, process-and-storm wastewater will be sent for treatment to the facilities provided at the LPG site.

Table 9.5.2: Process-and-storm water quality

Parameter	Unit	Concentration
pH		appr. 8
COD	mg/l	350
Particulate matter	mg/l	100, max.
Salt content	mg/l	appr. 700
Oil products	mg/l	100, max.
Hardness	mg_{eq}/l	appr. 8
Phenol	mg/l	30

Storm water system

Storm water runoff including rain and melt water from non-production facilities, roads, unbunded areas, as well as rain and melt water from bunded areas.

The main impurities in runoff water from industrial sites which is not contaminated with specific toxic substances are particulate pollutants, petroleum products adsorbed by suspended solids, mineral salts, and organic impurities of natural origin.

According to the FEED design, various pollutants are present in storm water in the following concentrations:

- Suspended solids – 200 mg/l, maximum;
- Oil products – 8 mg/l, maximum;
- Salt content – 200 mg/l, maximum;
- COD – 100 mg/l, maximum;
- pH - approximately 8.

Estimated total flow of rain and melt water from the site area is 38,430 m^3/day (385,000 m^3/year).

Process wastewater system

The operating polymer production facilities will generate process wastewaters of different types:

- sulphide alkali wastewater - 35 m^3/h or 300,000 m^3/year;
- saline wastewater - 145 m^3/h or 1,270,000 m^3/year.

Sulphide alkali wastewater quality:

- COD - approximately 700 mg/l
- Suspended solids - 100 mg/l, maximum;
- Petroleum products (ester-extractable) - approximately 50 mg/l;
- pH - approximately 12.5;
- sulphide - approximately 100 mg/l.

Saline wastewater:

- wastewater from boiler water demineralization process – 25 m^3/h or 220,000 m^3/year;
- purge water from water recycling systems - 125 m^3/h or 1,050,000 m^3/year

Table 9.5.3: Saline wastewater quality

Parameter	Wastewater from the boiler house	WRS purge water
COD	100 mg/l, max.	150 mg/l, max.
Particulate matter	200 mg/l, max.	100 mg/l, max.
Salt content	Appr. 3000 mg/l	Appr. 1800 mg/l
Petroleum products	5 mg/l, max.	5 mg/l, max.
pH	Appr. 10.5	Appr. 8.5
Hardness	Appr. 15.0 mg_{eq}/l	Appr. 15.0 mg_{eq}/l
Total alkali	Appr. 2 mg_{eq}/l	Appr. 6.5 mg_{eq}/l

Saline wastewater will be treated at the desalination unit with two outlet flows:

- desalinated reclaimed water flow of 250 m^3/h and maximum salinity 300 mg/l, maximum - directed for further treatment and disinfection before recycling to the process water network; surplus volumes will be discharged to the river via the common treated wastewater discharge system;
- waste water with high mineral content (highly-mineralized waste water, HMWW) with the average flow of 5 m^3/h and salinity of 300 g/l.

The Company is considering several different options for disposal of HMWW, including transportation to the field and injection into formation; recovery of valuable components of HMWW; complete boiling off of HMWW and burial of solid waste at specialized landfill. More details of the HMWW disposal alternatives are provided in Section 6 herein. It should be noted that all alternatives exclude discharge of untreated wastewater to the Lena River, therefore, potential negative impact on the water body will be prevented.

Wastewater treatment facilities

Given the location of the main plant facilities at different sites with a large elevation drop, the wastewater treatment facilities will be provided at three sites:

- upper site;
- lower site; and
- construction shift camp.

Upper site

The main technical design provides for a separate treatment line for the storm water system, and combined treatment facilities for domestic wastewater and for sulphide alkali and saline process wastewater.

Storm water treatment line

The following treatment steps will be provided for storm water:

- screening for removal of coarse debris;
- settling of coarse suspended particles in grit removal basins;

- gravity treatment of wastewater to remove suspended fines and petroleum products in RC settlement tank consisting of four sections; surface and bottom scrapers are provided in each section, for removal of settled particles and petroleum products;
- polishing treatment and disinfection in sand filters;
- if the required quality is not achieved after the sand filters, storm water is subject to further sorption treatment in coal filters.

Combined wastewater treatment system

Domestic, production-and-storm, sulphide alkali and saline wastewater are collected and fed to treatment by different pipeline systems.

First, wastewater will be screened to remove particles coarser than 5 mm.

After screening, domestic wastewater will be directly passed to the biological treatment, and all other flows will be first mixed and settled for removal of fine solids and petroleum products before biological treatment.

Biological treatment facilities using activated sludge will include the following process stages:

- biological oxidation of organic matter;
- oxidation of nitrogen ammonia to produce nitrite and nitrate (nitrification process) followed by reduction to molecular nitrogen (denitrification);
- chemical precipitation of phosphorus compounds (dephosphotation);
- ultrafiltration to separate activated sludge from treated wastewater.

Before recycling or discharge to river, purified wastewater shall be treated to remove dissolved matter (ions and salts). In accordance with the applicable process requirements, salt content in recycled process water shall not exceed 200-300 mg/l. Treated wastewater desalination is provided in the electrodialysis reversal (EDR) units.

Electrodialysis is a process controlled by the gradient of the electric field to ensure that mineral content is removed from solution by means of passing ions through ion-permeable selective membranes, to produce two outlet flows - desalinated and mineralized.

The above process is possible only within a limited range of pH values of inlet wastewater, therefore, the designed reagent facilities will include hydrochloric acid (HCl) and sodium hydroxide ($NaOH$) dosing systems. Regular acid washing of the membranes will be provided in the course of operation. Spent washing solutions will be neutralized in the neutralization system before discharge to the process wastewater system that will feed it to the start of treatment process at the wastewater treatment facilities.

The desalination block will produce two effluent flows:

- desalinated reclaimed water will be subject to polishing treatment and disinfection, after which it will be recycled or discharged to the Lena river;
- mineralized reclaimed water (mineralized solution) will be further concentrated to HMWW.

Mixed flow comprising treated storm, process-and-storm, process wastewater, and domestic wastewater will be recycled (makeup for the WRS). Surplus volume of treated wastewater will be discharged to the Lena River.

Before discharge to the river, effluent will be further treated in sorptive carbon filters to remove phenol, benzene and chlorine organic compounds, aromatic hydrocarbons, and (partially) heavy metal ions. After the filters, water will be passed through UV disinfection unit and discharged to the water body.

Quality information on the treated mixed wastewater is provided in the table below.

Table 9.5.4: Quality of treated mixed storm, process-and-storm, process and domestic wastewater

Parameter	Unit	Flow to recycling	Discharge to the Lena River after polishing treatment
COD	mgO_2/dm^3	35	15
BOD_{tot}	mgO_2/dm^3	5-10	3
Oil products	mg/dm^3	0.5, max.	0.05, max.
Total salt content	mg/dm^3	200-300	500
Mechanical impurities	mg/dm^3	7.0, max.	3.0, max.
Total hardness	mg_{eq}/dm^3	2.0, max.	2.0, max.
Nitrogen ammonia	mg/dm^3	0.5, max.	0.39, max.
Nitrite	mg/dm^3	0.08, max.	0.08, max.
Nitrate	mg/dm^3	40, max.	20, max.
Phenol	mg/dm^3	0.01-0.05	0.001
pH		7.0-8.0	7.0-8.0
Sulphate	mg/dm^3		100, max.
Chloride	mg/dm^3		300, max.
Total iron	mg/dm^3		0.1, max.
Phosphate	mg/dm^3		0.2, max.

Lower site

Process-storm, storm and domestic wastewater will be generated at the lower site. Process-storm effluents will be directed to the wastewater treatment facilities at the site of the LPG reception, storage and offloading terminal. To protect the treatment facilities located at the LPG/SGC RS&O site the following pre-treatment of process-storm effluents will be provided at the lower site: removal of debris, grit, and equalization of flow during rain events or snow-melting.

Storm water will be collected in dedicated tank at the WWPS and pumped into river water pipelines for treatment at the mechanical treatment facilities and subsequent utilization in the process water supply system. Therefore, no storm water will be discharged to recipient water body.

Domestic wastewater generated at the lower site will be removed from the site by trucks to the designed wastewater treatment facilities of the process site (Zone 1).

The following wastewater flows are anticipated:

- domestic wastewater – 12 m^3/h (20,000 $m^3/year$);
- process wastewater – 45 m^3/h (285,000 $m^3/year$);
- storm water – 1117.8 m^3/h (64,126.4 $m^3/year$), maximum.

Construction shift camp

Given the design accommodation capacity of 7000 persons, the shift camp facilities will produce domestic wastewater at the rate of 140 m^3/h or 600,000 $m^3/year$.

Considering the construction shift camp position at the border of the Polymer Production Facility, the design documents propose that consideration is given to priority construction of one line of biological treatment facilities at the Plant WWTP, for reception and treatment of domestic wastewater from the temporary accommodation facilities.

Discharge to the Lena River

Wastewater discharge point will be located on the Lena River. The design provides for construction of two lines of discharge sewer between the plant site and the river, and a diffuse discharge system.

The water quality monitoring station on the Lena River is located 500 m downstream the discharge point.

The monitoring station for background water quality in the Lena River is located 100 m upstream the discharge point.

According to Russian regulations, the permissible discharge limits (NDS) are defined on the basis of water quality standard for the water body. If standard water quality cannot be achieved due to natural factors which are beyond control, NDS limits are established at a level which provides natural background water quality at the monitoring station (section).

As the Lena River belongs to the highest grade of fishery water bodies, quality of wastewater discharged to the river must comply with the applicable standards for fishery water bodies, i.e. concentrations of pollutants in treated wastewater may not exceed the MPC limits established for fishery water bodies (MPC_{fish}) in the most contaminated flow filament at the monitoring station located at a maximum distance of 500 m from the wastewater discharge point.

Irkutsk Weather Authority (FGBU “Irkutsk UGMS”) reports that background pollution levels in the Lena River do not meet the standards for fishery water bodies (MPC_{fish}) in terms of BOD_5, and hygienic requirements for water bodies used for cultural and domestic purposes (MPC_{san}) in terms of COD and BOD_5 (Table 9.5.5).

Table 9.5.5: Background pollution concentrations in the Lena River

No.	Substance or chemical composition indicator of river water (the Lena River in Ust-Kut)	Background level, mg/dm^3	MPCfish, mg/dm^3[242]	MPCsan, mg/dm^3[243]
1	Particulate matter	6.16	background + 0.25	background + 0.25
2	COD	47.1	-	15
3	BOD_5	2.73	2.1	2
4	Total ions	383.6		< 1000
5	Oil products	0.01	0.05	0.3[244]

Taking into account the background concentrations and quality requirements for the recipient of treated wastewater, permissible concentrations of polluting substances in wastewater discharged to the Lena River should be within the following limits:

- Suspended solids 9 mg/dm^3
- COD 18 mg/dm^3
- BOD_5 2.5 mg/dm^3
- Total ions 800 mg/dm^3
- Petroleum products 0.3 mg/dm^3

[242] Water quality standards for fishery water bodies. Approved by the Ministry of Agriculture, Order of 13 December 2016 No. 552

[243] SanPiN 2.1.5.980-00. Hygienic requirements for protection of surface water bodies

[244] GN 2.1.5.1315-03. Maximum permissible concentrations (MPC) of chemical substances in water bodies used for drinking-domestic and cultural-domestic purposes

The volume of treated wastewater discharged to the Lena River depends on the quantity of industrial wastewater generated by the Polymer Production Facility operations, storm and melt water during snow-melting and precipitation events, and process water demand for makeup of the water recycling system (WRS).

In normal operation situation, the total volume of mixed storm, process and domestic waste water will be about 1800–2000 m^3/h. In the worst situation with river water flow as low as 37 m^3/s, contribution of treated wastewater will not exceed 1.5% of the total flow. Assuming that treated wastewater discharged to the Lena River will meet the most stringent standards (Table 9.5.5), the impact of wastewater discharges on water quality in the Lena River can be assessed as **negligible**.

The analysis of wastewater outlet arrangement for the Polymer Production Facility looks at the alternative configuration with discharge to the Polovinnaya River (refer to Section 6.4.3). Treated wastewater will be discharged to the river via a diffuse underwater outlet. According to the Sibgiprobum report (2019)[245], the wastewater outlet point is located 370 m downstream of the water intake facilities on the Polovinnaya River. Location of the connection point for treated effluent from the PPF process site is to be defined at subsequent stages of design development.

Relocation of the treated wastewater discharge to the Polovinnaya River will reduce the water quality impact on the Lena River to **negligible**.

Considering that treated wastewater quality will meet the fishery water standards applicable to the highest grade fishery rivers, the water quality impact on the Polovinnaya River can be assessed as **minor**. However, given the small flow in the Polovinnaya River during the winter low water period - only 0.60 m^3/s, the treated wastewater will make up over 90% of the minimal flow. Therefore, thermal pollution and changes in ice conditions are likely. In this case, the impact on the aquatic ecosystem is assessed as **high**.

Berth on the Lena River

The Company plans to build a berth in the area of Cape Tolsty where large equipment will be offloaded from river transport to trucks (large equipment offloading berth, LEB).

The main negative impact of the berth construction will be related to the earth works in the river channel (islet filling, piling, underwater technical operations), and with removal of a part of the Lena River bank and bottom area from fishery use. In 2019, the impact of the Project construction on fishery conditions in the water body was assessed by the Baikal Branch of FSBI "GLAVRYBVOD".

The earth works will affect the water body by increasing turbidity, due to soil handling in water. The design documents provide the following assessment of the expected turbidity plume from the earth works in the Lena River:

Description of the works	Concentration of suspended particles	Dimensions of turbidity plume	Settlement area of turbidity plume solids
Work site filling	0.095 g/l	Plume width - 51.8 m Length - 431.4 m	22347 m2
Work site dismantling	0.26 g/l	Plume width - 59.8 m Length - 498.4 m	29804 m2
Water area development	0.3 g/l	Plume width - 193.4 m Length - 1612.4 m	311838 m2

[245] IPP drinking water supply infrastructure and wastewater disposal. Main technical solutions. Vol. 1.1. Code: ИНК-210-54-09-19-OTP. Inv. No. 55043 - Irkutsk, Sibgiprobum, 2019. 142 pp.

Total land acquisition for the berth facilities is 2.8 h including:

- River bed area 1.4 ha;
- River bank within the water protection zone - 1.4 ha.

The river bank and bed area to be removed from fishery use on a temporary basis is about 1.99 ha including:

- River bank area - 0.82 ha;
- River bed area - 1.17 ha (at the long-time averaged water level in the river).

As the construction activities in the river channel will be limited in time and are not expected to cause any irreversible transformation of the water body, the impact of construction on the Lena river will be negligible. However, the construction impacts will still affect living environment of aquatic fauna, zooplankton and zoobenthos. Unavoidable damage to biological resource of the river is estimated at 1,106.7 kg of fish. The proposed mitigations include restoration of fish resources - artificial reproduction by fry release of sturgeon, or alternatively - grayling. Refer to Section 9.6 - Biodiversity Impact for a more detailed assessment of the berth construction impact on aquatic life, and description of recommended mitigations.

At the Project operation phase its impact on water resources will be related to water supply and wastewater disposal processes.

Water for domestic and drinking purposes will be supplied in bottles - 339 l/day or 18 bottles of potable water, 19 l each.

Sewage from the process area will be collected in portable toilets within the package modular buildings and subsequently removed by trucks presumably – to the wastewater treatment facilities designed at the process site (Zone 1).

Drainage gutters will be provided within the site area and along the access road for collection of runoff water from the berth facilities, trafficway and roadsides. The gutters will transfer collected water to grit removal system and further to the local treatment facilities designed at the berth site.

Grey water (handwash, housekeeping) will be collected in storm water gutters and transferred to the local treatment facilities.

Storm water and grey water from handwash from the berth facilities process area will be treated to fishery water standard before discharge to the Lena River, therefore, their impact at the operation phase will be **minimal**.

9.5.4 Water protection zone

The width of water protection zone of the Lena River is 200 m from water edge, on the right and left bank of the river. Among the components of the Polymer Production Facility only the 1st lift pumping station and the berth facilities are located within the water protection zone.

According to the national requirements, industrial operations may be conducted in water protection zones, provided that the facilities are provided with adequate systems for protection of water bodies against contamination, littering and water depletion.

Designed measures to prevent pollution of the Lena River during operation of the berth facilities are described above.

No storage of petroleum products or chemicals is anticipated in relation to operation of the 1st lift pumping station, thus there is no risk of the Lena River contamination.

Domestic wastewater from the toilet facilities at the pumping station is collected in 6 m^3 concrete septic tank and regularly transported to the municipal WWTP by specialist road tankers.

Rain and melt water is collected and treated by means of a mud chamber and storage tank. Conventionally clean runoff water is discharged to the Lena River, while contaminated surface runoff is accumulated and transported to the municipal WWTP by special road tankers.

With all design solutions adequately implemented and properly operating 1st lift pumping station, impact of the Project facilities in the water protection zone on the Lena River will be **minimal**.

9.5.5 Flooding and high water events

The Lena River in the area of Ust-Kut is prone to significant rises of water levels during high water periods in spring and summer. The maximum rise (934 cm) was recorded in 2001 (FGBU "Irkutsk UGMS" reference memo of 24.05.2019).

The 1st lift pumping station on the bank of the Lena River and the berth facilities process area are located within the flood risk zone. All other facilities of the Polymer Production Facility are located by far (up to 250 m) higher than the river water level, which means zero risk of flooding.

The risk of the Project facilities flooding is reduced to **minimum** by the design solutions adopted for the Polymer Production Facility. More details of the Project facilities flooding risk are provided in Section 9.9 - Climate Risks herein.

9.5.6 Summary

The main impacts on water resource during the polymer plant construction and operation are associated with water abstraction from natural sources and wastewater discharges to surface water bodies.

Drinking water for the Project facilities will be provided from ground water well in the Polovinnaya river valley.

Technical water for the Polymer Production Facility will be supplied from water intake facilities on the Lena river. Design capacity of the water intake is 900 m^3/h and may be extended to 2500 m^3/h.

As the minimum daily average water flow in the Lena River (99% probability) at the water intake is 37.2 m^3/s, proportion of water abstraction volume will not be more than 2% of the total river flow in the worst case.

In view of the insignificant volume of water abstraction from the Lena River for the Polymer Production Facility, and taking into account the design solutions selected for the intake facilities, impact on the water body and aquatic ecosystems can be assessed as **negligible**.

In normal operation situation, the total volume of mixed storm, process and domestic waste water will be about 1800–2000 m^3/h. In the worst situation with river water flow as low as 37 m^3/s, contribution of treated wastewater will not exceed 1.5% of the total flow. Assuming that treated wastewater discharged to the Water quality in the Lena River will meet the most stringent standards; the impact of wastewater discharges on water quality in the Lena River can be assessed as **negligible**.

Designed location of the 1st lift pumping station and the berth facilities is in the water protection zone of the Lena River. With all design solutions adequately implemented and properly operating 1st lift pumping station and the berth facilities, impact of the Project facilities in the water protection zone on the Lena River will be **minimal**.

The Lena River in the area of Ust-Kut is prone to significant rises of water levels during high water periods in spring and summer. The maximum rise (934 cm) was recorded in 2001. The risk of the PPF facilities flooding is reduced to **minimum** by the design solutions adopted for the Polymer Production Facility.

Taking into account the designed technical solutions and the planned environmental measures, overall impact on surface water bodies is assessed as **minor or negligible**.

However, negative impacts on surface water bodies during the Project construction and operation can be further mitigated through implementation of the proposed environmental measures (refer to Table 9.5.6).

Summary of requirements for monitoring of impacts on surface water bodies is provided in Table 9.5.7.

Table 9.5.6: Summary of impacts on surface water bodies and mitigation measures

Impact	Sign	Receptor	Receptor Sensitivity	Phase	Impact significance	Risk	Impact Mitigation	Residual impact
Impact of activities conducted near water bodies	N	Water protection zones	H	C	M	Mr	Prohibition of vehicle traffic outside the temporary and permanent access roads Prohibition of washing of motor vehicles and other machinery outside designated and adequately equipped areas with waterproof paving Prohibition of fuels and lubricants storage Earthworks arrangements taking into account the season, river water level, and ground conditions Minimization of period during which excavated trenches may remain open before installation of pipes Removal of construction wastes and remaining materials upon completion of construction works, cleaning of surrounding water catchment area	N
Chemical and biological contamination of surface water bodies	N	Surface water	H		M	Mr	Accumulation of domestic and process wastewater in storage tanks and timely transportation for treatment by third parties Prevention of ingress of snow, water, mud into pipes by avoiding pipes dragging on the ground surface at unloading pipes, and provision of temporary plugs (for individual pipes or sections in case of temporary storage) Domestic wastewater from the construction workforce accommodation camp will be sent for treatment to the municipal WWTP Process wastewater from hydraulic tests will be treated at the local WWTP Provision of adequate containers for collection of domestic and construction wastes at the work places Making sure that boundaries of the areas allocated for construction are observed Provision of the required quantity of water passage elements is provided within the line structures Refueling of crawler construction plant and machinery at an adequately equipped site, using a fuel loading system with a hose and lock valves at the delivery orifice, with spill-prevention trays. Refueling of motor vehicles and rubber-tired construction machinery at the nearest petrol station.	N
Chemical ground water contamination	N	Ground water	H	O	M	Mr	Filling machinery with fuel and lubricants in specially designated areas Monitoring of state of paving in the roads and technical sites, timely repair of damaged paving, especially in the areas where multiple machines are present, at vehicle washing facilities, temporary wastes storage sites	N

Impact	Sign	Receptor	Receptor Sensitivity	Phase	Impact significance	Risk	Impact Mitigation	Residual impact
Chemical and biological contamination of surface water bodies	N	Surface water	H		M	Mr	Treatment of wastewater to meet the applicable discharge limits (NDS) Continuous operational monitoring at the local WWTP Regular cleaning of the site areas Timely maintenance of paved surfaces Provision of edge skirting around the green areas, to prevent soil washout to road paving during rainstorms Prevention of seepage and emergency leaks of wastewater Prevention of discharge of domestic and process wastewater and storm water to ground by passing them to treatment or decontamination	N
Violation of water protection regulations during activities conducted near water bodies	N	Water protection zones	H		M	Mr	Compliance with rules and limits applicable to activities within water protection zones, including: prohibition of vehicle traffic (except for special vehicles) outside the temporary and permanent access roads; prohibition of fuel and lubricants storage, maintenance facilities, and vehicles washing Regular cleaning of the site areas including removal of all wastes Collection of fuel and lubricants in adequately equipped tanks Vehicles fuelling outside floodplain areas of rivers and lakes, at dedicated and adequately equipped sites, from special filling containers or tanks Fuel and oil filling of specialized machinery using special fuelling nozzles designed to prevent overfilling of fuel tanks Provision of adequate containers for collection of domestic and construction wastes at the work places and construction sites	N
Disturbance of natural runoff	N	Natural runoff lines	M		M	Mr	Provision of seasonal maintenance of water passage pipes Inspections of water passage pipes in accordance with specially designed schedule	N
Accidental pollution of surface and ground water	N	Surface and ground water	H	Emergency leaks of wastewater	H	M/ Mr	Measures to prevent accidental leaks of wastewater, fuels and lubricants: use of pipes with factory-installed high-grade corrosion protection coating; prevention of freezing of wastewater transportation system by providing thermal insulation of pipelines and tracing of tanks in the system; waterproof insulation of wastewater pipes, for protection against corrosion; waterproofing of fuel and lubricants storage tanks; bunding of areas with risk of oil leaks, and collection of contaminated storm water to the process wastewater system for subsequent treatment at the local WWTP; provision of underground drainage tanks in RC wells at the fuels and lubricants store; bunding of process areas, collection of process liquids leaks in adequate drainage and emergency vessels for recirculation to the process lines; collection of contaminated storm water for treatment at the local WWTP.	M/L

Table 9.5.7: Summary of requirements for monitoring of impacts on surface water bodies

Aspect	Phase	Task	Parameter	Regularity
Wastewater and state of water body	Construction	Wastewater and surface water monitoring with observation of flows, composition, physical and chemical properties of water in the water body	Monitoring of treated wastewater quality: Suspended solids BOD COD Petroleum products Hydrochemical quality of the Lena River: Suspended solids BOD COD Petroleum products	Quarterly, in accordance with the approved Environmental Operational Monitoring Programme
Water abstraction from the Lena River	Operation	Quantity monitoring of water consumption	Compliance with the water consumption limits set for the facilities, using flowmeters or by water balance estimations	Daily
Process water quality	Operation	Process water quality monitoring	Compliance with the applicable process water quality standards	Daily
Wastewater discharged to the Lena River	Operation	Monitoring of treated wastewater quality and performance of the treatment facilities	Progressive registration of wastewater generation quantities based on flowmeter readings or using water balance estimations Wastewater composition will be monitored for compliance with the applicable standards at the in-house laboratory	At least once per month Daily
State of water body receiving wastewater discharges	Construction / Operation	Water quality in the Lena River near the treated wastewater outlet	Hydrochemical monitoring of surface water and bottom sediments Monitoring station is established at the boundary of the monitoring zone. The boundary is located at a maximum distance of 500 m downstream of the discharge point, and also at the "background" monitoring point located at a minimum distance of 100 m upstream of the discharge point. Water sampling is accompanied by sampling of bottom sediments and definition of hydrological parameters of the water body. Parameters: • Temperature • Hydrogen index (pH) • Suspended solids • BOD5 • COD • Dissolved oxygen • Dry residue Auxiliary measurements: • Floating matter • Turbidity • Colour • Odour	Quarterly

Aspect	Phase	Task	Parameter	Regularity
			Concentrations of pollutants: • Ammonium ions • Nitrite ions • Nitrate ions • Hydrocarbonate • Total phosphorus • Phosphate • Potassium • Sodium • Chloride ions • Sulphate ions • Total iron • Total nitrogen • Zink • Copper • Nickel • Anionic surfactants • Nonionic surfactants • Phenol • Petroleum products	

9.6 Biodiversity Impact

Analysis of the baseline status of the wildlife, vegetation and biodiversity within the Project area is presented in Chapter 7. This Section includes the assessment of the Project's impact on the wildlife and vegetation and on economically significant ecosystems, as well as recommendations for the impact mitigation measures and monitoring of their implementation within the Project.

The significance of impacts has been determined based on the relationships between factors of the potential magnitude of the impact and the vulnerability of receptors exposed to the impact during the Project construction and operation. The significance of impacts has been considered for each aspect before and after the prevention / mitigation measures (residual impact).

The impacts of negligible significance from the viewpoint of biodiversity or the local communities have not been assessed and described in this Section.

9.6.1 Classification of habitats within the Project's area of influence

The IFC Performance Standard 6 - Biodiversity conservation and sustainable management of living natural resources (IFC PS6) defines the habitat as a terrestrial, freshwater, or marine geographical unit or airway that supports assemblages of living organisms and their interactions with the non-living environment. Habitats are divided into modified, natural, and critical (the latter being a subset of modified or natural habitats).

Modified habitats are areas that may contain a large proportion of plant and/or animal species of non-native origin, and/or where human activity has substantially modified an area's primary ecological functions and species composition. Habitats that do not match the above description are classified as natural.

Critical habitats are areas that meet at least one of the criteria set by IFC PS6:

- habitat of significant importance to Critically Endangered and/or Endangered species;
- habitat of significant importance to endemic and/or restricted-range species;
- habitat supporting globally significant concentrations of migratory species and/or congregatory species;
- highly threatened and/or unique ecosystems; and/or
- areas associated with key evolutionary processes.

The following conclusions are based on review of the environmental survey materials for the neighbour facilities of the Project, and scientific publications relating to the Project area (to be updated when results of the PPF surveys are available):

- the critical habitats nearest to the design boundaries can be tentatively identified with reference to the existing and planned designated conservation areas (DCAs) at the local and regional level;
- major part of the area affected by the Project matches the transformed habitats criteria - this conclusion is fully applicable to the lower (offloading) area of PPF, the planned berth facilities, the section of the Vilyui A-331 road scheduled for reconstruction, the existing technical corridors within the Ust-Kut industrial area of INK, and the secondary merchantable forests disturbed by felling operations and regular fires;
- the attributes of natural habitats (i.e. areas where human activity has not essentially modified primary ecological functions and species composition) can be expected only in the mature secondary (derivative) forest areas designated for spawning protection (protective forests) which will be partially affected by the Project linear facilities between the process and offloading areas.

9.6.2 Sensitivity of receptors

Special attention has been paid to environmental receptors having either high value or sensitivity:

- areas with a designated conservation status;
- critical habitats identified using the above criteria of IFC PS6;
- natural habitats identified using the above criteria of IFC PS6;

- Endangered species according to the IUCN Red List and the Red Data Books of the Russian Federation and Irkutsk Region;
- habitats or species of significant value in terms of their economic function (e.g. for fishing and hunting).

The criteria of receptors' vulnerability are presented in Table 9.6.1.

Table 9.6.1: Criteria for assessing the environmental value

Value / sensitivity	Criteria relating to species	Criteria relating to habitats or territories
Very high	Critically endangered and endangered species (according to IUCN classification)	Nature reserves of international significance (or of similar status). Highly threatened habitats of significant environmental importance at the international level.
High	Vulnerable species (according to IUCN classification). Species protected at the national level, of significant population size and importance.	Nature reserves of national significance (or of similar status). Highly threatened natural habitats of significant environmental importance at the national level, as well as natural habitats of significant environmental importance and/or high degree of biological diversity, with a limited replacement potential.
Moderate	Near threatened species (according to IUCN classification). Rare or endangered at the national level, of insignificant population size and not of national significance.	Natural habitats of regional significance. Modified habitats with high degree of biological diversity or nearing extinction within the boundaries of a region.
Low	Species of least concern (according to IUCN classification). Species of local significance.	Unprotected territories and habitats having a certain degree of biological diversity and cultural value. Modified habitats of limited environmental value. Other territories with certain degree of biological diversity and cultural value on a local, but not national scale. Modified habitats having biological diversity of limited value.
Insignificant	Species of least concern (according to IUCN classification). Species having no local significance.	Highly modified habitats, with biological diversity of no environmental significance.

9.6.3 Impact during the construction phase

Several industrial sites have been allocated for construction of the plant (process area and offloading area), and a number of infrastructure facilities will be constructed (boiler house, water supply and wastewater management systems, flare facilities, product store, transport right-of-ways, etc.). Information relating to the Project composition has been presented in Chapter 5.

The following direct and indirect impacts (but not limited to them) on the vegetation and wildlife will be possible during the construction phase of the Project:

- noise and light impacts on birds, bats and terrestrial mammals associated with the construction activities and disturbance factor;
- elevated level of risk of localized contamination of the nearest habitats (exposure to dust);
- localized changes in the atmospheric air quality as a result of construction activities and intensive traffic of transport vehicles within the subject area;
- forest clearing in the course of the construction site preparation;
- occasional introduction and spreading of invasive plant species during the construction period;
- physical destruction of plants and animals.

All these types of impact can cause deterioration of the status or complete destruction of habitats.

9.6.3.1 Designated conservation areas

There are no designated conservation sites or areas within the area allocated for the Project or near it. The nearest conservation areas are (see also Chapter 7):

- Land mark "Mir Rock Cliff", 14 km to the west;
- Prospective land mark "Mineral water spring Turuksky", 24 km to the south of the design boundaries;

- Land mark "Ust-Kut Water Spring", 24 km to the west of the design area;
- Nature park "Ust-Kut Resort", 25 km to the west of the planned production site;
- Tayursky state nature reserve, 33 km to the south-east of the Project sites.

The nearest designated conservation area downstream of the Lena River is the State Nature Reserve "Pilka" located at a distance of over 500 km from the Project sites.

Considering the remote position of the above DCAs in relation to the Project sites, no significant impact on those areas is expected.

Potential impacts can be imposed on the water protection zone of the Lena River, and direct impacts on the aquatic ecosystems and hydrobionts may be expected during the construction of water intake facilities, outlets for treated wastewater and pipelines. Description of such impacts and the recommended mitigation measures have been presented in the sections below and summarized in Table 9.16.

9.6.3.2 Identification of natural and modified habitats

The range of habitats that will be lost during the construction of the Polymer Production Facility includes the areas of the production sites, right-of-ways for the transport routes and adjacent areas.

IFC PS6 distinguishes between natural and modified habitats, and each category may also include critical habitats that meet certain quantitative and qualitative criteria. Modified habitats are most common in Ust-Kut city and Ust-Kut industrial area of INK. Those include developed urban and suburban areas, wooded areas, farming land, and private gardens.

On the other hand, within the territories acquired for the IPP main and associated facilities, only those with reference numbers 10-14 positively meet the modified habitats criteria of IFC PS6 (Table 9.6.2, Figure 7.8.7-1 in Section 7.8.2 herein) - shrub and grass associations in clearing areas, roadside vegetation, ruderal groups in heavily disturbed areas. All other habitats should be identified as natural or modified depending on the extent of anthropogenic transformation and remaining primary ecosystem services.

Table 9.6.2: Proportion of plant communities in the total site area of the main IPP facilities

Reference number in Figure 7.8.7-1	Plant community	Area	
		ha	%
1	Cedar-fir shrub (Vaccinium vitis-idaea, V. myrtilus) small-grass (Trientalis europaea, Maianthemum bifolium, Aegopodium alpestre, Goodyera repens, Orthilia secunda) - true-moss (Pleurozium schreberi, Hylocomium splendens, Ptilidium ciliare) forests in flat water divide areas, and a series of restored associations in their place:	45.3	10.5
1a	Aspen-birch forest with grass and true moss ground cover, forest recovery series of plant associations	20.8	4.8
1в	Birch-larch-pine dwarf-shrub/small-grass/true-moss recovery series of plant associations	45.2	10.5
1г	Birch-aspen forest with grass and true moss ground cover, forest recovery series of plant associations	27.7	6.4
1д	Cultivated pine plantations with cedar and fir undergrowth grass associations	88.4	20.5
2	Cedar-fir shrub (Ledum palustre, Vaccinium vitis-idaea) forests with small-grass/true-moss ground cover on gentle slopes, and recovery series of plant associations:	0.0	0.0
2a	Birch forests with grass and true moss ground cover, forest recovery series of plant associations	1.9	0.4
2г	Aspen forests with grass and true moss ground cover, forest recovery series of plant associations	1.7	0.4
2д	Grass recovery series of plant associations in the areas affected by forest fires and logging	40.0	9.3

Reference number in Figure 7.8.7-1	Plant community	Area	
		ha	%
2е	Cultivated pine plantations with cedar and fir undergrowth grass associations	7.9	1.8
3	Cedar-pine and larch forests on gentle well-lighted slopes, including recovery series of plant associations:	0.0	0.0
3а	Aspen forest recovery series of plant associations	5.2	1.2
4	Pine and larch forests with cedar, with lingon-berry (Vaccinium vitis-idaea), small-grass (Trientalis europaea, Maianthemum bifolium, Aegopodium alpestre, Goodyera repens) and true moss (Pleurozium schreberi, Ptilidium ciliare) ground cover, stable derivative forests on shady slopes	25.4	5.9
4б	Aspen-birch forest with grass and true moss ground cover, forest recovery series of plant associations	7.6	1.8
4г	Cultivated pine plantations with cedar and fir undergrowth grass associations	67.4	15.7
7	Larch forests with spruce and cedar, blueberry-ledum, true-moss and occasionally sphagnous ground cover, stable derivative forests in broad water-collecting gullies	2.4	0.6
7а	Young fir-tree associations	15.3	3.6
7б	Birch-tree recovery-stage associations	5.1	1.2
7в	Grass recovery-stage associations in the areas affected by forest fires and logging	13.8	3.2
7г	Cultivated pine plantations with cedar and fir undergrowth grass associations	9.5	2.2

Clearly, the study area includes natural although disturbed forest habitats, namely: cedar-fir shrub true-moss forests in gently sloping interfluve area (Contour 1 on the map in Figure 7.8.7-1, about 10% of the main IPP facilities' site); stable derivative pine and larch forests with cedar, lingon-berry/small-grass/true-moss ground cover on shady slopes (Contour 4, about 6%); larch forests with spruce and cedar, blueberry-ledum, true-moss and occasionally sphagnous ground cover, stable derivative forests in broad water-collecting gullies (Contour 7, less than 1%).

All other habitats (about 83%) in the IPP area consist of modified associations with species compositions markedly different from natural, and ecosystem services subjugated to certain uses or completely degraded. In the other sites allocated for the lower operational area and associated facilities of the IPP, proportion of natural habitats is even smaller - 5-10%. The only exception is the interfacility road routed through forest habitats where forest fires are the only significant factor of degradation.

Based on the above discussion, the Consultant assumes 15-20% as the maximum proportion of natural habitats in the Project area, like at the main operational site of the IPP.

9.6.3.3 Critical Habitats

Along with location in the existing or future nature conservation areas (p.9.6.3.1), critical habitats in the terms of IFC PS6 are also identified by their importance to rare, particularly endemic, relict and other protected species. Threatened and unique ecosystems, habitats supporting globally significant concentrations of certain species, and areas associated with key evolutionary processes are also recognised as critical habitats.

Environmental studies for the main IPP process area, the interfacility road, and the IPP power supply facilities did not identify any unique ecosystems within the above facilities' sites. These areas do not support any significant concentrations of any species of flora or fauna, or play any special role in bio-evolution processes. The nearest designated conservation areas are located tens and hundreds of kilometres away. On the other hand, the survey materials provide a list of species which may be present within the Project sites and the area of influence. The Consultant reviewed the list using all available information on the species' ecology, and drew conclusions on likelihood of their actual presence within the Ust-Kut industrial area of INK (Table 9.6.3).

Particularly, the least disturbed habitats should considered as the areas of most probable presence of rare and protected plants. Having examined the full list of rare and protected plant species which, according to the surveyors, may be potentially present in the Project area (Table 9.6.3), the Consultant identified only three species that, due to their ecological properties, can be actually encountered in the IPP sites:

- Pennsylvanian or candlestick lily (- Lilium pensylvanicum) – small perennial herbaceous plant, common in the Eastern Siberia; used in ornamental gardening for its beautiful blossom;
- Peony Maria's root, also known as "anomalous peony", "common peony", "pink peony" (- Paeonia anomala) – perennial herbaceous plant growing in mixed open forests, meadows and forest margins, as well as river valleys in Siberia, Kazakhstan, Mongolia and China; the specie is also known in European Russia; used in ornamental gardening, and, despite its poisonous properties, as crude drug and food additive.
- Mezereon (- Daphne mezereum) – deciduary subramose shrub, very common in Russia and few other countries; used in ornamental gardening, and despite poisonous properties of the fruits, in indigenous medicine.

None of the above plants was identified during the pre-design survey. However, these three species may be encountered in the INK sites, whereas all other listed species are characteristic for a wider area but are unlikely to occur in the Project area, for ecological reasons.

The Project area does not provide preferred or possible habitats for most of the animal species listed in Table 9.6.3 (and the survey materials). The exceptions are peregrine falcon which also lives in urban areas of Ust-Kut, and, apparently, booted eagle with distribution area spread further to the north along the Lena river valley.

In general, the Project survey materials and other available information on biodiversity in the Project area demonstrate that the Ust-Kut industrial area of INK, both at present and before the start of development, does not and did not represent any significant value in terms of conservation and maintaining populations of the wildlife species listed in Table 9.6.3. Therefore, the Consultant concludes that it is extremely unlikely that any critical habitats (in the context of IFC PS6) could be identified in the Project's area of influence.

Table 9.6.3: Rare and protected elements of terrestrial ecosystem biodiversity in Irkutsk Region, and assessment of likelihood of their presence in the Project area

Species	Conservation status		Preferred habitats in Irkutsk Region	Presence within the Project area	Identification (direct or indirect) during the Project survey
	RF	IUCN			
Lichen					
Laurer's nephromopsis (*Nephromopsis laureri*)	Irkutsk Region Red Data Book. - Category 4 (I). Species with unassigned status, scattered Eurasian range, mostly in the Russian Federation. Registered in the RF Red Data Book	Not assigned	Trunks of coniferous and leaved trees (pine, larch, spruce, fir, cedar, birch, rowan), windfallen trees, large stones. Common in most districts within the region, particularly in mountainous areas. The species is reportedly present in 16 districts within the region, but not in Ust-Kut District	Presence in the study area is assessed as unlikely. Limiting factors - forest fires, logging, economic development (other than the Project and operations of INK)	Not identified
Fungi					
White birch bolete (*Leccinum percandidum*)	Irkutsk Region Red Data Book. - Category 3 (R). Rare species.	Not assigned	Virtually omnipresent in the region, however, fungal fruits are seldom encountered. Also present in neighbour regions - Buryatia, Khakassia, Zabailaksky Krai, Krasnoyarsk Krai	Presence in the study area is assessed as unlikely. Limiting factor is the reduction of undisturbed coniferous (particularly cedar) forest areas	Not identified
Vascular plants					
Shiny cotoneaster (*Cotoneaster lucidus*)	RF Red Data Book – Category 3a. Rare species. Russian endemic species. Irkutsk Region Red Data Book. - Category 3 (R). Rare species. East-Siberian endemic species.	Not assigned	Pine and larch forests, forest margins, steppe and rocky slopes, pebble stone areas. Present on the shored of Baikal lake, in its southern and central parts	Not present in the study area	Not identified
Cotoneaster tjuliniae (*Cotoneaster tjuliniae*)	Not registered in the Red Data Book	Not assigned	Northern shores of Baikal lake	Not present in the study area	Not identified
Calypso orchid (*Calypso bulbosa (L.) Oakes*)	Irkutsk Region Red Data Book. - Category 3 (R). Rare species. Registered in the RF Red Data Book	NT – near-threatened	Shady mossy coniferous forests, sometimes water-logged areas	Presence in the study area is unlikely. Limiting factors: logging, forest fires, sprouting is only possible in presence of symbiotic soil fungi	Not identified
Pennsylvanian lily (*Lilium pensylvanicum*)	Irkutsk Region Red Data Book. - Category 3 (R). Rare species	Not assigned	Wet floodplain meadows, forest open spaces and margins, sparce bush thickets, pebble stone areas	Reportedly present in the study area	Not identified
Dwarf lily (*Lilium pumilum*)	Irkutsk Region Red Data Book. - Category 3 (R). Rare species	Not assigned	Steppe and steppe-like slopes, forest margins, rock cliffs in forest belt	The species is not characteristic for the examined area	Not identified
Calcareous lady's slipper (*Cypripedum calceolus*)	Irkutsk Region Red Data Book. – Category 2 (V). Vulnerable species. Registered in the RF Red Data Book	LC – least concern	Sparse leaf and mixed forests, open spaces in forests and brushwood. Habitats in calcareous soil areas	According to the Irkutsk Region Red Data Book, the species is not present in Ust-Kut District	Not identified
Lady's slipper (*Cypripedium guttatum Sw*)	Listed in the Red Data Books of 38 Constituent Entities of the Russian Federation. Not listed in the Red Data Book of Irkutsk Region	LC – least concern Listed in CITES Annex II	Leaf, mixed and coniferous forests, forest margins, limestone cliffs, sandy rock slides	Presence in the study area is unlikely. Limiting factors: logging, forest fires, sprouting is only possible in presence of symbiotic soil fungi	Not identified
Peony 'Maria's root (*Paeonia anomala*)	Irkutsk Region Red Data Book. - Category 3 (R). Rare species	Not assigned	Birch, pine, mixed forests, forest margins and open spaces in forests, dry meadows. The plant is present in medium-moisture habitats, in sufficiently warm and light areas	Occasionally encountered in Ust-Kut District. Presence in the study area is assessed as likely	Not identified
Mezereon (*Daphne mezereum*)	Irkutsk Region Red Data Book. - Category 3 (R). Rare species. Tertiary nemoral relict	LC – least concern	Sporadically present in mixed or dark coniferous forests.	Occasionally encountered in Ust-Kut District. Presence in the study area is assessed as likely	Not identified
Siberian (Apennine) adonis (*Adonis sibirica patrin x Ledeb. / Adonis apennina*)	Irkutsk Region Red Data Book. - Category 3 (R). Rare species	Not assigned	Light forests, forest margins, open spaces in forests, bush thickets. Most common in forest and forest-steppe zones.	The species is not characteristic for the examined area	Not identified
Birds					
Black stork (*Ciconia nigra*)	RF Red Data Book – Rare species. Irkutsk Region Red Data Book. - Category 3. Rare nesting and migrating species.	LC – least concern	Omnipresent, except for open steppe, farmed ecosystems, and highland areas. Variable nesting conditions. The critical condition is combination of old forest masses, individual trees or rock cliffs with bogs and open banks of rivers and lakes. Encountered in the valley of Kuta river and Yelovyi kreek (tributary of Lena river) during the route survey in 2016.[246]	Environmental conditions within the Ust-Kut industrial area of INK are inherently unsupportive for this species, do to the lack of over-mature forests and lacustrine-boggy complexes, and the development in the Lena river floodplain	Not identified
Flamingo (*Phoenicopterus roseus Pallas*)	RF Red Data Book – Category 3. Rare species Irkutsk Region Red Data Book. - Category 4. Regular migrating species	LC – least concern	Encountered on transit in warm shallow water areas of rivers, wet grass meadows, floodplains, in shrubs and near dwellings. Irkutsk Region does not provide any biotopes preferred by this species; occasional visits of single or small groups (up to three) of the birds are reported in the southern areas; a single encounter was registered in Ust-Kut District in 1947.	The species is not characteristic in the Project area	Not identified

[246] V. V. Popov. Notes on Ust-Kut District ornithofauna. Russian Ornithological Journal 2018. Vol. 27. Express issue 1613

Species	Conservation status		Preferred habitats in Irkutsk Region	Presence within the Project area	Identification (direct or indirect) during the Project survey
	RF	IUCN			
Baikal teal (*Anas formosa*)	Irkutsk Region Red Data Book. - Category 1. Endangered nesting and transit subspecies	LC – least concern	Small tranquil taiga rivers with and low water-logged banks surrounded by open tussock meadows. Not encountered in central areas of Irkutsk Region	Environmental conditions of the floodplain and terrace complex of the Lena River valley within the Ust-Kut industrial area of INK are inherently unsupportive for this species, due to the lack of low water-logged banks, tussock meadows and other preferred biotopes of this species	Not identified
Golden eagle (*Aquila chrysaetos*)	RF Red Data Book – Category 3. Rare species. Irkutsk Region Red Data Book. - Category 3. Rare nesting, migrating and partially wintering species	LC – least concern	Nesting on large trees and rock cliffs. Common in the Baikal-Lena and Vitim natural reserves, and the Baikal National Park	Environmental conditions within the Ust-Kut industrial area of INK are unsupportive for this species, due to the lack of over-mature forests with large trees, bedrock outcrops suitable for nesting, and other preferred habitats of the species. Further limiting factors are exploitation of forests and waste disposal sites	Not identified
Osprey (*Pandion haliateus*)	RF Red Data Book – Category 3. Rare species. Irkutsk Region Red Data Book. - Category 3. Rare nesting species	LC – least concern	Banks of fish-abundant lakes and rivers with transparent water. Makes nests on broken tops of large trees near water bodies	Environmental conditions in the Ust-Kut industrial area of INK are unsupportive for this species. The limiting factors are the lack of suitable trees for nesting and reduction of fish resources	Not identified
Red-footed falcon (*Falco vespertinus*)	Irkutsk Region Red Data Book. - Category 0. Former nesting and currently migrating species	NT – near-threatened	Forest steppe and cultivated landscapes. Ust-Kut city and surrounding areas are located outside the occurrence range of this species	Not encountered	Not identified
White-tailed eagle (*Haliaeetus albicilla*)	RF Red Data Book – Category 3. Rare species. Irkutsk Region Red Data Book. - Category 3. Nesting, migrating and occasionally wintering species with decreasing population size	LC – least concern	High forest stand near fish-abundant lakes and rivers. Within Irkutsk Region, most common in the catchment area of Lower Tunguska river and on the shores of the northern and central sections of Baikal lake	Environmental conditions in the Ust-Kut industrial area of INK are unsupportive for this species. The limiting factors are the lack of large enough lacustrine-boggy complexes, exploitation of forests and waste disposal sites, frequent forest fires, and development of the Lena river valley	Not identified
Gyrfalcon (*Falco rusticolus*)	RF Red Data Book – Category 2. Decreasing population size Irkutsk Region Red Data Book. - Category 3. Very rare, probably nesting, rare wintering species with a decreasing population.	LC – least concern	Valleys of rivers, mountain tundra areas. Use nests made by other birds on trees and rock cliffs. Most common on mountain ridges in the north of Baikal basin, may be encountered near settlements in winter. The occurrence range is in the Region's south	Not encountered	Not identified
Peregrine falcon (*Falco peregrinus*)	Irkutsk Region Red Data Book. - Category 3. Rare nesting and migrating species	LC – least concern	Rock cliffs in river valleys near floodplain meadows, lakes, bogs occupied by ducks and waders; most common in forest steppe and steppe areas. Prefers hardly accessible nesting places. In 2016, a couple of peregrine falcons was found in Ust-Kut city (Popov, 2018). Recommendations for the species protection refer to forest steppe habitats in Irkutsk Region.	Environmental conditions in the Ust-Kut industrial area of INK are generally unsupportive for this species. Presence of individual birds or nesting couples is likely, even in developed areas	Not identified
Eurasian eagle owl (*Bubo bubo*)	RF Red Data Book – Category 2. A very common species which population in most of the occurrence range abruptly declined or vanished by the end of 20th century Irkutsk Region Red Data Book. - Category 3. Rare non-migratory species	LC – least concern	Taiga, forest steppe and mountain landscapes; the birds are attracted by river valleys and make nests on cliffs and bedrock outcrops. The species prefer hardly accessible terrain positions and avoid human presence nearby. The species is most common in forest steppe, less frequently in taiga areas	Forest fires heavily affect eagle owl nesting grounds. Extensive anthropogenic activity is the main factor which minimises the chance of encountering this species in the Project area	Not identified
Bean goose (*Anser fabalis*)	Irkutsk Region Red Data Book. - Category 1. Endangered nesting and transit subspecies	LC – least concern	Encountered in remotest taiga areas. Prefers habitats near small streams in valleys of small rivers and creeks, open bogs with sedge, horsetail and bushgrass vegetation, unfrequented lakes with abundant aquatic vegetation	The Project area does not provide preferred habitats for this species. The chance of its presence is further limited by frequent forest fires, fragmentation of habitats and active use of the area (other than the Project and operations of INK)	Not identified
Whooper swan (*Cygnus cygnus*)	Irkutsk Region Red Data Book. - Category 3. Nesting and migrating species.	LC – least concern	Banks of large water bodies (larger than 1 km^2) with abundant aquatic and emergent vegetation. In Irkutsk Region, selects hardly accessible places for nesting	The Project area does not provide preferred habitats for this species	Not identified
Marsh harrier (*Circus aeruginosus spilonotus*)	Irkutsk Region Red Data Book. - Category 3. Decreasing population size	LC – least concern	The main habitats are forest steppe landscapes. Nesting grounds are on banks of water bodies with reed thickets, and close by open meadows or marshes	The Project area does not provide preferred habitats for this species	Not identified
Japanese sparrowhawk (*Accipiter gularis*)	Irkutsk Region Red Data Book. - Category 3. Rare	LC – least concern	The occurrence range is in the southern half of the region area (does not include Ust-Kut city and	The limiting factors are the development activities in the river valley and adjacent forest areas. This species is very unlikely to be	Not identified

Species	Conservation status		Preferred habitats in Irkutsk Region	Presence within the Project area	Identification (direct or indirect) during the Project survey
	RF	IUCN			
	nesting and migrating species		neighbourhood). The common habitats are river valleys	present in the Ust-Kut industrial area	
Booted eagle (*Hieraaetus pennatus*)	Irkutsk Region Red Data Book. - Category 5. Rare nesting and migrating species. Population is currently restoring	LC – least concern	Plain and mountain forest areas, mainly floodplain forests. Six birds were encountered in 2008 in the Lena river valley section between Ust-Kut and Kirensk. The species is considered understudied. Most of its occurrence range is in the region's south.	The species is sensitive to human presence, forest fires and other nuisances, therefore, its presence in the Ust-Kut industrial area of INK is very unlikely (with or without the Project)	Not identified
Greater spotted eagle (*Aquila clanga*)	Irkutsk Region Red Data Book. - Category 3. Decreasing population size	VU – vulnerable	Nesting in forests near large wetlands. In Irkutsk Region, the species is present mainly in the south-west (the main occurrence range) and occasionally in other areas, but not in the Lena river section near Ust-Kut city	The species is not characteristic for the Project area. Further limiting factors are related to human activities - forest fires, exploitation of forests and waste disposal sites, traffic, etc.	Not identified
Pigeon hawk (*Falco columbarius L*)	Irkutsk Region Red Data Book. - Category 3. Rare nesting, migrating and partially wintering species	LC – least concern	Most common in forest and forest-steppe zones. In Irkutsk Region, is sporadically present mainly in the south and south-east of the region. During warm season, is also characteristic for the north taiga and forest tundra habitats	Environmental conditions in Ust-Kut District are unsupportive for the species that prefers sparse forests, forest steppe or forest tundra habitats	Not identified
Common crane (*Grus grus*)	Irkutsk Region Red Data Book. - Category 3. Nesting and migrating species	LC – least concern	Water-logged areas. Shores of small lakes adjoining vast tussock swamps, edges of lacustrine beads surrounded by bogs. Most common in Cisbaikalia	There are no lacustrine-boggy complexes in the Ust-Kut industrial area and surroundings, therefore the species may be encountered only on transit	Not identified
Corncrake (*Crex crex*)	Irkutsk Region Red Data Book. - Category 3. Nesting and migrating species	LC – least concern	Wet tall-grass meadows and mixed-herb dry bogs with patches of open water. Makes nests in grass. Lives in forest steppe floodplain meadows	The species are not characteristic for the Project area (hardly encountered in taiga). Furthermore, environmental conditions of the floodplain complexes in the Ust-Kut industrial area are unsupportive for nesting of these species (lack of large enough tallgrass meadow and wetland habitats)	Not identified
Common reed bunting (*Emberiza schoeniclus*)	Irkutsk Region Red Data Book. - Category 3. Rare nesting and migrating species, locally present in the region	LC – least concern	Reed and cattail thickets on banks of water bodies in forest steppe areas		Not identified
Curlew (*Numenius arquata*)	Irkutsk Region Red Data Book. - Category 3. Nesting and migrating species	VU – vulnerable	Nesting in meadows of various types in river floodplains. Lives on bogs. During migration, is encountered in all forest steppe areas		Not identified
Scops owl (*Otus scops*)	Irkutsk Region Red Data Book. - Category 3. Rare nesting and migrating species, eastern periphery of the occurrence range	LC – least concern	Nesting of the species is reported on the north-western shore of Baikal lake and middle reaches of Angara river. Gradual extension of the occurrence range is observed further to the north, toward Yakutia	The lack of over-mature forests, frequent forest fires, exploitation of forests and disposal of wood processing wastes are the main factors that limit nesting of the species in the Ust-Kut industrial area of INK	Not identified
Roody shelduck (*Tadorna ferruginea*)	Irkutsk Region Red Data Book. - Category 5. Nesting migrating species	LC – least concern	Banks of freshwater and brackish steppe and forest steppe water bodies, shores of the Baikal lake	The species is not characteristic for the taiga zone, therefore, Ust-Kut District does not provide preferred habitats for the species	Not identified
Terrestrial mammals					
River otter (*Lutra lutra Linnaeus*)	Irkutsk Region Red Data Book. - Category 3. Rare species.	NT – near-threatened	Fast flowing rivers with cold water, steep bank slopes, rifts and rapids. The critical requirement is availability of non-freezing river sections and ice cover with intermediate layers of air	This species is unlikely to be encountered, as Lena River completely freezes in winter and flows in its tributaries are too small. Other limiting factors include long-term development of banks of Lena river and tributaries, extensive hobby fishing near Ust-Kut, and also poaching	Not identified
Ikonnikov's bat (*Myotis ikonnikovi Ognev*)	RF Red Data Book – Category 2. Vulnerable species. Irkutsk Region Red Data Book. - Category 3. Widely spread species with relatively small population	LC – least concern	Mountain taiga areas with developed hydrological network, near lakes. In summer - in cracked cliffs, tree cavities, under bark, or in man-built structures. Wintering base was found in Argarakan cave	Environmental conditions in the Ust-Kut industrial area are unsupportive for this species: over-mature and mature forests are scarce (which means the lack of old trees with cavities), availability of bedrock outcrops, caves and other suitable shelters is extremely limited. The species is sensitive to forest felling and fires, which further reduces the chance of its encounter in the Project area.	Not identified
Insects					
Beautiful demoiselle (*Calopteryx japonica Selys*)	Irkutsk Region Red Data Book. - Category 2. Decreasing population size	Not assigned	Slow rivers and streams with silty bottom and sedge and bulrush thickets; flow-through lakes	According to the Red Data Book of Irkutsk Region and survey data from 1973 and 1995, the species may be encountered in Ust-Kut city. On the other hand, recommended protection and conservation measures for this species are applicable for forest steppe areas in Angara region, therefore, the Ust-Kut industrial area of INK with its mountain taiga and hydrogenic valley landscapes is not a preferred habitat for the species	Not identified

9.6.3.4 Project Impact on Terrestrial Ecosystems

The main form of damage to be caused to natural habitats is decrease in forest areas, reduction in the total vegetation reserves, littering of the logging area, and enhanced fire risk. Felling and mechanical damage of trees and shrubs, compaction of the soil with grass vegetation, destruction of the forest undergrowth affect the crown cover density and result in compaction of the topsoil layer.

In the process of the environmental engineering surveys for the integrated liquefied petroleum gas reception, storage and offloading terminal (2014), a vegetation map had been plotted covering partially also the area considered for implementation of this Project (Chapter 7). Despite the fact that a major part of the described area belongs to the forest fund land, it has been modified by anthropogenic impact. Intensive exploitation of forests during the previous years, logging operations, unauthorized waste dumping, construction of motor roads, pipelines and power transmission lines virtually destructed virgin taiga forest complexes within the subject area. Typical forests existing currently in the Project area are secondary larch and pine forests with dark coniferous undergrowth and small-leaved elements. Birch and aspen trees grow in unrecovered areas of felled tree stands and areas affected by forest fires.

Potential impact on vegetation will be directly and indirectly related to the construction activities. The direct impact is immediate destruction or damage of vegetation in the course of construction. The indirect impact is a change in the plant communities' growth conditions induced by the construction activities.

The greatest impacts on natural habitats in the Project area will include:

- deforestation of the Project site areas;
- loss of forest resources;
- reduction of valuable plant resources;
- loss of individual specimen or rare and endangered plant species, including those listed in the Red Data Books of the Russian Federation and Irkutsk Region;
- damage of vegetation at the boundaries of construction sites and temporary roads;
- inhibition of plant growth due to emissions of dust from construction activities and harmful substances;
- increased fire risk in the area.

The Forest Resource Ministry of Irkutsk Region approved re-categorisation of the forest land parcels requested by the Company which have no conservation status or special forest management features into the industrial land category. In connection therewith, it is specifically mentioned that such re-categorisation will not result in enclavement or fragmentation of forest areas, or their isolation from transport communications.

The lease agreements for the respective forest land plots describe the most common environmental offences by forest users as follows:

- topsoil damage or destruction;
- disturbance of water courses;
- works resulting in development of erosion processes;
- area littering with logging residues;
- violation of merchantable wood handling rules;
- failure to implement the measures provided fore in the Forest Development Project document (fire safety, sanitation, forest regeneration).

To avoid potential negative effect of the land use, the lease agreements provide for the following requirements to the lessee:

- compliance with the land use regulations established for the leased areas;
- conservation of the plant and animal species listed in the Red Data Books of the Russian Federation and Irkutsk Region and their habitats;
- implementation of measures for prevention of forest fires (including installation of awareness raising billboards at the vehicle/pedestrian entrances of the forest areas);
- sanitation of the leased areas;
- forest regeneration activities in the leased areas;

- biodiversity conservation measures (particularly, conservation of individual valuable trees or groups of trees in all layers of forest) set forth in the Forest Management Regulation for Ust-Kut Forestry Department.

Detailed description of mandatory activities to be implemented by the lessee is included in the specific Forest Development Project (FDP) documents that are prepared in relation to each lease agreement. Pursuant to those documents, the lessor (represented by the Forest Resource Ministry of Irkutsk Region) anticipates re-categorisation of the leased areas into the industrial land category when the technical facilities are put into operation. Cessation of the lessee’s operations in the leased area (including early termination) eventuate the need for the land reclamation for forestry use and return to the lessor in adequate condition for further forest management.

Clearcutting of tree and shrub vegetation by the lessee is permitted within the limits which are specifically set in each lease agreement: 48768.2 m^3 (including 36877.0 m^3 of merchantable wood, i.e. about 75 %) in the land plots with cadastral numbers 38:18:000010:1488, :1489 and 24451 m^3 (including 17309 m^3 of merchantable wood) in the land plot number 38:18:000010:1438. Therefore, and considering that the land will be used for permanent facilities within the Ust-Kut industrial area, all leased areas will constitute non-forest land during the whole period of lease, and no forest maintenance activities are included in the Forest Development Project documents.

The FDP documents provide for the following duties of the lessee:

- ensuring compliance with the forest conservation and protection requirements of the Forest Management Regulation and the Forest Development Project document;
- forest development in line with their designated use and useful features; securing water conservation, protective and other functions of the forests;
- ensuring fire and health safety in the forest areas.

Operations in the leased areas will be managed to minimise impact on vegetation and fauna through using the following methods:

- compliance with environmental requirements aiming to minimize emergency risks and reduce emissions of harmful substances to air;
- vehicle and machinery traffic solely on designated roads;
- adequate maintenance of all water passage and drainage facilities;
- fire prevention measures (fire prevention arrangements, procurement of fire protection and forest fire-fighting equipment, development of fire safety action plans);
- safety embankments, perimeter bunding of the production area.

The following measures will be implemented to mitigate the impact of chemical contamination of soil and vegetation damage during the construction activities:

- keeping all construction activities and vehicle traffic strictly within the allocated land, prohibition of offroad movement of vehicles;
- prevention of untreated wastewater spills, leaks and discharge to ground;
- segregate collection and storage of waste in dedicated containers or vessels, and subsequent removal to adequately equipped landfills or recycling facilities;
- technical maintenance of vehicles and construction machinery in dedicated areas outside the protection zones of water bodies;
- storage of construction materials in areas without tree vegetation, prevention of construction site littering and contamination with fuel and lubricants.

At the end of the works, restoration of fauna communities with species composition similar to the baseline situation will be possible only after complete regeneration of the vegetation cover being a vital component of animal habitats. Therefore, the main focus of the land reclamation activities shall be regeneration of vegetation.

Considering the significant area of the habitats that will be irreversibly modified as a result of construction of the Project facilities, overall impact of the loss of habitats, ground vegetation and terrestrial vertebrates is assessed as **high**. After the land reclamation and forest regeneration measures, the residual impact will be reduced to **moderate** or **low**, depending on the scope of reclamation activities. On the Consultant's opinion, the scale of forest regeneration shall be commensurate with or exceed the area of occupied spawning protection forest land. Preliminary estimation of the respective areas is included in Section 9.9 and is subject to updating following development and approval of the land planning and demarcation documents.

The forest land reclamation areas and methods shall be selected in cooperation with the Ust-Kut Forestry Department and the Forest Resource Ministry of Irkutsk Region. The Forest Development Project documents approved in 2018-2019 for the forest plots leased by INK under earlier agreements set forth a number of general and special requirements to forest-oriented reclamation of land disturbed by the Company's operations. In particular, they provide a basic process flow chart for restoration of forest plants, including nursling planting rates. This scheme is subject to further adaptation at the stage of design development for the forest restoration measures in the sites after temporary occupation, and in the areas designated for compensatory reforestation, considering local soil and geomorphologic conditions, geometry, surrounding landscapes, exposure to sunlight, etc.

In conformity with Article 60.3 of the RF Forest Code and the "Rules of Sanitary Safety in Forests"[247], the use of forests for construction, modernization and operation of communication lines, roads, pipelines and other linear facilities, as well as for other purposes may not deteriorate the sanitary condition of the forests located in the forest areas allocated for such use and in the adjacent areas.

In particular, activities at the construction phase shall include comprehensive measures for minimization of air pollution due to the emissions from fixed and portable sources (refer to Section 9.1 for more detail). After such measures, the residual impact of air pollution on habitats is estimated as **low**.

Uncontrolled hunting (poaching) is a significant factor of the impact at the Project construction phase. After the appropriate mitigation, the residual impact can be reduced to **insignificant**.

Besides operations within the official land allocation (re-categorisation of land into the industrial land category), Article 25 of the RF Forest Code[248], permissible activities in other areas affected by the Project may include the use of merchantable forests for construction, modernization, operation of linear facilities and supporting infrastructure. Another regulation that supplements the Forest Code and must be respected for preservation of the area's environmental sustainability is the "Rules[249] for Use of Forests" (approved by the Federal Forestry Service of Russia (Rosleskhoz), No.223 of 10.06.2011).

Some of the forests in the subject area belong to the category of protective (spawning protection) forests in accordance with Article 102 of the RF Forest Code. Originally (in 2016-2017), two options were considered for location of the polymer plant process site. The first one promised the best performance in terms of technological processes and logistics but required acquisition of 644 ha of designated spawning protection forests. The second alternative which has been selected as the preferred option provides for construction of the PPF process area at an elevated site within the merchantable forest, therefore, disturbance (destruction and fragmentation) of spawning protection forest will be minimised. The impact on protective forests cannot be completely avoided due to the need for the technical communications corridors between the PPF process area and the offloading terminal, the gas fractioning unit and the existing transport corridors. Therefore, a part of the spawning protection forest will be acquired for construction of the linear facilities. The protective forests surrounding the Project land are subject to the environmental monitoring and comprehensive measures aiming to ensure adequate conditions, including fire safety.

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[247] RF Government Decree of 29.06.2007 "Rules of Sanitary Safety in Forests". (expired after coming into effect of RF Government Decree No.607 of 20.05.2017 "On the Rules of Sanitary Safety in Forests").

[248] Forest Code of the Russian Federation, No.200-FZ of 04.12.2006 (rev. of 03.07.2016) (amended and supplemented, with effect from 01.03.2017)

[249] Order of the Federal Forestry Agency (Rosleskhoz), No.223 of 10.06.2011, Moscow, "On approval of the Rules for use of forests for construction, modernization and operation of linear facilities"

9.6.3.5 Fire Hazard

Based on the forest survey materials, the forest areas leased by INK are classified as areas with fire hazard class 2, 3 and 4 (the average class for the whole area is 3, i.e. "medium risk of fire"). In the conditions with medium risks of fire, the potential outbreak of fire may be associated with sorrel and bilberry pinery, cowberry larch forests, all types of cedar forests except for riverine and sphagnous, cowberry and sorrel spruce forests. Therefore, the most probable types of fire, conditions and duration of the periods of possible fire outbreak and development are defined as follows: ground and crown fires possible during the maximum fire risk period in summer, and in relation to cedar forests - also during the maximum fire risk periods in spring and particularly in autumn.

The Forest Development Project documents establish the following requirements to the lessee of forest land plots:

- clearing areas for the power transmission lines shall be kept clear of combustible materials during the fire-risk season;
- the pipeline corridors and associated buffer zones in the forest areas shall be kept clear of combustible materials during the fire-risk season; crossing points for fire-fighting machinery shall be provided on the pipelines with intervals of 5-7 km; firebreaks of 2-2.5 m in width shall be provided around the pipeline inspectors' homes, and around manholes on the pipelines;
- management of the power transmission lines and pipelines construction, reconstruction and operation shall provide for forest clearing, storage and removal of the cut timber, logging residues and other combustible materials.

Pursuant to the RF Government Resolution of 16.04.2011 No.281, entities conducting forest use operations shall, before the beginning of fire-risk season, provide training of their personnel and other persons involved for their massive operations in forests on the Fire Safety Rules in Forests.

In accordance with the Fire Safety Rules in Forests in relation to construction, reconstruction, operation of linear facilities in the leased forest land plots, the design provides for the following fire safety measures and arrangements:

- maintenance of linear facilities corridors routed through forest areas including removal of dead fallen and stand wood, other waste and combustible materials;
- installation of fire awareness billboards;
- provision of staging post for fire-fighting equipment (according to the Forest Development Projects, the post will be located at a distance of 1.1 km from the boundary of the leased forest area plots).

Fire-fighting machinery, equipment, rig, tools will be transported as required to the leased forest land plots by the existing earth roads.

Pursuant to the RF Government Decree on approval of the Fire Safety Rules in Forests of 30.06.2007 No. 417 (rev. of 17.04.2019), the above requirements are supplemented with the following measures aiming to minimise the risk of fire outbreak:

- monitoring fire safety performance of the Company's divisions and contractors;
- provision of a system for fire detection and alerting system.

Considering the high fire risk in the location area of the Project sites, and the presence of a large wood processing waste dump prone to regular open and latent fires in the adjoining site, the fire risk at the construction phase is assessed as **high**. After the above measures and assuming that the wood processing waste dump will be adequately managed (operated by third party), the risk can be reduced to **moderate**.

9.6.3.6 Impact on vegetation

Development activities in any area inevitably cause destruction and transformation of the vegetation cover structure. Potential impacts on the vegetation cover are directly related to the impacts on habitats, including loss and destruction of habitats, their mechanical disturbance and contamination.

The most common types of plant associations in the area adjacent to the construction sites are pine and larch forests, aspen-birch forests growing in areas affected by logging operations and anthropogenic impacts. Based on the information on the area of habitats to be lost in the process of construction and taking into account the mitigation measures, the impact on the vegetation cover associated with the loss of habitats can be assessed as **moderate**.

Few rare and protected plant species listed in the Red Data Books of the Russian Federation and Irkutsk Region may be present in the Project area (refer to Section 7.6.5.2 for more detail). Given the lack of geobotanical data on the subject area, the potential impact on the 'Red Book species' should be assessed as **moderate**.

The Forest Development Project documents include the lists of plant species with conservation status in accordance with Russian law which are or may be present in the leased forest land plots. The lessee is obliged to take measures for conservation of such species and their habitats. In particular, the Forest Development Project documents prohibit forest felling in the areas where protected species are present or impose certain limitations with regard to seasons of permitted logging operations in such areas (provided that such limitations ensure sufficient protection of the species and habitats), and restrict construction of infrastructure and other facilities in the forest areas occupied by protected species. In absence of detailed information on the protected species’ habitats, the lessee of the forest land plots must arrange for survey activities as appropriate to collect such information.

The adverse impact of the construction activities on the populations of protected plant species within the Project's area of influence can be abated by implementation of the following measures supplementing the above requirements of the Forest Development Project documents:

- Strict compliance with the boundaries of the land allocated for the Project and limitations on the auxiliary works associated with the construction activities in the areas where rare and protected plant species grow, including the use of the existing transport network;
- Removal of garbage and logging residues from the forest areas;
- Compliance with the fire safety requirements;
- Limitations related to access of construction workers to the areas where protected plant species have been reported;
- Information and awareness raising activities among the personnel of construction contractors and the Company;
- Separation and demarcation of areas requiring special protection of rare plant species in case of their detection.

Implementation of the above system of mitigation measures will reduce the impact on rare and protected plant species to a **low** level.

9.6.3.7 Impact on fresh water ecosystems

The natural conditions of the upper reaches of the Lena River are not sufficiently favourable for the ichthyofauna, which is the central element of freshwater ecosystem and one of the most valuable natural resources of the subject region. The ichthyocoenosis of the Lena River section affected by the Project features a relatively scarce diversity of fish species, however, it includes few species of commercial value. Its main components are psychrophilic osyphilic and lithophilic fish which are highly vulnerable to anthropogenic impacts - water contamination, transformation of river bed, extensive fishing and navigation.

The impact water areas of the Lena River and tributaries are not preferred biotopes for the species with conservation status in Russia and at the international level; nevertheless, the Project planning shall take into account vulnerability of their populations under pressure not attributable to the Project.

Some of the Project facilities (surface water abstraction facilities, sewer lines to outlets for treated wastewater discharge) will be located directly in the river and within the water protection zone of the Lena River valley. Construction in this area will affect hydrobionts due to contamination of surface water bodies and waste generation. Potential leaks of fuel and lubricants, liquids products, reagents, wastewater or other technical liquids due to violation of process technology requirements or in case of accidents may affect the water environment.

Hydrocarbons are the most common and hazardous substances polluting the natural waters. The MPC value applicable to fishery water bodies is 0.05 mg/l[250]. Petroleum hydrocarbons are especially toxic for fish roe, larvae and young fish. Although the main production site of the polymer plant is located at a certain distance from the river bank, the topography of the area facilitates drainage of pollutants leaks toward the watercourse. Migration of pollutants to the river is also possible from the PPF offloading facilities located within the terrace system of the Lena River valley, at a distance of 220-240 m from the low water line.

The greatest impact on the aquatic organisms providing the basic food resource for fish will be directly related to the impact on their habitat, particularly during the dredging operations, construction of the berth, water abstraction and discharge facilities in the river and the floodplain. The following negative impacts are expected during the construction activities in the Lena River water area:

- loss of phyto- and zooplankton due to pollution of water with high concentrations of suspended solids during dredging and other underwater technical operations;
- reduction of phyto- and zooplankton productivity due to increased turbidity during dredging and other underwater technical operations;
- benthos loss in the affected bottom area during dredging and other underwater technical operations;
- benthos loss in the bottom area silted with a layer of more than 5 mm of settled fines during dredging and other underwater technical operations;
- loss of zooplankton and zoobenthos under the impact of noise, vibration and shock waves during piling operations (if required for construction of the temporary berth facilities);
- degradation of environmental conditions including:
  - disturbance of natural relief at the river bottom and floodplain system, lythodynamic conditions and subsoil composition for development of benthos communities;
  - increased nutrients content in water due to nutrients release from excavated soil, resulting in eutrophication of the aquatic water system and deterioration of water environment quality;
  - contamination of the water area with rain and melt water (runoff) from the construction sites, and due to potential occasional and accidental leaks of technical, washing and domestic wastewater, emergency oil spills from tanks or equipment used for the construction works;
  - secondary contamination due to pollution transport from the shore ground and bottom sediments into the water flow of the River Lena.

Water contamination with wastewater discharges from vessels is not considered as a regulated impact, as such impact shall be completely prevented at all vessels involved by the Project for transportation of goods for the PPF construction and operation.

Similarly to the impact on phyto- and zooplankton and zoobenthos, the greatest impact on rare and valuable commercial fish species will be related to dredging and other underwater technical operations, as well as navigation and wastewater discharges. The above activities will affect living environment of all aquatic organisms including flora and fauna, disturb the productional processes at all trophic levels, with sequential decline of productivity and eventual reduction of fish resource in the impact water area.

The following negative impacts on the Lena River ichthyofauna are expected at the construction phase:

- loss of fish eggs and juvenile and young due to high concentrations of suspended solids during dredging and other underwater technical operations;
- loss of fish eggs and juvenile due to physical impacts: noise, vibration and shock waves during piling operations;

[250] On approval of water quality standards for fishery water bodies, including standards for maximum permissible concentrations of harmful substances in the waters of fishery water bodies. RF Ministry of Agriculture. Order No.552 of 13.12.2016.

- deterring and re-distribution of fish under hydroacoustic impact of the works and moving vessels;
- food resource reduction due to decrease of phyto- and zooplankton productivity during dredging and other underwater technical operations;
- disturbance of the fish migration routes during dredging and other underwater technical operations;
- contamination of the water area with rain and melt water (runoff) from the construction sites, and due to potential occasional and accidental leaks of technical, washing and domestic wastewater, emergency oil spills from tanks or equipment used for the construction works.

Activities in the valleys of the small streams - Sukhoy and Gremyachiy creeks and the Polovinnaya Kiver - will have an indirect impact on fresh water ecosystem of the Lena River. At present the Consultant assumes that all treated wastewater flows will be discharged to the Lena River and the Polovinnaya river will not be used as recipient of treated wastewater[251]. In this case, the system of impacts on the three water courses will include construction and operation of the stream crossing sections of roads, pipelines, power transmission and communication lines. The related impacts will include:

- disturbance of morphological structure of the water courses, surface relief and moss-and-plant cover of the flood valleys (bottoms) and walls of valleys during construction of the crossing structures and culverts;
- loss of young fish and aquatic organisms (also at significant distances from the work sites) due to increased suspended solids concentrations during construction of the crossing structures and culverts;
- physical loss or reduction of spawning areas in estuaries due to disturbance of the bottom morphology and water flow patterns;
- disturbance and degradation of hydrochemical conditions in the water bodies due to construction of crossings and culverts;
- noisy works deterring fish calling at the small streams and creeks during the spawning period;
- contamination of aquatic ecosystems as a result of accidental leaks of hazardous substances, or with insufficiently treated runoff water.

Considering the local extent and short duration (most impacts will be present only during the period of construction), the integral intensity of the Project impact on aquatic life is assessed as **moderate**. Implementation of the special mitigation measures and compliance with the technology specifications will reduce the pollution impact on the hydrobionts down to the **low** level. The chance that the Project activities may cause a significant impact on populations of rare and valuable commercial fish species in the Lena River catchment area is negligible.

According to Russian law, any activity with potential effect on aquatic biological resources is subject to assessment of its specific impact on the exposed aquatic ecosystems. Such assessment should be conducted by specialised research and design institutions under the Federal Agency for Fisheries (FAF), or institutions accredited by FAF. The report on assessment of impact on aquatic bio-resource and proposed remediation measures must be approved by the territorial authority of FAF, as a mandatory prerequisite for acceptance of the Project design documents by the state environmental expert review board, or by non-state expert review.

Such estimations and conclusions have been prepared earlier for the facilities within the Ust-Kut industrial area of INK that use Lena River water for their operation needs. The Conclusion issued by the Angara-Baikal Territory Authority of the Federal Agency for Fisheries (No.Zh-1649 of 24.07.2015) with regard to the industrial and stormwater treatment facilities for the liquefied petroleum gas reception, storage and offloading terminal includes a recommendation to undertake certain compensatory measures for aquatic bioresources restoration. In particular, it is proposed to release hatchlings of whitefish to the river.

The IPP associated facilities with the greatest impact on freshwater ecosystems are the berth and construction of the interfacility road (which will partially affect the water protection area of Lena river).

[251] Final decision about the drainage systems configuration for the polymer plant is pending

By the time of finalization of this report, the impact of these facilities and potential damage to aquatic biological resource have been fully assessed.

In particular, the project design for the berth construction has been approved by the following supervising authorities of the Russian Federation and competent non-state expert review agencies:

- FBI "Lena Catchment Inland Waterways Administration of the FAMART" (Letter # 05-08-2428 of 20.05.2019);

- Angara-Baikal Territory Authority of the Federal Agency for Fisheries (Conclusion # IS-2438 dated 10.07.2019 and Conclusion # IS-3598 dated 09.10.2019);

- LLC "SibStroiExpert" (positive conclusion dated 01.07.2019 on the results of non-state expert review of design survey materials);

- Siberian Centre for Construction Expert Review (positive conclusion # 38-2-1-2-018610-2019 dated 19.07.2019 on the results of non-state expert review of design documentation).

Based on the above conclusions and approvals, permit for construction of the berth facilities was issued to Irkutsk Oil Company (#38-523102-044-2019 dated 23.07.2019). The impact of the planned construction and operation of the berth facilities was assessed by the the Baikal Branch of FSBI "GLAVRYBVOD" in 2019252 It has been demonstrated that the greatest negative impact on aquatic life will be caused by acquisition of 1.4 ha of water area and onshore area of similar size, filling of soil foundations under water, and dredging for the access channel.

The suspended particles plume from the berth construction is estimated to be 50 m wide and extend 400-450 m downstream of the works. Particles suspended by the construction activity will settle on the river bottom in the total area of 2.2 ha. Removal of the berth and auxiliary facilities will also cause short-time emission of particulate matter into the water flow of Lena River - the respective plume dimensions will be 60 m by 500 m, with the settlement area of 3 ha. Dredging activity will produce the largest turbidity plume (200 m by 1600 m) and a 30 ha settlement area.

The total loss of aquatic biological resources caused by the above impacts of the berth construction and operation is estimated as 1106 kg of fish, in natural terms. Recommended remediation for the above damage is release of sturgeon fry (at least 73,738 units 1.2 g each) in the catchment area of Baikal lake. If implementation of the above measure is impractical, the alternative is release of 614,483 units of grayling fry (0.5 g each) into Baikal lake, or to rivers discharging to the lake. Final decision about the compensatory stocking will be made jointly by the project entity (INK) and the Angara-Baikal Territory Authority of the Federal Agency for Fisheries. Estimated cost of the proposed measures is RUB 6.6 million or RUB 21.5 million in current prices, depending on the selected option (sturgeon or grayling, respectively). Even though the price of sturgeon fry is higher than that of grayling, compensatory stocking with sturgeon will be less expensive, due to the smaller numbers of sturgeon fry to be released to meet the standard requirements.

The supervising authority issued the following instructions to be followed during the underwater technical operations:

- The activities should be conducted outside the spawning period (i.e. working is prohibited between 15 May and 30 June, and between 1 September and formation of ice cover);
- All machinery and equipment should be kept in good working order;
- Restrictions applicable in the shoreline protection belt and the water protection zone should be respected during the onshore activities.

The last instruction in the above list is also applicable to construction of other facilities within the water protection zone of Lena River and tributaries. According to Conclusion #Zh-1649 of 24.07.2015 issued by the Angara-Baikal Territory Authority of the Federal Agency for Fisheries, damage to aquatic biological

[252] Assessment of the impact on aquatic biological resources and their habitats of the planned activities under the Project "Large equipment unloading berth on the Lena River", Baikal Branch of FSBI "GLAVRYBVOD", 2019.

resources during construction of the interfacility road will be caused by the reduction of natural runoff from the modified surfaces. Baikal branch of the Russian Federal Research Institute of Fisheries and Oceanography (VNIRO) estimated the damage as 31 kg of fish, in natural terms. The mandatory compensatory measure is release of 17,222 units of grayling fry 0.5 g into Lena river or any of the regional water reservoirs (Irkutskoye, Bratskoye, Ust-Ilimskoye). Alternatively, fry of other fish species may be released - whitefish (peled, 4000-5500 units), sturgeon (2067 units) or wild carp (4133 units) - into the reservoirs or their feeding rivers.

To prevent the river contamination during construction, the following requirements should be met:

- avoid contamination of the water protection zone of the river with garbage, wastes, fuel and lubricants;
- prohibit storage of soils prone to washout within the water protection zone;
- maintenance, repairs, refueling and washing of the machinery and vehicles should be performed in special areas located outside the water protection zone of the Lena River and tributaries;
- своевременное осуществление мероприятий по предупреждению и ликвидации ЧС на водном объекте;
- Timely prevention of and response to emergency situations on the water body;
- Prompt reporting to the territorial authorities in charge of water resource management and protection of fish, in case of accidents, traffic incidents and other emergency situations on the water body;
- Getting approval from the fish protection authorities when scheduling any works on fishery water bodies;
- Providing conditions for unrestricted migration of fish in all seasons;
- Prohibition of any hydro-engineering work within the streambed during the spawning periods in spring and autumn:
    - 15 May to 30 June - in all fishery water bodies within the catchment area of Lena river;
    - from 1 September until ice cover is established - water bodies in Irkutsk Region.

Implementation of the environmental measures during the construction phase will reduce the impact level to **low**.

Uncontrolled production of fish as a source of food for construction workers may deplete the fish resources and entail an impact of **moderate** severity on local populations of certain types of fish (particularly grayling). The impact will be reduced to low if adequate measures are taken to control illegal production of fish.

9.6.3.8 Impact on terrestrial vertebrates

Birds

According to the preliminary information, it is potentially possible that bird species listed in the RF and Irkutsk Region Red Data Books, including nesting birds, can be found in the Project area (see the table in Section 7.6). Few species are encountered in the area only on transit during seasonal migrations, i.e. their presence is limited in time and associated with specific seasons. Migration routes of various bird species, including the main one (Toreya-Kirenga-Tunguska) and secondary, pass through the Project area.

The negative impact of **construction** of the Plant and associated facilities on the bird fauna is mostly related to immediate destruction of habitats in the land plots allocated for the Project facilities. In the neighbour areas, the impact is related to changes in the living environment, more specifically:

- nuisance due to increased level of noise from the construction activities and running machinery;
- nuisance due to presence of people and equipment in the immediate vicinity of nesting sites;
- disorientation of migrating birds by lighting at the construction sites;
- indirect impact due to improved access to the birds' habitats for hunters and poachers, as a result of construction of roads and other communication lines.

Nuisance and potential desorientation of migrating species is also expected at the Project **operation** phase (light and heat radiation from the flaring systems, electromagnetic radiation, noise, lighting and other factors). Birds may be killed on the power transmission lines or in forest fires.

There is no generally recognized quantitative threshold for assessing the significance of impact on bird populations. The threshold of 1% is generally accepted as a useful reference (e.g. loss of 1% of the population of a species in a given geographical region). Nevertheless, decisions taken by the competent agencies with regard to impact levels for certain projects in Europe (including those in designated bird conservation areas at the international level) indicate that in many cases a loss of a population proportion far smaller than 1% may be of great significance and even affect integrity of the object of conservation (Hoskin and Tyldesley, 2006).

Therefore, the 1% threshold in relation to birds populations is adopted as an indicator of high negative impact. At the construction phase, impact on the birds populations will be mostly related to loss of habitats, as well as noise and light impacts, and nuisance. The habitats that may be destroyed by the construction include ground-based nesting and feeding areas. The habitats that will be immediately lost make up a significant part of the Project sites area. Assuming that proportional decrease of nesting birds population in the respective habitats, the absolute intensity of this impact is assessed as **moderate** (population size of nesting birds is to be clarified). Detailed description of the mitigation measures is provided in Table 9.5.1. Their implementation will reduce the residual impact to low.

The air pollution with emissions from the Project facilities may cause reduction of density or complete disappearance of larger species - grouses, owls, daytime birds of prey, pigeons - which is attributable not only to the increasing intensity of disturbance factor in the vicinity of the emission sources (grouses), but also the lack of suitable places for nests (birds nesting in hollows in a tree trunk) and scarce food resources for specialized bird species. The decreasing population density of owl species and daytime birds of prey is attributed to the decreasing abundance of mice in the conditions of growing technogenic pressure.

Out of bird species associated with the tree layer, only synanthropic crow species prosper in case of increasing technogenic pressure. An increase in the open habitats facilitates an increase in the abundance of species nesting on the ground or in burrows.

The impact of disturbance factors is assessed as **high** without mitigation, and as **moderate** after mitigation.

Mammals

Development of areas creates adverse impacts virtually on all wildlife species due to the deteriorating conditions of their habitats, decrease in the population size and risk of death of animals. In the course of the field surveys in the zones adjacent to the Project area, no protected species of terrestrial animals have been detected. Within the Project area itself, the fauna composition has not been investigated. Review of the pertinent literature suggests that both protected species and commercial species (hoofed, sable, red fox, ermine, squirrel, etc.) can be found within the subject area.

The main sources of impact on mammals are associated with construction activities, operation of machinery and equipment, transport vehicles and construction personnel. The impacts can be divided into three groups:

- Land acquisition and physical transformation: direct impact on animals (as an obstacle), and indirect - changes in feed and habitat;
- Noise: direct impact - high levels of noise with immediate effect, and low noise with depressing effect; indirect impact - behavioural reactions disorders;
- Chemical contamination: direct impact - immediate death of animals in case of accidents; indirect - reduction of food resource, deterioration of forage organisms quality.
- The following impact types are especially significant:
- A decrease in the habitat ranges as a result of allocation of land areas for construction, where the biotopes will be completely destroyed;
- Transformation of habitats in areas adjacent to the construction sites;

- Contamination of the natural environment (soil and vegetation cover, atmospheric air and water bodies) entailing certain modifications of conditions for existence of baseline, commercial, recreationally significant, rare and endangered species;
- Disturbance factor within the construction zone forcing animals to leave their usual biotopes;
- Death of animals as a result of illegal hunting, operation of industrial facilities, chemical intoxication affecting the biodiversity level in the vicinity of construction sites;
- Impact on traditional natural routes and directions of animal migrations.

The decreasing habitat areas and biotope transformation in the areas adjacent to the construction sites are the most significant forms of impact on mammals. One and the same type of impact imposed by the planned facilities will affect different groups of animals to a different degree. Minor terrestrial vertebrates (insect eaters, rodents, amphibians and reptiles) are affected by anthropogenic impacts in a manner similar to the effect of the same impact on invertebrates. It can be expected that their population size and diversity will decrease proportionally to the area of the land occupied for the Project construction.

Destruction of forest vegetation as a result of forest fires of anthropogenic origin is a specific type of transformation of wildlife habitats. Such fires are usually caused by workforce negligence, use of equipment without spark preventing devices, littering of forest areas and certain other causes. In addition to death of significant numbers of animals of various species, forest fires also cause transformation of wildlife habitats.

On the other hand, development of new areas is likely to induce growth of population sizes of synanthropic animals (dogs, house mice, grey rats, etc.). During the construction phase, stray dogs will appear in the vicinity of construction sites, resulting in a decrease in the population size of nesting birds (grouses, certain duck species, sandpipers), as well as many fur animal species due to virtually complete extermination of young animals by dogs. Medium-size and large mammals will be affected by the disturbance factor to a largest degree.

Commercial game animals will be exposed to impact within an area significantly exceeding the area of the construction sites. Currently, seasonal migrations of game animals have no well-defined routes. Due to the fact that all the planned Project facilities are located in the area transformed to a significant degree by human activities, the impact of the construction on terrestrial vertebrates after the planned mitigation measures will be **low**.

9.6.3.9 Aggressive invasive species

Spread of invasive species is the second most significant threat to the biological diversity after the habitat destruction. The probability of intrusion of alien species is higher in habitats, which had been modified or disturbed, for example, during the construction phase. The following features are typical of aggressive invasive species:

- fast growth;
- fast reproduction;
- good ability for spreading;
- adaptability to the existing conditions;
- vitality within a wide range of environmental conditions;
- ability to survive within a wide range of food types;
- biocoenosis with human beings.

No aggressive invasive species have been detected so far in the subject area. Nevertheless, any development project poses a threat of spreading of invasive species, including plant, fish and invertebrate species. The IFC PS 6 (IFC, 2012) recommends the following best methods to prevent spreading of alien species with having a potential for invasive behaviour:

- prohibition of intentional introduction of alien aggressive species regardless of the existing national regulatory framework;
- assessment of the risk of invasive behaviour when introducing alien species (e.g. planting of greenery);

- implementation of measures preventing accidental introduction or spreading of alien species (see below);
- implementation of measures aimed at extermination of aggressive alien species in the natural habitats under the client's control.

It is recommended to plan the following preventive measures to control and monitor invasive species:

- minimization of traffic intensity and covered distances;
- procurement of goods/materials from local suppliers, if possible;
- checking the presence of alien species and notification about their presence, if any;
- if infested area is identified: thorough treatment is required prior to and after execution of any work; washing of wheels of transport vehicles with water under pressure;
- ensure the awareness of the personnel about invasive species;
- collection and disposal of garbage;
- registration and reporting of the presence of invasive species;
- safe disposal of infested materials;
- minimization of soil disturbance or mixing of soil and vegetation, erosion prevention;
- checking of imported soil to make sure that it is free of invasive species (commission a proven supplier; inquiry of information on the soil origin);
- prevention of growth of invasive species on unprotected soil in the process of soil storage (avoid storage of unprotected soils near known sources of invasive species; used covers / stabilization methods);
- preservation of natural vegetation to a maximum possible degree;
- use of native plant species for land reclamation and greenery planting;
- avoidance of modification of soil and water bodies properties.

9.6.4 Impact during the operational phase

9.6.4.1 Designated conservation areas

No potential significant impacts on designated conservation areas have been identified due to their remote location in relation to the Project sites. Therefore, it is concluded at this stage that no designated conservation area will be exposed to significant negative impact of the Project.

9.6.4.2 Natural and modified habitats

No further loss of habitats is expected during the Project operation. The loss of habitats during the construction phase will be partially compensated for by land reclamation of temporary sites using native plant species.

The impacts on the vegetation associated with the deteriorated air quality during the operational phase are discussed in Section 9.1. Preliminary assessment of air emissions indicates that the predicted air pollution level can affect the biota due to the pollution of the ground-level atmospheric air and pollutants precipitation onto the plant surfaces involved in the photosynthesis processes. After the environmental measures, the residual impact will be **low** within the sanitary protection zone and **insignificant** outside of the SPZ.

During the Project operation there is a risk of potential impact on freshwater habitats due to contamination of water bodies, in particular, in connection with release of inadequately treated wastewater to the Lena River. The results of an assessment of potential impacts on surface water bodies due to different types of activities are presented in Section 9.5. Provided that adequate measures will be taken to reduce the impact and comply with the time schedule of operational environmental monitoring and supervision and with the planned quality of wastewater treatment, the residual impact on the surface water bodies is assessed as **insignificant**.

Waste generation during the operational phase of the Project might potentially affect the terrestrial and aquatic habitats. The issues relating to assessment and control of impacts associated with waste generation are considered in detail in Section 9.7. Without adequate control the impact can be **moderate**. After appropriate mitigation measures the residual impact will be **insignificant**.

9.6.4.3 Impact on biota

Rare plant species

No direct impact on rare plant species is expected due to additional loss of habitats during the operation phase. The indirect impact due to deterioration of air quality will be low or insignificant because the respective standard limits will not be exceeded.

Hydrobionts

During the operational phase of the Project it is planned to discharge the treated wastewater from the on-site treatment facilities to the Lena River with potential impact of treated wastewater on the hydrobionts. The consequences of potential impact on surface waters due to various types of activities are presented in Section 9.4. After the mitigation measures and provided that wastewater is treated to fishery quality standards, the residual impact of contamination on fish is assessed as **insignificant**.

Another source of impact on hydrobionts will be related to water abstraction from the Lena River. Small organisms including larvae and young fish may be carried by the abstracted water flow, therefore, fish protection systems shall be provided at the water intake facility. The water use at the PPF facilities is not expected to have any significant influence on water level patterns in the Lena River, therefore, the residual impact of water abstraction facility operation on ichthyofauna is assessed as **low**, considering the local effects of turbulence. The latter will be supported by the impact of the nearby wastewater discharge facility: besides agitation of fine particles, the effluents will produce a warmed water plume the extent of which cannot be estimated at present but may reach as far as 0.5-1.0 km downstream of the discharge point, The expected transport of pollutants will be small, as the Project design provides for wastewater treatment to the fishery water standard (the most stringent quality standard in the RF for most of the controlled parameters). During normal operation of the water intake and discharge facilities on the Lena River, the impact will be local and **insignificant**. It will hardly extend further than few hundred meters within the impact area and will not reach the river section at the Polovinka village. The PPF is not expected to produce any significant effect on hydrological and hydrochemical conditions of the aquatic life habitats in the Lena River. The above conclusions should be regarded as preliminary opinion pending the reports from environmental survey of in the Project area, including the berth facilities site.

Birds and chiropterians

No direct impact on birds and bats is expected during the operational phase of the Project due to any additional loss of habitats.

The impact on birds caused by the nuisance factors will be similar to that during the construction phase, but of a less significant intensity. Most of the passerine bird species are not affected by the disturbance factor provided that they have suitable habitats. It is predicted that the population size of synanthropic bird species, including crows, will grow and threaten thereby the survival of young birds in the areas adjacent to the Project sites.

Other mammals

No direct impact on terrestrial animals is expected during the operational phase of the Project due to loss of habitats.

The impact on terrestrial animals caused by the nuisance factors will be similar to that during the construction phase, but of a less significant intensity. An insignificant impact factor will be noise exposure due to operation of the process equipment and the traffic of transport vehicles. However, in case of compliance with the applicable regulatory noise exposure norms at the plant sites, the computed noise exposure levels beyond the plant sites will not exceed the applicable regulatory levels, and the transport traffic intensity during the operational phase will be significantly lower than during the construction phase. Provided that the above conditions will be complied with, the significance of impact on terrestrial animals is assessed as **insignificant**.

Illegal hunting (pouching) is the most significant impact factor during the operational phase. After the mitigation, the residual impact can be reduced down to **insignificant**.

9.6.4.4 Impact on ecosystem services

Potential deterioration and loss of ecosystem services may cause operational, financial and reputational risks to the Project sustainability. The major part of ecosystem services which is related to biodiversity within the Project's area of influence belongs to the 1st priority category, i.e. services on which project operations are most likely to have an impact and, therefore, which result in adverse impacts to affected communities. The only ecosystem service with direct influence on the Project is supply of drinking and technical water.

The increase of water intake from the Lena River at the Project operation phase will be insignificant compared to the total flow rate in the river. Furthermore, the wastewater treatment facilities are designed to achieve effluent quality better than raw water. The Project operation impact on fishery will not be significant. The impact of the Project on the freshwater quality in the Lena River is considered to be negligible, however, insignificant combined negative impact is still probable. Drinking water will be supplied from artesian well with no effect on surface water resources.

At the initial stage of construction, the areas allocated for construction of the Project process facilities have been completely deforested. The impact of Project operation on logging operations will be negligible. Considering the fact that the land area re-categorised from the forest land into the industrial land category for the purpose of Plant construction makes up less than 0.1% of the total forest land in Ust-Kut district, the impact on logging activities can be assessed as **negligible**.

The Project impacts on commercial and recreational hunting are considered in Chapter 10 - Social Impact Assessment.

The Project impact related to the loss of genetic diversity is considered in this section above, in the context of degradation of natural habitats, destruction of vegetation cover and loss of habitats of rare and valuable species.

Table 9.6.2: Assessment of the significance of impact on wildlife and vegetation and proposed mitigation measures

Impact	Receptors	Stage	Impact significance	Design and mitigation measures	Residual impact
Risk of physical loss of representatives of species with conservation status and their habitats	Species with conservation status	C O	Moderate	Prohibition for the Company's and construction contractors' personnel to visit forests and gather wild plants, as well as to hunt and fish and possess corresponding equipment (with compensation in the form of other social and cultural activities, see Chapter 10). Revision of the INK Personnel Code of Conduct to take into consideration the new limitations; pertinent explanations for the Company's and construction contractors' personnel. In case of identification of habitats of rare and protected species near the accommodation camp and the Project site SPZ, additional measures will be developed for protection of such habitats. Prohibition to burn dry old grass in spring.	Insignificant
Loss of habitats	Terrestrial natural habitats (flora) Natural habitats (fauna)	C	High (flora) Moderate (fauna)	Prohibition for the Company's and construction contractors' personnel to visit forests and gather wild plants, as well as to hunt and fish and possess corresponding equipment (with compensation in the form of other social and cultural activities, see Chapter 10). Revision of the INK Personnel Code of Conduct to take into consideration the new limitations; pertinent explanations for the Company's and construction contractors' personnel. Organization of transport routes in such a way that all construction sites will be connected by motor roads. Prohibition of vehicle traffic outside of the approved roads and sites. Development of a Transport Traffic Management Plan. Provision of erosion-preventive and river bank protection areas within the water protection zone (during construction of water intake facilities) and elsewhere, if required. Stabilization of soil dumps and slopes (geoweb with crushed stone filling, sawing of grass). Preservation of any forest areas as far as possible around the construction sites and facility within the land areas allocated for the Project. Regular checks of compliance with the right-of-way dimensions for the linear facilities to be constructed. Regular checks of the condition of areas designated for short-term waste storage and timely removal of logging residues. Prohibition of introduction of invasive plant species and prevention of their spread. Prohibition to burn dry old grass in spring. Communications with the Forestry Management Department (see Chapter 4 and Chapter 10 for the recommendations relating to development of a Stakeholder Engagement Plan).	Moderate (flora) Low (fauna)

Impact	Receptors	Stage	Impact significance	Design and mitigation measures	Residual impact
				The areas of the habitats lost on a short-term basis during the construction phase (e.g. topsoil stockpiles, provisional facilities) are subject to land reclamation immediately after the construction completion and sawing with grass or other native plant species. Provision of temporary fencing of reclaimed areas for a period required for recovery of vegetation ecosystems. Compliance with the fire safety rules to prevent forest and grass fires.	
	Birds and bats	C O	Moderate Low	Prohibition of noisy works and vehicles traffic at night, monitoring of noise contamination of the environment in the work areas Limitation of the artificial illumination at nighttime (the light should be directed inside the sites and along the guarded perimeter; lowering of the security illumination intensity).	Low Insignificant
	Terrestrial natural habitats (flora and fauna)	O	Low	Restriction of any activities related to the Project outside of the industrial sites, accommodation camp and access roads. Assessment of risks of spills of fuel, lubricants and petroleum products, development of oil spill prevention and response procedures. Development of measures aimed at preventing unauthorized and accidental release of hydrocarbons. Construction of additional facilities as far as possible within of the existing built-up zones or in historically disturbed areas.	Insignificant
Habitat quality deterioration (nuisance)	Terrestrial vertebrates Birds Chiropterians	C O	Low	In addition to the measures aimed at preventing loss of habitats, the following mitigation measures are required: • Speed limitations for transport vehicles; • Provision of a wire mesh fencing around the sites to prevent access of terrestrial vertebrates; • Provision of bird-protection devices on overhead power transmission lines (if killed birds are reported); efficiency monitoring. • Prohibition to keep domestic animals in the temporary accommodation camps; supervision over keeping of security dogs at the Company's sites; prohibition to keep unleashed dogs (it is also recommended to integrate this requirement in the Accommodation Management Plan); • Prohibition to leave open trenches and excavations for a long period of time to prevent entrapment of reptiles, amphibians and minor mammals; • Prevention of the fall of animals into vessels and storage tanks at all Project facilities; • Keeping food waste in closed containers in places where they cannot be accessed by birds and mammals	Insignificant

Impact	Receptors	Stage	Impact significance	Design and mitigation measures	Residual impact
Contamination of water course in the process of construction activities in the river's streambed and within the water protection zone	Hydrobionts	C	High	Waste and materials management shall be organized in accordance with the applicable requirements. Arrangement of erosion-preventive, soil and river bank protection areas within the water protection zone. Stabilization of soil dumps and slopes (geoweb with crushed stone filling, sawing of grass). Technical maintenance, repairs, refueling and washing of the machinery and vehicles should be performed in special areas located outside the water protection zone of the Lena River; Prohibition of any hydro-engineering works in the river during the spawning period (spawning period of salmon being the most valuable and rare component of the Upper Lena ichthyocoenosis shall be considered as top priority)	Moderate
		O	Moderate	Compliance of treated wastewater discharged to the river with the MPC standards for fishery water bodies.	Insignificant
Animal loss due to the impact of underwater structures	Small hydrobionts	O	Low	• Provision of fish protection barriers on the water intake and other underwater structures	Insignificant

Table 9.6.3: Summary requirements to monitoring of impacts on wildlife and vegetation

Aspect	Project phase	Location	Parameter	Regularity
Terrestrial habitats	C O	Any areas where the vegetation was exposed to impact and land reclamation	Habitat restoration Diversity of plant species, character and structure of the ground surface by means of photography by quadrants marked with benchmarks	On time in summer, once every two years
	C	Any areas where vegetation was exposed to impact	Monitoring of the vegetation status separately in 10m x 10 m areas.	Once per month during the vegetation period
	C O	Any areas adjacent to the production facilities	Traversing monitoring of the population sizes of terrestrial animals (possible in cooperation with the forestry management department and Ust-Kut city branch of Irkutsk Region Association of Hunters and Fishermen; in the future, it is recommended to incorporate this activity into the SEP)	Once ever half year
Freshwater habitats	C O	Area including all directly affected water bodies and water bodies that could be affected in an indirect way (e.g. by surface runoff), as well as water bodies located outside of the impact zone as reference area.	Habitat restoration Monitoring of modifications in the aquatic environment, including geochemistry, water contamination, water temperature, water level, flow rate, etc. Phytoplankton, zooplankton, zoobenthos and fish (diversity, density and age structure of species).	On time in summer, once every two years
Alien and invasive plant species	C O	Project area	Alien and invasive plant species The area where such plant species have been detected; plant species and their quantity / density.	Continuous

9.6.5 *Conclusions*

The Project impact on the wildlife and vegetation has been assessed with and without the proposed mitigation and compensation measures. This assessment should be further updated when results of the environmental survey and design solutions are available.

The Project is not expected to cause any effect on designated conservation areas, due to their remote position - more than 14 km. There are no habitats within the land areas allocated for the Project or in the immediate vicinity, which can be classified as critical habitats in the context of the IFC PS6.

The impact on natural habitats and the larger area of modified habitats is expected mainly in the form of a decrease in the forest area and in the overall vegetation resources. The total impact due to the loss of habitats is assessed as **moderate**. The implementation of the proposed mitigation measures will reduce the residual impact down to the **low** level.

It is still probable that rare and protected species of plants and animals listed in the Red Data Books of the Russian Federation and Irkutsk Region may be identified in the Project sites. Implementation of the proposed system of mitigation measures will reduce the impact on rare and protected plant and animal species to the **insignificant** level.

Especially severe impact on hydrobionts will be imposed in the course of construction of the berth, the water intake and wastewater discharge facilities on the Lena River. Compliance with the environmental requirements in the process of the project design development and construction phases and prevention of excessive discharge of pollutants to water bodies will reduce the overall impact on freshwater ecosystems from **high** to **low**.

The negative impact on birds will be more felt at the Project construction phase, due to loss of habitats, nuisance (noise and illumination), especially during the nesting period, as well as destruction of brood by stray dogs and man-caused fires. During the Project operation, the main impacts will be related to illumination, noise, and pouching. It is also possible that birds may be killed on overhead power transmission lines.

The main impact factor affecting the terrestrial vertebrates during the construction phase will be destruction and transformation of natural and modified habitats, noise and other nuisances from the construction activities. At the operation stage, the main impact factors will include environmental pollution, light, noise and other effects, death of animals in road traffic accidents, and poaching. In general, this will result in a decrease in the population sizes of terrestrial vertebrates within the designed area of the Polymer Production Facility.

Implementation of the proposed environmental measures will reduce the residual impact on birds and terrestrial vertebrates to **moderate** and **low**.

9.7 Waste Management

9.7.1 General

Domestic and industrial wastes management at INK is based on the principle of minimization of environmental impacts through reduction of waste generation volumes and weight, recycling of certain categories of wastes, and keeping landfill disposal to the minimum.

Waste shall be collected, stored, reused and disposed in line with the environmental standards, occupational health, industrial and fire safety rules in order to avoid emergencies, fire, environmental damage and harm to human health. For this purpose, adequate facilities shall be provided for segregate collection and storage of wastes at dedicated sites within the work areas, using metal containers, tightly closed vessels, etc.

All waste management procedures shall meet both Russian regulatory requirements and standards of international financial institutions. Design solutions relating to a specific category of wastes shall first consider possibility of prevention of the waste generation, and then other solutions shall be considered in the following decreasing order of priority: minimization of waste volume and weight, reuse, recycling, energy recovery, and disposal at landfill.

Waste generation is expected in the course of the Project construction and operation, therefore, waste disposal scheme should be identified. Issues related to environmental impact from waste generation and disposal in the decommissioning phase are discussed in Chapter 11 herein.

Unless the corresponding measures are implemented, waste management may result in negative impact on human health and the environment - soil, air, ground and surface water. This Section covers the assessment of waste production volumes and management methods to be applied to reduce the negative impact down to acceptable levels at each Project site, including associated facilities, namely:

- complete system of IPP production facilities (including ethylene, polyethylene, and butene-1 units);
- IPP offsite facilities;
- accommodation camp for construction and operation workforce;
- IPP power supply facilities;
- water supply and drainage system;
- berth on the Lena River;
- substation;
- motor roads (interfacility road, and a section of the Vilyui A-331 road).

Types of waste that will be produced at the Project construction and operation are characterized by the volumes of production and hazard class. Types of waste are classified in accordance with the Federal Classificatory Catalogue of Wastes (FCCW). Within the FCCW, waste is divided into five hazard classes, this classification is slightly different from that applied in other countries, such as the Member States of the European Union, where the most common classification divides waste into three groups: hazardous, non-hazardous and inert[253]. Brief characteristic of hazard classes used within the FCCW versus extended typical "international" classification of waste is given in Table 9.7.1.

[253] Definition of inert waste used in the EU is extremely rigid and excludes any reactive waste, including that of ferrous materials, wood, etc. Therefore, in accordance with the EU definition, only a very small amount of waste from the Project construction will be categorized as inert.

Table 9.7.1: Classification of waste in the FCCW

Hazard class used in the RF	Definition of hazard used in the RF	Examples of waste	Equivalent as per typical international classification
I	extremely hazardous	Luminescent mercury-containing lamps, activated carbon contaminated with mercury sulphide.	hazardous waste
II	very hazardous	Concentrated acids, alkalines, halogenated solvents, lead-acid batteries, dry batteries, etc.	
III	medium hazard	Used lubricating oil, oily sludge, oily rags, used oil filter, non-halogenated solvents, waste paint, etc.	
IV	low hazard	Domestic waste, non-ferrous scrap, certain chemicals, certain construction waste, wastewater treatment sludge, treated medical waste, water-based drilling fluid, etc.	non-hazardous
V	practically non-hazardous	Inert waste: plastic, ferrous scrap, inert construction waste, food waste, chatwood, non-treated wood waste.	

In the construction and operation phases, the Project will generate solid and liquid waste; hazardous, non-hazardous, and inert waste.

Project-generated waste may cause major impacts such as:

- environment pollution, in particular pollution of surface water bodies, ground water and soils, due to waste spills resulting from improper management or storage (spills of waste materials, infiltration, etc.);
- uncontrolled emissions, e.g. dust or gas, while handling and storage of some waste types;
- air emissions from incineration of wastes at thermal destruction facilities;
- overexploitation of limited capacity of landfills;
- health impact on personnel and community due to attraction of vermin and pests (rodents, birds, insects), and development of pathogenic micro-organisms;
- fire and explosion risks posed by highly reactive, flammable and explosive materials;
- degradation of aquatic habitats due to contamination of water;
- visual impact due to inadequate waste storage arrangements.

Construction and operation phases are likely to generate hazardous waste to include: spent oils and solvents, contaminated polyethylene and polypropylene packaging, oily rags, sweepings, hydraulic liquids, lubricants, paintwork waste, contaminated soil (owing to possible leaks and spills), spent batteries, waste ultraviolet lamps, and waste catalysts and polymers. Management of such hazardous waste needs particular caution especially as regards the selection of options for its recycling, treatment/neutralization or disposal.

Details of the planned types of waste and generation rates at specific Project phases are currently unavailable; however, based on review of similar projects, future waste generation, including hazardous waste, during the IPP construction and operation is estimated as moderate. Due to the lack of information, the methods and approaches have been identified to provide for adequate treatment, transportation, temporary storage, recycling, neutralization, and disposal of waste in line with the best applicable practice.

Background information on waste management facilities and INK’s waste management system is provided in Section 7.9. Analysis of waste generation outlook and management methods for the Project construction and operation phases is covered by Sections 9.7.2-9.7.3. Description of the impact mitigation approach is included in Section 9.7.5.

9.7.2 *Waste management at the construction phase*

The section provides characteristics of waste that can be generated by the Project construction, considering the materials used for the activity.

Materials to be used in construction include components of the Project equipment, as well as materials for the site development, such as steel bars for piling and erection of buildings, concrete for foundations, road paving asphalt and concrete, as well as auxiliary structures, steelwork, elements of the construction site development, finishing materials.

Waste generation. It is expected that construction activities for all Project facilities will produce similar waste streams; therefore, a common tentative list of waste types can be applied for the whole construction phase. Waste generation is attributed to the following operations: earth works, road works, erection of building structures and installation of equipment, finishing works, commissioning, unpacking of materials, operation of vehicles and machinery. The generated waste will include waste construction materials, ferrous and non-ferrous scrap, packaging waste, spent batteries, waste oils and solvents, paintwork waste, oily rags, oil-contaminated soil, rubber tyres. Spent mercury-containing lamps will not be generated, since the decision was made to abandon their use and replace them with LED lighting. A temporary accommodation camp designed for 7000 occupants will be provided for the workforce during the IIP construction. Operation of the accommodation camp during the Project construction camp will generate significant quantities of domestic waste and food waste. Domestic wastewater from the accommodation facilities will be sent to the biological wastewater treatment facility. Methods of management of waste from the wastewater treatment processes are discussed in the thematic Section - Waste management at the operation phase. Also, it is expected that septic sludge will be produced at the temporary sanitary facilities at the construction sites.

Table 9.7.2 provides a tentative list of waste which the Project is expected to produce at the construction phase, including its potential impact, potential significance and handling/storage and disposal methods. More accurate estimation of waste from the Project construction will be provided at subsequent stage of design development.

Table 9.7.2: Waste generated at the construction phase: potential impact, recommended waste management/on-site storage methods and final disposal

Waste type	Potential impact	Method of management / storage	Method of disposal
Non-hazardous construction waste			
Cement waste	Uncontrolled dust emissions Environmental pollution (soil) Landfill, where utilization or recycling is unfeasible.	Segregate collection in compliance with the FCCW requirements and proper temporary storage in the temporary waste accumulation area. To minimize waste amounts, surplus cement should be utilized at other sites or returned to supplier.	Concentrated waste can be crushed/ground and used in road construction or as bulk additive, or landfilled. Cement-contaminated soils can be used as a covering material at landfills. Any surplus quantity of this waste will be passed over to licensed contractor for recycling or disposal. Cement mortar has to be dried. Transfer to contractor for recycling and disposal.
Cement wash water	Environmental pollution by sedimentation in water bodies	Wash water that cannot be immediately used will be stored in an open pit with lining or in open tanks for settling or other on-site treatment.	Cement wash water shall be utilized on-site, where practical. The on-site process of concrete mixing should include a wash water recirculation system. Surplus wash water shall be stored and evaporated.
Ferrous metal scrap	Landfilling, where the waste cannot be separated and utilized Visual impact from improper waste storage.	Segregate collection in compliance with the FCCW requirements and proper temporary storage in the temporary waste accumulation area.	Removal to contractor’s recycling facilities.
Non-ferrous metal scrap	Landfilling, where the waste cannot be separated and utilized Visual impact from improper waste storage	Segregate collection in compliance with the FCCW requirements and proper temporary storage in the temporary waste accumulation area.	Removal to contractor’s recycling facilities.
Broken bricks and ceramic tiles	Landfilling, where the waste cannot be separated and utilized	Segregate collection in compliance with the FCCW requirements and proper temporary storage in the temporary waste accumulation area.	Reuse. Surplus material shall be kept on site.
PE packaging	Landfilling, where the waste cannot be separated and utilized Visual impact from improper waste storage	Segregate collection in compliance with the FCCW requirements and proper temporary storage in the temporary waste accumulation area.	Removal to contractor’s recycling facilities.

Waste type	Potential impact	Method of management / storage	Method of disposal
Damaged wooden pallets	Landfilling, where the waste cannot be separated and utilized	Segregate collection in compliance with the FCCW requirements and proper temporary storage in the temporary waste accumulation area.	Removal to contractor for repair and reuse.
Broken glass	Landfilling, where the waste cannot be separated and utilized	Segregate collection in compliance with the FCCW requirements and proper temporary storage in the temporary waste accumulation area.	Removal to contractor for recycling.
Waste paper and cardboard	Landfilling, where the waste cannot be separated and utilized Visual impact from improper waste storage	Segregate collection in compliance with the FCCW requirements and proper temporary storage in the temporary waste accumulation area.	Removal to contractor for recycling
Wood waste	Landfilling, where the waste cannot be separated and utilized	Segregate collection in compliance with the FCCW requirements and proper temporary storage in the temporary waste accumulation area.	Removal to a contractor for recycling, if economically viable. All wood waste is subject to reuse or sale.
Other non-hazardous waste			
Municipal (domestic) waste	Landfilling, where the waste cannot be separated and utilized Visual impact from improper waste storage	Segregate collection in compliance with the FCCW requirements and proper temporary storage in the temporary waste accumulation area.	Storage in closed containers and disposal on a licensed landfill (the municipal landfill of OOO Spetsavto or the landfill of OOO INK in Verkhnemarkovo).
Food waste from kitchens and catering facilities	Health impact on personnel and community due to attraction of vermin and pests (rodents, birds, insects), and development of pathogenic micro-organisms. Visual impact from improper waste storage	Segregate collection in compliance with the FCCW requirements and proper temporary storage in closed containers in the temporary waste accumulation area.	Storage in closed containers and regular removal for disposal at a licensed landfill (the municipal landfill of OOO Spetsavto or the landfill of OOO INK in Verkhnemarkovo).

Waste type	Potential impact	Method of management / storage	Method of disposal
Plastic	Landfilling, where the waste cannot be separated and utilized Visual impact from improper waste storage	Segregate collection in compliance with the FCCW requirements and proper temporary storage in the temporary waste accumulation area.	Removal to contractor's recycling facilities.
Drums, tanks, and containers used for non-hazardous materials	Landfilling, where the waste cannot be separated and utilized Visual impact from improper waste storage	Segregate collection in compliance with the FCCW requirements and proper temporary storage in the temporary waste accumulation area.	Removal to contractor's recycling facilities.
Septic sludge	Landfilling, where the waste cannot be separated and utilized Health impact on personnel and community due to toxic properties and development of pathogenic micro-organisms.	Collection at source, in leak-tight vessels	Regular removal to biological treatment facility by specialized vehicles
Hazardous waste			
Spent batteries	Contamination of the environment with hazardous substances Health impact on personnel and community due to toxic and corrosive properties Landfilling, where the waste cannot be separated and utilized	Segregate collection in compliance with the FCCW requirements and proper temporary storage in the temporary waste accumulation area.	Possible recovery and reuse is to be considered in detail. Removal to contractor for disposal or recycling. If reuse is unfeasible, transfer for neutralization to adequately licensed contractor
Fuels and lubricants	Contamination of the environment with hazardous substances Risk of fire Landfilling, where the waste cannot be separated and utilized	The waste is subject to segregate collection within a bunded area dedicated for the temporary accumulation of liquid waste, in adequately marked containers.	Recovery and reuse alternatives shall be considered. If recovery or reuse is unfeasible, transfer for neutralization to adequately licensed contractor.

Waste type	Potential impact	Method of management / storage	Method of disposal
Oily rags	Contamination of the environment with hazardous substances Risk of fire Landfilling, where the waste cannot be separated and utilized	Segregate collection in compliance with the FCCW requirements and proper temporary storage in the temporary waste accumulation area.	Removal by a licensed contractor for neutralization.
Waste paintwork materials	Contamination of the environment with hazardous substances Risk of fire Health impact on personnel and community due to toxic properties Landfilling, where the waste cannot be separated and utilized	Segregate collection in compliance with the FCCW requirements and proper temporary storage in marked vessels within a bunded area dedicated for the temporary accumulation of liquid waste.	Recovery and reuse alternatives shall be considered. If recovery or reuse is unfeasible, transfer for neutralization to adequately licensed contractor.
Spent solvents	Contamination of the environment with hazardous substances Risk of fire Health impact on personnel and community due to toxic properties	Segregate collection in compliance with the FCCW requirements and proper temporary storage in marked vessels within a bunded area dedicated for the temporary accumulation of liquid waste.	Regeneration and reuse, or return to supplier. Where transfer to specialized contractors is unfeasible, incineration in the INK's thermal treatment facilities can be accepted
Waste tyres	Landfilling, where the waste cannot be separated and utilized Visual impact from improper waste storage	Segregate collection in compliance with the FCCW requirements and proper temporary storage in the temporary waste accumulation area.	Removal to recycling contractor.

Waste management. During construction, waste will be collected in dedicated sites to be arranged in compliance with the applicable regulations and transferred for disposal to the existing landfills - municipal landfill in Ust-Kut and MSW landfill of INK at Verkhnemarkovsky OGCF. Hazardous waste will be transferred to licensed contractors for neutralization, recycling or disposal. Septic sludge from temporary sanitary facilities at the construction sites will be removed by specialized transport to biological treatment facilities. Waste containing valuable components landfilling of which is prohibited (waste paper, cardboard and paper packaging, tyres, waste polyethylene and PE packaging, waste glass and glass packaging) will be transferred to specialized contractors for recycling and reuse.

Environmental impact of waste generated at the construction phase (in terms of uncontrolled emissions to air, soil contamination, health impact on personnel and community, visual impact) is expected to be moderate in magnitude, short-term, and largely reversible. The above potential impacts will be controlled through the Waste Management Plans to be further developed by construction contractors.

9.7.3 Waste management at the operation phase

Waste generation

The section provides characteristics of waste that are expected to result from the Project operation, considering the involved feedstock materials and technological processes.

During the IPP operation, waste will be generated by the main and auxiliary processes, namely:

- operation of IPP process units: pyrolysis unit, PE unit, and linear alpha-olefin unit;
- repair activities in maintenance workshops;
- maintenance of vehicles and equipment;
- maintenance of wastewater treatment facilities;
- chemical tests in the chemical laboratories;
- cleaning of hydrocarbon feedstock storage tanks;
- cleaning of site area, storage facilities, garages and parking areas;
- personnel life activities;
- cooking in the canteen;
- operation of the construction shift camp.

Chapter 5 provides lists of feedstock and materials used in the production processes of the operating ethylene and PE units. The Project will use natural gas fuel, and maintenance operations will use the following materials: batteries, paint, oil, POL, detergents, and solvents. Requirements for handling and storage of materials and chemicals that will be used at the Project operation phase are specified in the respective safety data sheets.

The hazardous waste expected at the Project operation phase include spent reagents, catalysts, adsorbents, and POL materials. Packaging waste will be generated in relation to supplies of feed stock and auxiliary materials.

The most hazardous wastes at the Project's operation phase will be wastes of hazard class I (spent mercury-containing ultraviolet lamps of the wastewater disinfection unit) and class II (spent lead accumulators). Waste of hazard class III comprise: spent pyrolysis resin, catalysts, sorbents, POL and antifreeze agent. Wastes of hazard classes I, II and III will account for 53% of the total generated amount, whereas the largest share in this quantity (about 50%) will be contributed by pyrolysis resins (hazard class III) from the quench column of the ethylene unit. The amount of waste of hazard class I is not specified at the moment. The rest will be low-hazard and non-hazardous waste of classes IV and V (municipal solid waste, sweepings, waste from treatment facilities, metal scrap, contaminated soil, packaging waste, broken and waste PE articles, sorbents containing no contaminants).

Potential negative environmental impact of waste management at the operation phase will include the following:

- pollution of the environment (soil, surface and ground water);
- visual impact;

- land acquisition for disposal of waste;
- air emissions from incineration of wastes at thermal destruction facility;
- health impact on personnel and community;
- taking-up the limited capacities of waste disposal facilities;
- deterioration of resource efficiency performance, in case of landfilling and lack of recycling and reuse of valuable components.

Waste generated in the course of operation is subject to temporary accumulation, reuse, recycling, neutralization or disposal in compliance with special procedures so that negative environmental impact is mitigated, and applicable requirements of the national and international standards are met.

Appendix 5 provides detailed information including source processes of each waste, hazard class, properties, planned generation volume, as well as planned management/disposal methods, considering the need to minimize potential adverse environmental, health and safety impacts of waste management.

<u>Waste management</u>

All wastes shall be managed in line with the national regulations of the Russian Federation, standards and guidance documents of international financial institutions, and the best industry practices. The IFC EHS Guidelines for Petroleum-based Polymers Manufacturing (April 2007) provides guidance on best international waste management practice in polymer industry. Also, best industry practice is provided in the EU Reference Document on Best Available Techniques (BAT) in the Production of Polymers (August 2007). The Project will use the existing waste management system of INK.

Segregate collection will be provided for all waste. Management arrangements for the most hazardous wastes which will be routinely generated during the operation activities (waste mercury-containing lamps, waste accumulators, POL) provide for segregate collection and temporary storage in dedicated facilities within the IPP site area, and transfer to specialized contractors for neutralization and disposal. According to Ust-Kut District Administration, local businesses in the district do not offer specialized services for reception and neutralization of spent oil, accumulators and mercury-containing lamps. Therefore, consideration should be given to engaging contractors from other areas. The closest waste contractor is the individual entrepreneur A. V. Mityugin located in the city of Bratsk, operating under license No. 038 00141 dated December 28, 2015. Further, for thermal treatment of waste fuels and lubricants, the INK's own facilities may be used, particularly, the thermal waste neutralization units at the Markovsky and Yaraktinsky OGCFs, and the local incinerator at the wastewater treatment plant. Capacity of the above facilities is sufficient to provide thermal treatment of the concerned wastes in the operation phase.

With reference to the planned process technologies, spent catalysts and sorbets will be generated with significant intervals (once in 3-10 years, during media recharge operations). These materials will be regenerated before discharge and transferred to suppliers (in case of high-value catalysts) or disposed at specialized industrial and municipal solid waste (IMSW) landfill at the Yaraktinsky OGCF (for spent sorbents).

Waste from the pyrolysis unit containing hydrocarbons (pyrolysis resin and coke), from wastewater treatment plant (WWTP) (primary and biological sludge, etc.), as well as oily rags are subject to immediate thermal neutralization in the incinerator to be integrated into the WWTP facilities.

Waste of lower hazard classes will be transferred for recycling and reuse, or otherwise will be disposed at the IMSW landfill of INK at the Yaraktinsky field. It should be noted that landfilling of waste paper, cardboard and paper packaging, tyres, waste polyethylene and PE packaging, waste glass and glass packaging is prohibited in Russia since 2019. Since 2021 the list of items prohibited for disposal at landfills will be extended to include computers and office appliances, accumulators and household appliances, and electric tools. Therefore, the above fractions will be transferred to specialized contractors for recycling and reuse. Pre-treatment/recovery methods should be identified for plastic scrap, after which recovered polymer materials can be sold as off-spec products. MSW, sweepings and other waste of hazard classes IV and V will be transferred for disposal to the IMSW landfill. The Company will practice MSW sorting starting from year 2024, for recovery and reuse of valuable components.

Waste transportation will be provided by licensed contractors or by INK, using specialized vehicles, in accordance with valid license No.038 00194 of 05.04.2016 for collection, transportation, treatment, recycling, neutralization and disposal of waste of hazard classes I - IV.

Wastes from the Project operation will be transported for disposal to the IMSW landfill which is currently being constructed as a part of the auxiliary facilities for the Yaraktinsky OGCF. The landfill is intended for reception, detoxication and disposal of industrial waste of hazard classes III-V, municipal solid waste of hazard classes IV-V, drilling waste of hazard class IV from the INK Group companies, for reception and detoxication of petroleum-contaminated snow and soil, and for treatment of runoff water from industrial sites. The landfill operations will include preparation of waste material before transfer to recycling: compaction of metal scrap and crushing of tyres. Impact of the landfill operation is not considered as part of the Project.

The waste landfill being constructed by INK will provide sufficient capacity to serve the needs of the Project. Specialized recycling companies shall be identified as consumers of the waste streams with recycling and reuse potential.

Where recycling of certain types of waste is unfeasible, such wastes are subject to volume reduction using the thermal neutralization process, prior to transfer for disposal at the INK's IMSW landfill. Local incinerator at the wastewater treatment facilities on the IPP site will be used for thermal treatment of certain types of waste including spent sorbents (activated carbon and coal powder, petroleum-contaminated coke, pyrolysis resin from the quench column, dewatered sludge from WWTP (excess activated sludge), waste petroleum products recovered at the treatment plant, and oily rags. Estimated total quantity of waste incineration is 3630.4 tpa. This arrangement is intended to minimize the volume of landfilled waste and the cost of its transportation. The main environmental impact of the local incinerator is related to its emissions to air. Mitigation will be provided by an efficient flue gas treatment system including an afterburn chamber, two flue gas cooling scrubbers, and a flue gas treatment system comprising a fabric filter, three dust collecting bells, three treated flue gas chambers, and a discharge system (air impact of the local incinerator is considered in the thematic Section - Assessment of Impact on Atmospheric Air). Ash from the thermal treatment process will be disposed at the IMSW landfill of INK at the Yaraktinsky field.

Overall significance of waste management activities at IPP operation is assessed as moderate. Quantity of high-hazard waste will be small, and most part of generated waste will be of medium or low hazard class. The waste management approaches are selected considering physical/chemical properties and toxicity of specific waste, as well as national regulations and other applicable requirements, to minimise negative impacts of waste management. The design provides for adequate capacities that will be established for collection, transportation, neutralization, recycling and disposal of all waste streams.

9.7.4 *Impact mitigation measures*

In accordance with the requirements stated in the IFC General EHS Guidelines all generated waste (irrespective of the Project phase) shall be collected with segregation to hazardous or non-hazardous waste with account for its feasible reuse, recycling or disposal. The Project will use the existing system of INK for tracking waste transit from generation sources to recycling or disposal destinations.

Russian regulations require that wastes shall be categorized by classes and types starting from their collection and temporary storage, to ensure minimization of waste quantities, as well associated hazards and environmental impact of the Project operation. Combined management of different waste streams is permitted only for the streams which can be jointly transported and disposed of. Other envisaged arrangements provide for the following:

- regular removal of waste from the Company's sites;
- regular checks of serviceability of the waste-generating process equipment;
- keeping records of types of quantities of generated waste;
- drafting a Wastes Generation and Disposal Limits Book and its approval by Rosprirodnadzor authority;
- making agreements for waste management services with specialized licensed contractors;

- transfer of wastewater from the Project sites to the integrated wastewater treatment facilities;
- on-site thermal treatment of pyrolysis resins and coke;
- thermal treatment of oily sludge and biological sludge from wastewater treatment processes.

Collection, accumulation, transportation, treatment, recycling, neutralization and disposal of industrial and domestic waste shall be provided using the methods that ensure environmental and health safety and meet the sanitary standards and other regulatory requirements of the Russian Federation.

The Project will also consider the following requirements of the IFC General EHS Guidelines on waste management:

Non-hazardous waste:

- Waste management planning: identify and characterize all waste streams of the Project and solutions for their final disposal;
- Prevention of waste generation: in the first instance, identify the ways to prevent waste generation;
- Recycling and reuse: identify the ways for waste reuse and recycling using own resources or by contracting licensed companies; and
- Treatment and disposal: where recycling and reuse are unfeasible or impractical, identify appropriate treatment and/or disposal methods for all waste streams.

Hazardous waste:

- Waste storage (accumulation): temporary waste storage (accumulation) system shall be fully elaborated and its design shall be consistent with best industry practice;
- Transportation: all containers designated for removal of waste from the Project sites the offsite shipment shall leak-proof and appropriately marked; their filling shall be supervised by competent and adequately trained personnel of INK;
- Treatment and disposal: where recycling and reuse are unfeasible or impractical, identify appropriate treatment and/or disposal methods for all waste streams, including hazardous waste; and
- Monitoring: waste transit tracking procedures shall be in place. In addition, regular audits of waste management practice and compliance with regulatory requirements shall be conducted throughout the Project lifecycle. Recommendations for the improvement of waste management practice shall be included into routine operating reports.

At the construction phase, the Company will arrange special areas for waste collection and temporary accumulation, some of which can be later on used at the operation phase. The areas will be used for temporary accumulation of materials prior to their removal to waste disposal facilities. They will be equipped to comply with the following requirements:

- separate areas for hazardous and non-hazardous wastes;
- separate containers for each waste stream to ensure segregate collection and maximize reuse and recycling;
- provision of all containers with proper covers (to prevent blowing off of light materials or wetting with precipitation);
- collection of liquid waste in tanks or drums on sites with bunding capacity equal to 110% of the total waste storage capacity, in compliance with national safety requirements;
- provision of spill response kits at liquid waste collection sites;
- hazardous waste accumulation areas shall be located away from existing sensitive receptors, e.g. existing production facilities;
- prevention of theft and vandalisms risks;
- easy and safe access; and
- sufficient ventilation.

9.7.5 Summary

The proposed mitigation measures for accumulation, collection, transportation, recycling, neutralization and disposal of industrial and domestic waste will minimise the residual impact of waste management at the Project construction and operation, so that the residual impact is assessed as low.

Summary of waste management activities and mitigation of their environmental impact at the Project construction and operation is provided in Table 9.7.3. The requirements for monitoring of impacts of waste generation are summarized in Table 9.7.4.

Table 9.7.3: Waste management and impact mitigation summary

Impact	Receptor	Phase	Project solutions and mitigation measures	Residual impact
Waste management facilities	Waste management infrastructure owned by INK MSW landfill at the Markovsky OGCF	Construction	Disposal at landfills with limited capacity is permitted only when all other methods of disposal are impractical Minimization of waste volumes, incl. by treatment, , incineration on TTPs, compaction) Moderate volumes of hazardous waste generationSegregation of hazardous waste by types Catalysts will be regenerated and reused. If regeneration is impractical - sell to third partiesRegular waste collection either by licensed contractors or through own efforts provided that relevant license is in place Recycling of major part of wastes at licensed facilities. Disposal of waste at facilities registered in SRWDS Transfer of waste containing valuable components (PE, cardboard, paper, metal scrap) to licensed contractors for regeneration, recycling and reuse	Low
	IMSW landfill at the Yaraktinsky OGCF	Operation		
Health impact	Personnel, construction workforce	Construction, operation	Segregation of hazardous waste by types. Safe temporary accumulation of waste strictly within designated areas. Hazardous waste accumulation areas shall be located away from existing sensitive receptors, e.g. existing production facilities. Prevention of theft and vandalisms risks. Fitting of waste collection containers with tightly closing lids; all waste storage containers shall always be closed. Washing and treatment with disinfectants of containers and surface under them no less than once in 10 days (except for the winter season). Regular waste collection either by licensed contractors or through own efforts provided that relevant license is in place. Removal of waste with segregation by type to specialized landfills. Preventing presence of unauthorized persons during transportation of waste, except for the escorting personnel of the Company. Waste management training of personnel. Control of vermin (rodents, insects, birds) at waste disposal sites through timely eliminating waste which serves as their feeding source.	Low

Impact	Receptor	Phase	Project solutions and mitigation measures	Residual impact
			As needed, conducting deratization (e.g. mouse traps) around kitchens and catering facilities. Provision of portable toilets and removal of waste by specialized vehicles to wastewater treatment plant.	
Environmental impact	Surface and ground water	Construction, operation	Hard paving of roads using materials resistant to petroleum products. Collection of liquid waste from occasional spills during transportation. Inspecting containers prior to waste transportation, to avoid dusting, spills and other losses along the route. Equipping temporary waste accumulation sites with adequately marked steel and plastic containers with lids, leak-proof bags, etc. Provision of spill response kits at liquid waste collection sites Asphalt or concrete paving under containers and 1.0-1.2 m fencing on three sides to prevent litter spread onto adjoining area. Collection of liquid waste in tanks or drums on sites with bunding capacity equal to 110% of the total waste storage capacity Provision of access drive- and walkways to each temporary waste accumulation area.	Insignificant
Environmental impact	Atmospheric air	Construction	Concentrated cement waste can be crushed/ground and used in as bulk additive for road construction. Cement-contaminated soil can be used as a covering material at waste landfills. Any unused cement will be returned to supplier	Insignificant
		Construction, operation	Waste disposal sites closest to the Project facilities will be selected to minimise waste transportation distance. Waste will be transported by special vehicles of INK or by a waste treatment, recycling or disposal company. Transportation of waste by dump trucks with tarpaulin top wetted to prevent dusting. Containers will be inspected prior to waste transportation, to avoid dusting, spills and other losses along the route.	Not significant
		Operation	Emission sources at the local incinerator will be provided with flue gas treatment systems.	Low

Impact	Receptor	Phase	Project solutions and mitigation measures	Residual impact
Environmental impact	Terrestrial fauna	Construction, operation	Elimination of feed sources for rodents through secure temporary storage of food waste in closed containers in dedicated areas, regular collection and removal either by licensed contractors or by own efforts provided that relevant license and special vehicles are available Collection of liquid domestic waste (septic sludge) in special containers and timely removal to wastewater treatment plant by special vehicles	Not significant
Environmental impact	Environment (general)	Construction, operation	Appointment of personnel responsible for waste management at each site of the Amur GPP. Timely training of personnel responsible for waste management. Development of waste management procedures within the scope of design documentation / WGDLB. Segregate collection of hazardous waste. Monitoring for timely accumulation, collection and removal of all types of wastes. Timely signing of agreements for waste transportation, treatment and disposal services with licensed operators of facilities listed in the SRWDS. Transportation of hazardous waste only subject to having a hazardous waste certificate, by vehicles specially equipped and provided with special signs, subject to observing safety requirements for the transportation of dangerous goods.	Not significant

Table 9.7.4: Summary requirements for waste generation impact monitoring

Aspect	Phase	Location	Parameter	Regularity
Industrial and domestic wastes	Throughout the entire Project	Temporary waste storage (accumulation) areas	Verification of compliance of waste collection, accumulation and storage conditions with environmental, sanitary and epidemiological, and fire safety requirements; Keeping records of waste quantities (volumes) by types and hazard classes; Keeping records of presence or absence of any waste outside the temporary accumulation areas; Keeping records of types and quantities of any waste found outside the temporary accumulation areas.	Progressively as waste is generated and accumulated but no less than once a month.

9.8 Efficient Use of Resources

During the Project implementation, the Company will apply approaches and methods based on rational resource use, energy efficiency and environmental pollution prevention/minimization in the context of environmental and technological expediency. Such approaches and methods are considered in the course of the project documentation development for the PPF in terms of the Company's obligations and commitments and international requirements (Chapter 2 of the ESIA Report), Project specifics, and particular features of the baseline environment conditions, potential negative impacts, risks and hazards identified by the ESIA. The project documentation of the PPF is prepared in compliance with provisions of Federal Law No. 261 "On Energy Saving and Energy Efficiency Improvement"[254]. Pursuant to it, requirements and possible applicable technological solutions for improving energy efficiency shall be identified for each construction project and appropriate measures, including managerial, shall be developed.

At large, rational and efficient resource use will be achieved by preventing energy and materials losses through application of effective management approaches at all Project phases, implementation of the continuous improvement principle, and use of best industry practice, best available technologies and high-end equipment.

INK is implementing elements of the energy management systems, including annual energy performance review at the corporate level. Continuous efforts are applied to increase oil recovery, specific measures and performance indicators are developed.

The Project-level governance measures to ensure efficient use of resource and minimisation of negative impact will be implemented within the scope of the existing corporate Environmental Management System (Chapter 14 of the ESIA Report), including development and implementation the Environmental and Social Action Plan, Environmental and Social Management Plans for the construction and operation phases, particularly the Waste Management Plan, and other sector-specific management plans to be developed as far as a need for them is identified. To supplement these, efficient resource use actions to cover feedstock, power and water will be implemented. These are described as the planned designed solutions in Chapter 5. Impact prevention and mitigation measures intended to minimize the drift of feedstock materials to waste are discussed in a few sections of Chapter 9 herein.

The Irkutsk Polymer Plant project is the third phase of INK Gas Business Development Programme, which has its main focus on more efficient processing of produced crude hydrocarbons; therefore, it can be assumed that the Project main goal is a more efficient use of natural resources. Among the main resource-efficiency measures is utilisation of the available reserves of oil and gas by-products (natural and associated petroleum gas), which are currently reinjected into formation or flared, as a feedstock for production of an end product (polyolefins). Also, the synthesis of polyolefins from NG and APG is a more environment-friendly technology as compared to polymer production from petroleum refining products. The process chain at the designed IPP is organized in such a manner that the product of one production unit is both a commercial product and a feedstock for other production units, which implies value-added processing of the original raw material.

A boiler house will be constructed for production of steam, hot water and specially treated water for on-site needs of PPF (refer to Chapter 5 herein). Excess heat from operating process equipment will be recuperated. The boiler house is designed for operation using natural gas as the main fuel and ethane as backup fuel. Construction of the boiler house will reduce the potential load on power grid and district heating networks in the Project area and minimize energy losses during transportation. The described approach to energy generation will dampen potential increase of greenhouse gas emissions in the Project area through implementation of efficient modern equipment.

The preferred plant site location has been selected considering the optimal relative positions of other components of INK gas facilities, the railway and the Lena River (the main source of process water supply and the treated wastewater recipient). Such disposition will ensure minimization of land acquisition for

[254] Federal Law "On Energy Saving and Energy Efficiency Improvement and on Amendments to Certain Legal Acts of the Russian Federation" of 23.11.2009 # 261-FZ (rev. of 03.07.2016)

construction of the linear infrastructure facilities (access roads, pipelines, etc.), reduce materials consumption for construction, as well as transportation costs.

Process water supply of Project's assets will be arranged as a closed-loop system. It will significantly decrease the raw water intake, improve efficiency of its use, and reduce the overall load on the water body. Process water supply systems will be replenished with the Lena River water after appropriate treatment. The drainage system is designed to have two or three circuits for separate collection and disposal of different wastewater flows, which will enable the most efficient wastewater management and treatment.

Generally, the designed Irkutsk Polymer Plant will be a high-tech facility that will meet both Russian and international standards and employ modern resource- and energy-efficient technologies and solutions in construction and operation. The main designer for the PPF project is Toyo Engineering Corporation, and UNIPOL™ process by Univation Technologies has been selected as the main PE production technology.

9.9 Climate Change Risk Assessment

9.9.1 Risk assessment approach

In 2017, extreme weather events for the first time appeared at the top of the global risks list presented at the World Economic Forum[255], following a decade of steady growth of the weather and climate risks significance rating. In the WEF Report 2019, the top two lines in the list were already presented by risks of "extreme weather events" and "failure of climate-change mitigation and adaptation".[256]

The global climate changes and their manifestation in the Russian Federation is documented and expressed in the form of extreme weather events and long-term changes of climate conditions[257]. The related risks and opportunities need to be identified and managed in appropriate way to avoid loss and damage to the Project facilities, its infrastructure and associated facilities, and potential harm to workforce or local community. Therefore, planning and implementation of the technologically and technically complex Project shall be managed with allowance for the climate changes in the Irkutsk Region and potential extreme events, to ensure long-term climate resilience and minimisation of risks during construction and operation.

This section identifies the relevant existing variations to climate conditions that should be accounted for as Project risks. The climate baseline and trends have been considered using the key climate variables in the region, as well as available research publications and reports with analysis of long-term existing and predicted climate trends.

As a baseline, the observational climate data were considered for the medium- and long-term periods of time (refer to Section 9.9.2, Figure 9.9.1), using the information from international and Russian data bases:

- 1960(1961)-1997(2018) - Ust-Kut weather station (nearest to the Project) and
- 1961-2018 - Kirensk weather station (the longest available continuous data set in the vicinity of the Project area).

The following limitations must be taken into account when using the results of this review:

- **The baseline information and observation records** have been reviewed using the medium- and long-term data on air temperature (annual average and extreme minimum and maximum), precipitation and wind velocity, extreme climate events at the selected weather station during the selected time period. The long-term trends (normalized for 1961-1990) are based on the climate change analysis in the reports of the Federal Service for Hydrometeorology and Environmental Monitoring of the Russian Federation (Roshydromet) dated 2014-2018 and research publications. In this way, overall trends of climate changes have been identified.
- **The future projections** review considered the Roshydromet reports on climate risks and climate conditions (2018) and recent research publications, as well as simulations of future climate based on likely economic development scenarios and assumptions using the climate models. Therefore, the model outputs should be treated as projection options rather than factual values. They are generated as series of internally consistent probability-based climate characteristics which can be achieved in response to a range of potential forcing scenarios.
- **Climate change risks minimization**: Considering the fairly high uncertainty of the climate projections, the Consultant's experts prepared recommendations for the Project risks minimization and adaptation measures with reference to average predicted values and where possible to potential climate change trends at the regional and local level. Accordingly, any further research, data analysis or decision-making should take account of the probability-based

[255] http://reports.weforum.org/global-risks-2017/

[256] http://www3.weforum.org/docs/WEF_Global_Risks_Report_2019.pdf

[257] Report on climate conditions in the Russian Federation in 2018. Roshydromet. - Moscow 2019. - 79 pp.

nature of the climate projections and should consider the available up-to-date observations data, research materials and additional studies.

9.9.2 Baseline climate knowledge

The baseline climate conditions in the Project area have been reviewed using the observation data from the weather stations in Ust-Kut and Kirensk for the medium- and long-term periods of 1960(1961)-1997 and 1961-2018. Priority was given to the data from Ust-Kut weather stations, and in case of significant gaps in the data set, records from the Kirensk station were used. Due to relatively remote location of the Kirensk weather station (177 km from Ust-Kut), though with very similar climate conditions, its data have been used for the analysis with due regard to comparison of trends at the level of the Irkutsk region. The observational data was obtained from the international and Russian meteorological databases TuTiempo.net and rp5[258,259,260,261].

Locations of the weather stations nearest to the Project sites are shown in Figure 9.9.1.

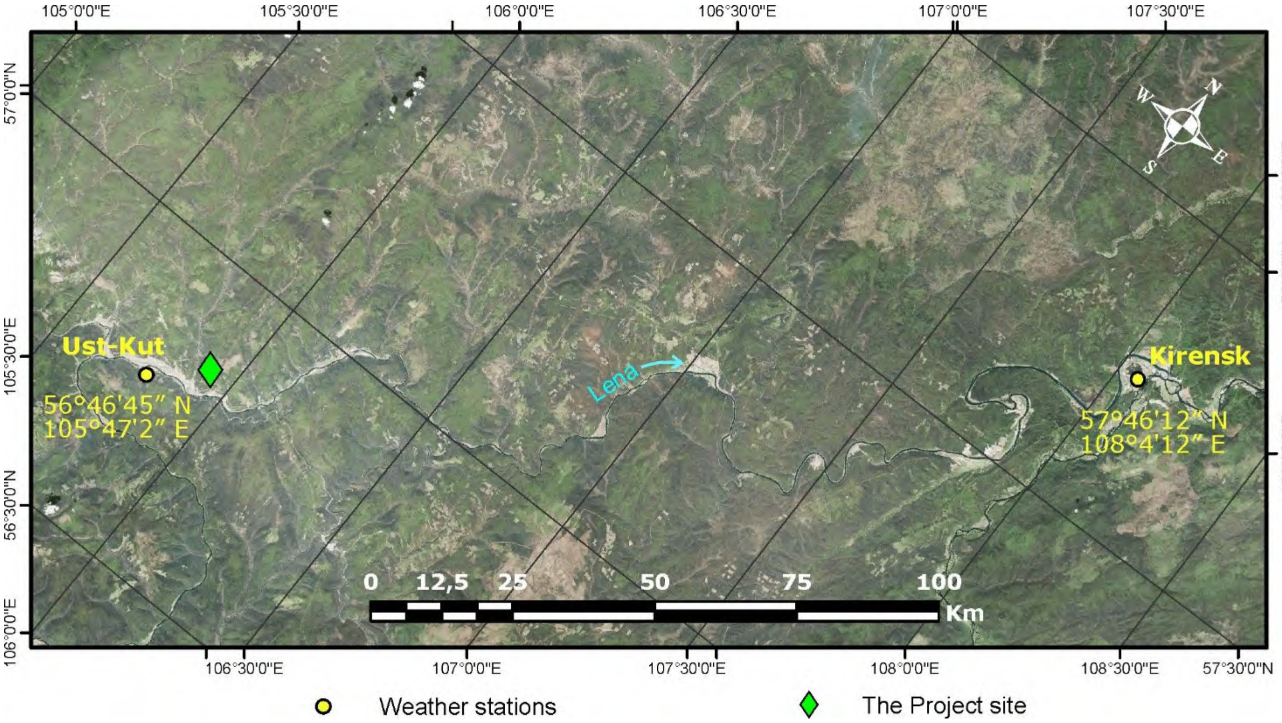

Figure 9.9.1: Location of weather stations in the Project area

9.9.3 Climate change overview

9.9.3.1 Temperature

The climate warming (both at the average annual level and during specific seasons) has been reported in Russia over the past decades, with few exceptions in winter and summer seasons in certain regions. According to the Roshydromet and RAS Institute of Global Climate and Ecology, the medium growth rate of average annual temperature in the territory of Russia during the period 1976-2018 was 0.47°C/ 10 years. Such pace is by 2.5 times faster than global temperature growth over the same period: 0.17-0.18°C / 10 years, and by more than 1.5 times faster than average warming rate of

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258 Climate Ust-Kut, climate data: 1953 – 2000 The weather station 303200 // Online publication at the Tutiempo Network web-site https://en.tutiempo.net/climate/ws-303200.html

259 Climate Kirensk, climate data: 1934 – 2019 The weather station 302300 // Online publication at the Tutiempo Network web-site https://en.tutiempo.net/climate/ws-302300.html

260 Ust-Kut weather data archive. Weather station (WMO ID) 30323 // Online publication at the website of Raspisaniye Pogody, LLC https://rp5.ru/Архив_погоды_в_Усть-Куте

261 Kirensk weather data archive. Weather station (WMO ID) 30230 // Online publication at the website of Raspisaniye Pogody, LLC https://rp5.ru/Архив_погоды_в_Киренске

ground level air temperature in the terrestrial parts of the globe: 0.28-0.29°C / 10 years (estimations based on data from the Hadley Centre and the East Anglia University: Had – CRU UEA; NOAA).[262]

Globally, year 2018 was the fourth warmest year over the whole period of instrumental observations that started in the second half of 19th century. According to Had – CRU UEA, the global average annual temperature (over terrestrial and ocean areas) exceeded the mean temperature over the period 1961-1990 by 0.595°C (by 0.662°C according to NOAA).

Year 2018 was warm also in Russia: the average annual temperature was by 1.58°C higher than normal level over the period 1961-1990, which is the ninth highest result observed since 1936. A number of major climatic anomalies were reported in the same year including the most significant one - the abnormally warm autumn with the mean temperature in the whole territory of Russia by 2.32°C higher than normal (the second highest level over the observations period).

In the Siberian Federal District (SFD), year 2018 was warm too: the average annual temperature was reportedly higher than normal by 1.3°C, and the autumn was the warmest season that year. Considering the physiographic zones, in Cisbaikalia and Transbaikalia the average annual anomaly was slightly higher than Russia's mean one (1.72°C vs. 1.58°C; and ~1.5°C in the Project area), and the seasonal anomaly in the spring was significantly greater (2.35°C vs. 0.81°C).

Assessment of the average temperature development rate is based on the linear trend coefficient over the observation period of 1976-2018. Year 1976 was selected as the starting point for recent warming measurement against the global temperature curve. The warming process continues throughout Russia, at the average annual level and during all seasons except winter (minor cooling is reported in a region in the south of Russia). Russia's mean average annual temperature has been growing at the rate of 0.47°C / 10 years, where the fastest growth is reported in spring (0.61°C / 10 years). Average annual temperatures are increasing in all physiographic regions and federal districts of Russia.

The regional trends assessed using the time series of spatially averaged temperature anomalies over the same period demonstrate a slower growth of average annual temperature in Cisbaikalia and Transbaikalia – 0.38°C / 10 years, almost slowest among Russia's regions in autumn and winter – 0.2°C and 0.25°C per 10 years, and a relatively high growth in spring - 0.62°C / 10 years.

According to the monitoring data from the Ust-Kut weather station for the period 1961-2018, average annual temperature varied within the range from -4.9°C (in 1969) to -0.2°C (in 2005 and 2007) (Figure 9.9.2).

The annual average maximum temperatures reported at the Kirensk weather station varied from -0.1°C in 1966 to 5.2°C in 2015, annual average minimum temperatures – from -14.1°C in 1966 to -8.4°C in 2015 (Figures 9.9.3 and 9.9.4).

[262] This sub-section is prepared on the basis of Reports on climate conditions in the Russian Federation over the period 2014-2018 (Roshydromet)

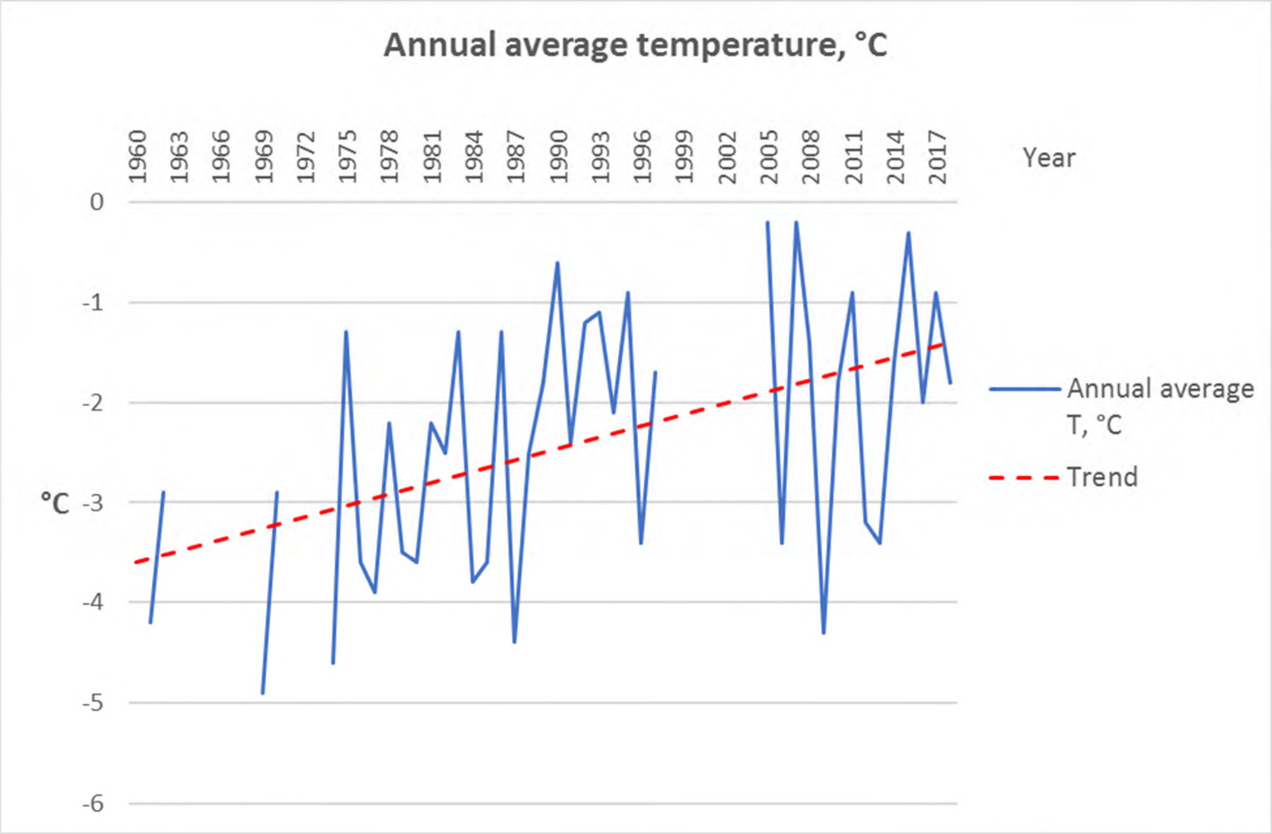

Figure 9.9.2: Average annual temperatures in 1961-2018, Ust-Kut Weather Station

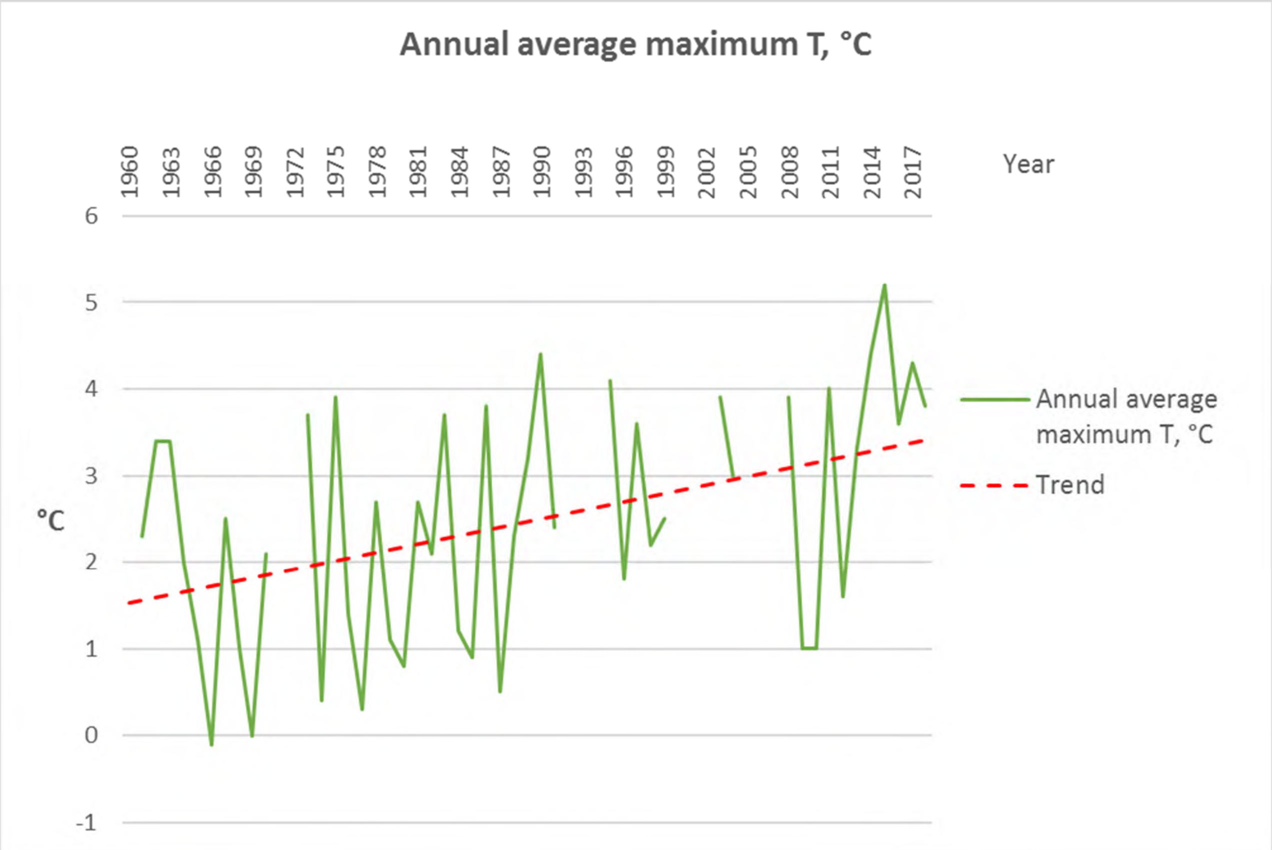

Figure 9.9.3: Annual average maximum temperature for years 1961-2018, Kirensk Weather Station

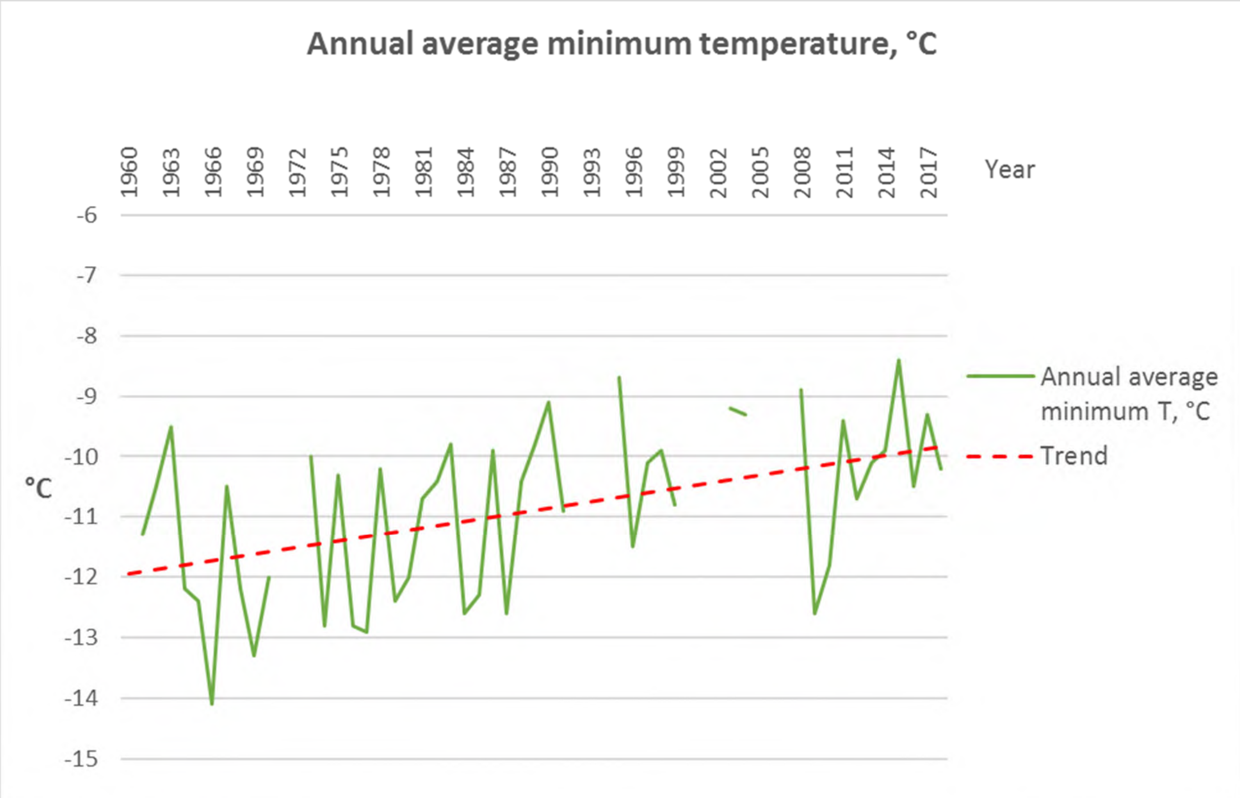

Figure 9.9.4: Annual average minimum temperature for years 1961-2018, Kirensk Weather Station

The extreme maximum temperatures reported at the Ust-Kut weather station during the same period varied from 29°C in 1973 and 2012 to 36.9°C in 1997, the extreme minimum temperatures – from -50°C in 1060 to -30°C in 1973 and 1977 (Figures 9.9.5 and 9.9.6).

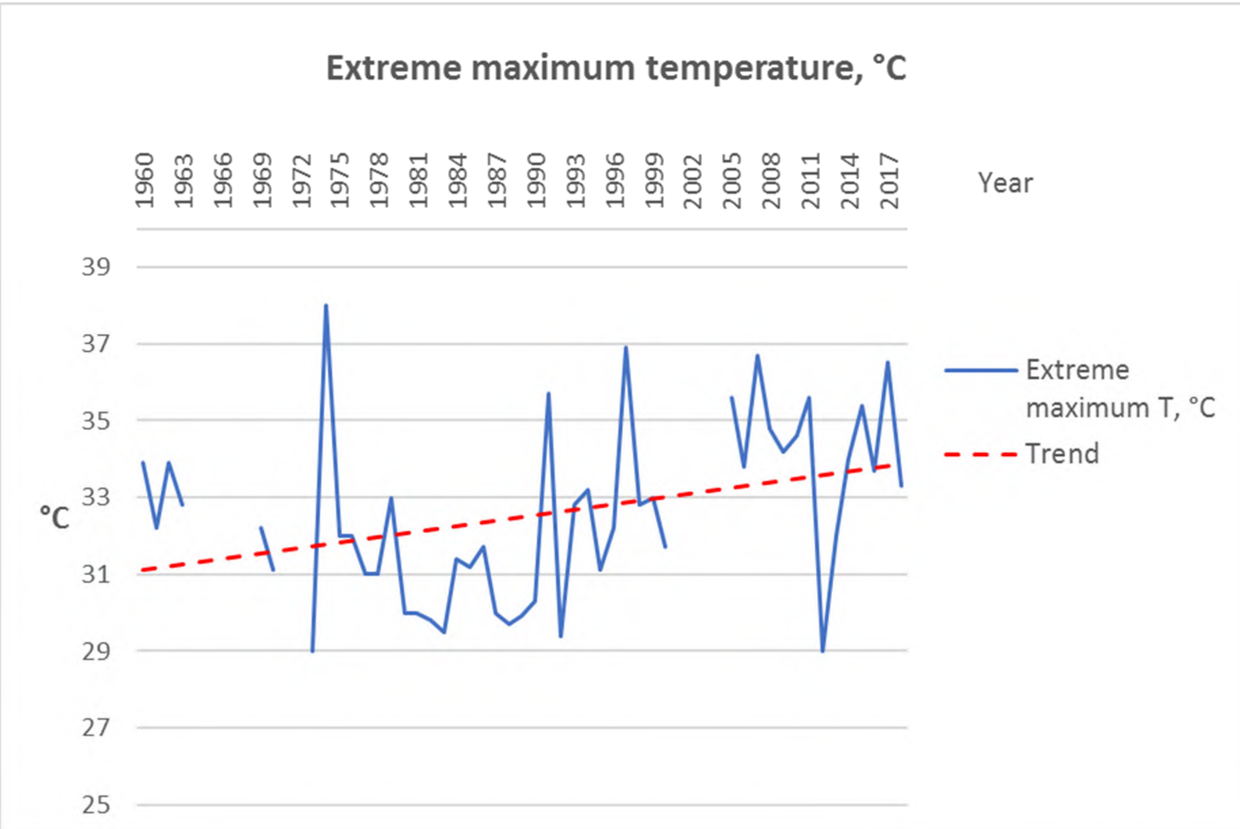

Figure 9.9.5: Extreme maximum temperatures reported by the Ust-Kut weather station, 1960-2018

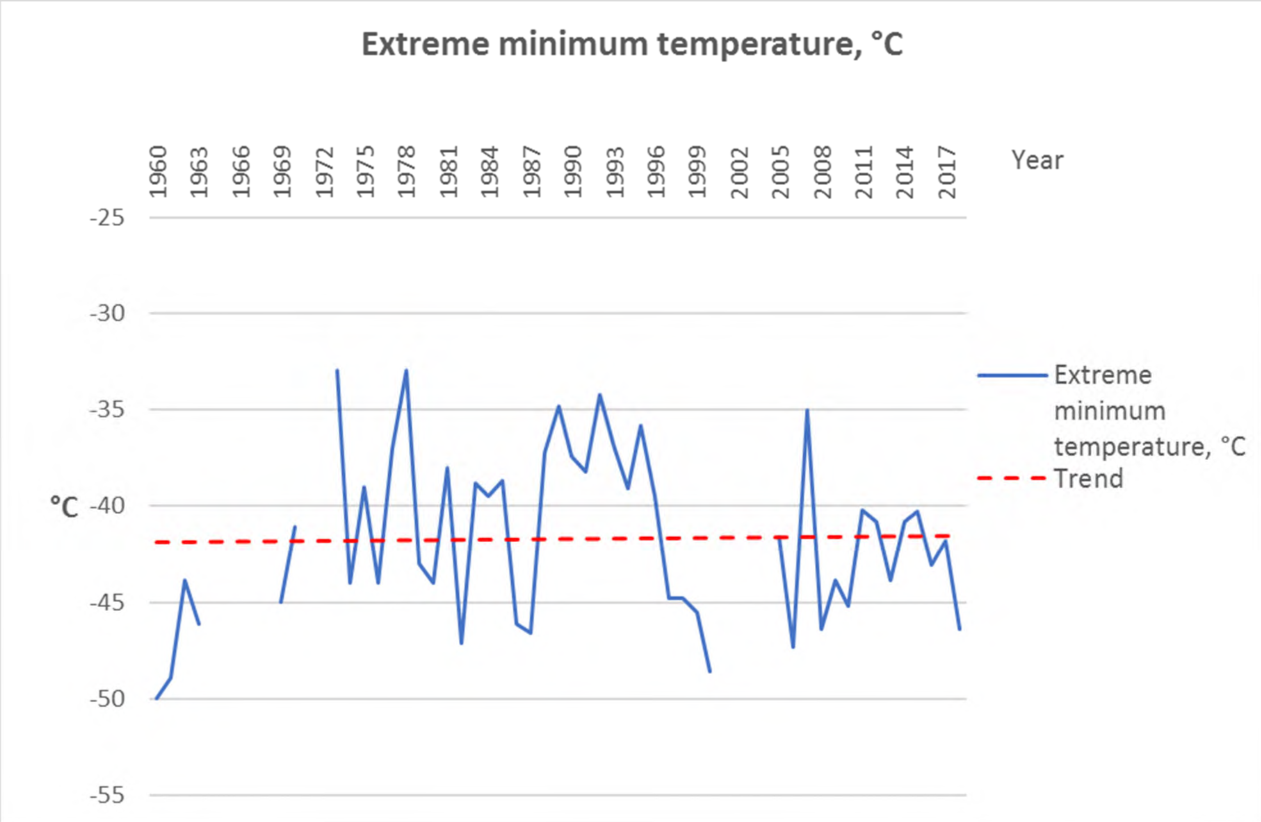

Figure 9.9.6: Extreme minimum temperatures reported by the Ust-Kut weather station, 1960-2018

During the past half-century (1960-2018) an overall trend towards meaningful growth of average annual temperatures is demonstrated the Project area, at a slightly slower rate than the Russia's average one (~0.38°C / 10 years), with the linear growth trend of annual average maximum and minimum temperatures (0.34-0.36°C / 10) and a rise of extreme maximum temperature by ~3°C over past 58 years. Besides that, the extreme minimum temperature changed at a significantly less extent – <1°C over the same period.

The observable growth trend of average annual temperature reported in the Project area is slightly slower than the overall trend in Russia which is 2.5 times greater than the global one. The reported annual average maximum and minimum temperatures are also increasing.

9.9.3.2 Precipitation

The changes also affected annual precipitation. At the country level, the annual precipitation quantity has been growing during the period 1976–2018 (by 2.2% of the normal quantity per 10 years, with a slight growth trend), mainly due to the growth of precipitation in spring at the rate of 5.9% of the normal quantity per 10 years.

In year 2018 reported precipitation in Russia was 104% of the normal quantity. Along with the increase in spring precipitation, a decline in summer precipitation quantity is reported in European part of Russia, and increase of the same in Siberia and the Russian Far East. The reported annual total precipitation in Cisbaikalia and Transbaikalia was 114% of the normal quantity, with a peak in winter (144% of normal winter precipitation).

Analysis of the linear trends of seasonal and annual precipitation in Cisbaikalia and Transbaikalia over the period 1976-2018 indicates a minor but statistically significant long-term growth trend at the average rate of about 1.2 mm / 10 years (4.8 mm / 10 years in winter, which is twofold faster than Russia's mean seasonal trend). The regional precipitation distribution during the year has higher (winter) and lower (spring) extremums.

According to the monitoring data from the Kirensk weather station over the period 1973-2018, annual precipitation varied from 291 mm (2014) to 990 mm (2015) (Figure 9.9.7), with significant variations between years. The local precipitation trend is slightly negative (statistically insignificant).

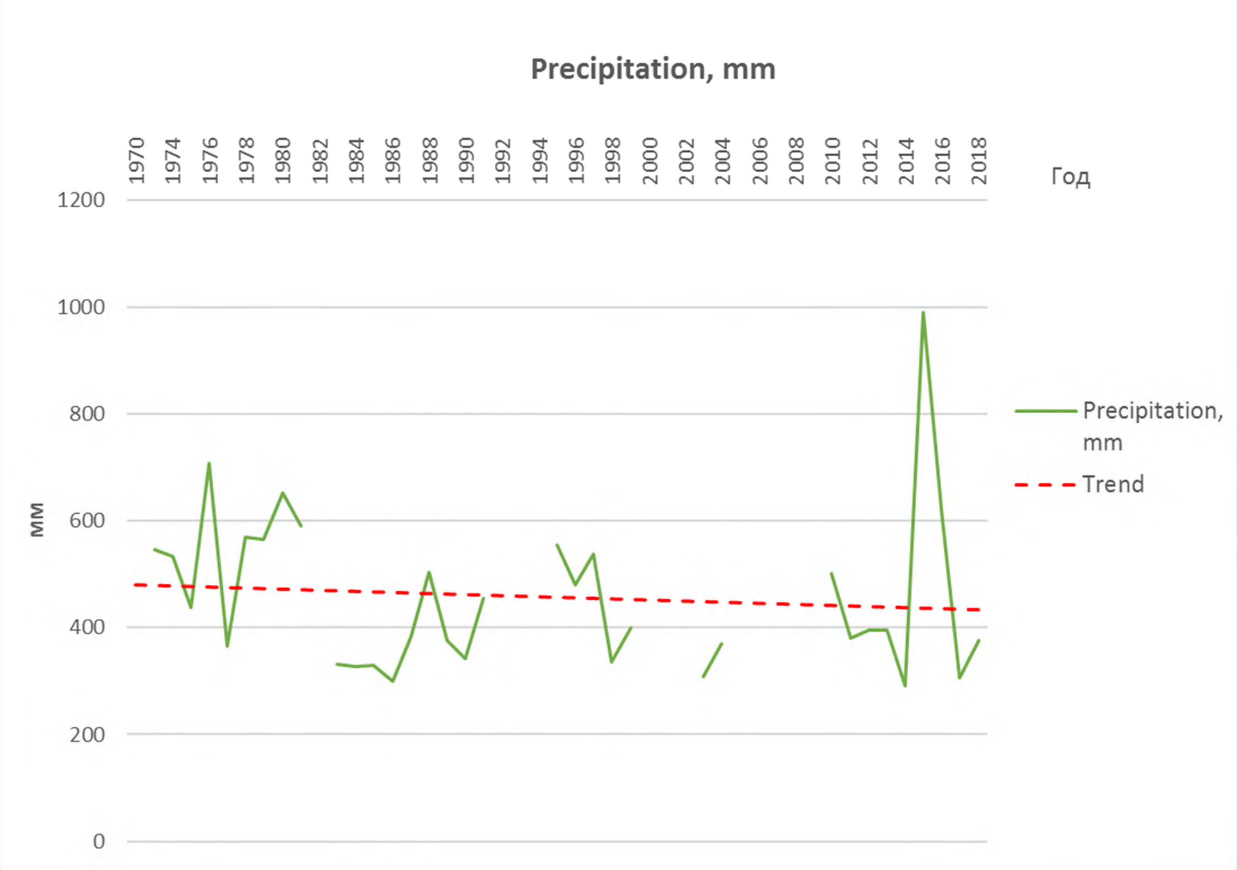

Figure 9.9.7: Annual precipitation 1973-2018, Kirensk Weather Station

During the cold season, the climatic conditions in Cisbaikalia are dependent on the influence of the Asiatic anticyclone associated with intrusion of cold Arctic air masses moving southwards from the Kara sea or from the central part of the Arctic region. During the warm season the air circulation conditions are substantially different due to the fact that the huge territory of Asia is warmed to a significant degree and atmospheric air pressure decreases. A high amplitude of the ambient air temperature variations in the Arctic zone and the warm air masses above the continent facilitate development of cyclonic activity in the north of the territory. Formation of cyclones is especially likely during the second half of summer, i.e. during the period of the maximum annual air temperature.

According to the data from the Kirensk weather station over the period 1961-2018, the long-term average number of days with rains is 81 (Figure 9.9.8; the data series is statistically non-credible). The long-term average number of days with snow cover reported by the same weather station is 146.

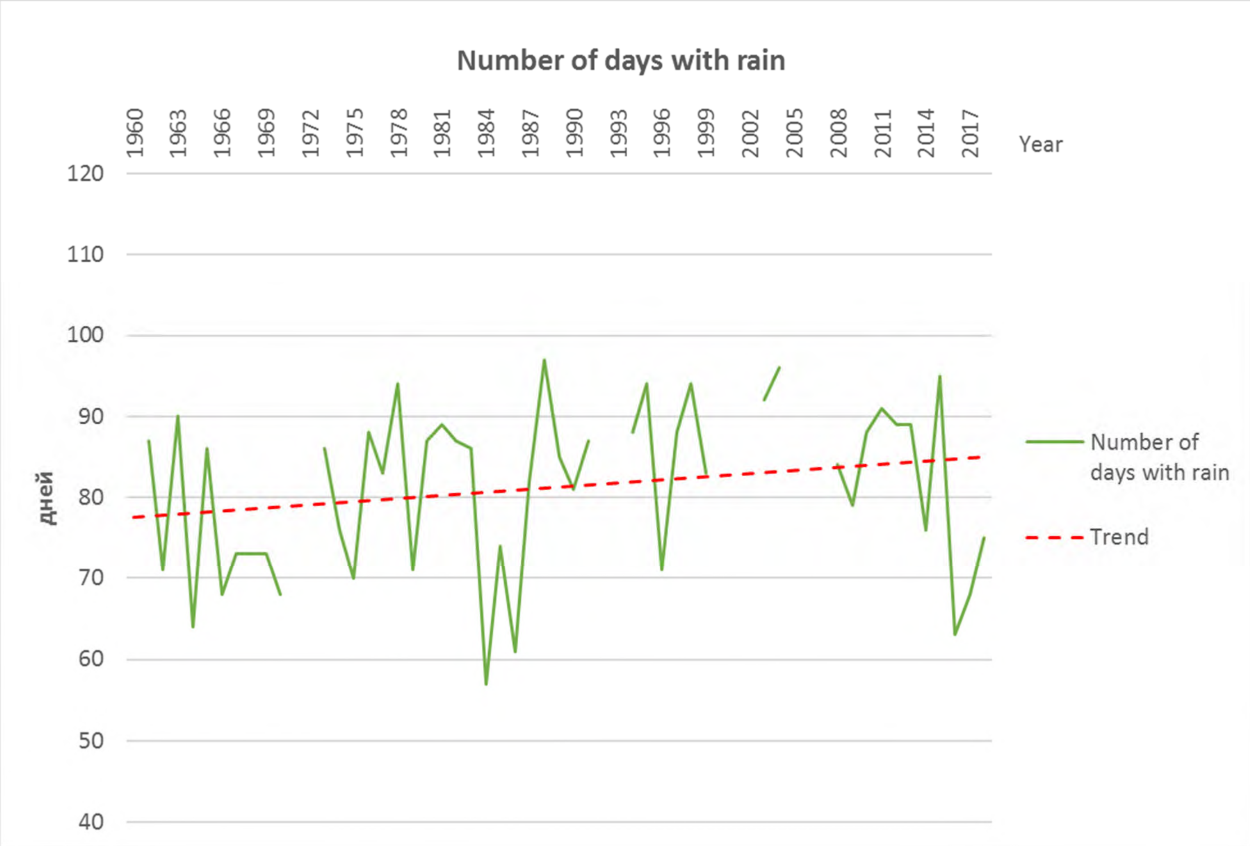

Figure 9.9.8: Number of days with rain in years 1961-2018, Kirensk Weather Station

Duration of period with snow cover has been reducing in many parts of Russia, but in winter 2017-2018 this period was in average shorter than normal, by 1.32 days only. On the other hand, the maximum snow cover depth was in average more than 11 cm, i.e. more than a climatic norm and the highest since 1967.

In winter 2017-2018 snow cover appeared earlier than normal in most parts of Western Siberia, Krasnoyarsk Krai, in *Irkutsk* and Amur Regions, south of Yakutia, and in the north of Kamchatsky Krai. Snow cover disappeared earlier than normal in the north and south-west of Yakutia, *Irkutsk* and Amur Regions, and in Zabaykalsky Krai.

9.9.3.3 Extreme climate events and wind conditions

The observation data demonstrate the global growth of damage caused by dangerous weather and climate events where 90% of most severe economic losses are due to extreme hydrometeorological events like floods, highwater, strong wind, rainstorms, hailstorms, droughts. The IPCC research reports always refer to the growth of extreme and dangerous events during the climate warming period; this trend is also reported in Russia.

The total number of extreme hydrometeorological events (extreme weather events - EWEs) is monitored in Russia since 2008. According to Roshydromet, the total number of EWEs reported in Russia in 2018 is 1040 (including agrometeorological and hydrological), i.e. by 133 events more than in 2017 (refer to Table 9.1.1 below). 465 of the EWEs reported in 2018 caused significant damage to economy and communities.

Table 9.9.1: Annual total numbers of EWE reported over ten years

Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Total EWE number	1090	923	972	760	987	963	898	973	988	907	1040

During the period 1990-2000[263] Russia reported 150-200 damaging hydrometeorological EWEs every year. Then the number increased to 250-300 events per year, and starting from 2007 more than 400 EWEs with damages have been reported every second year, on average (Figure 9.9.9). Besides that, the EWEs reported during two past decades were more intensive and destractive than ever.

Last year was the third worst year over the past 23-year period in terms of the number of extreme weather events that caused significant damage to economy and communities: 465 EWEs (the maximum number of 469 EWEs was reported in 2012). 20 emergency EWEs occurred in 2018. Most EWEs happened during warm period (May - September), due to the seasonal activation of convection processes in all regions of Russia.

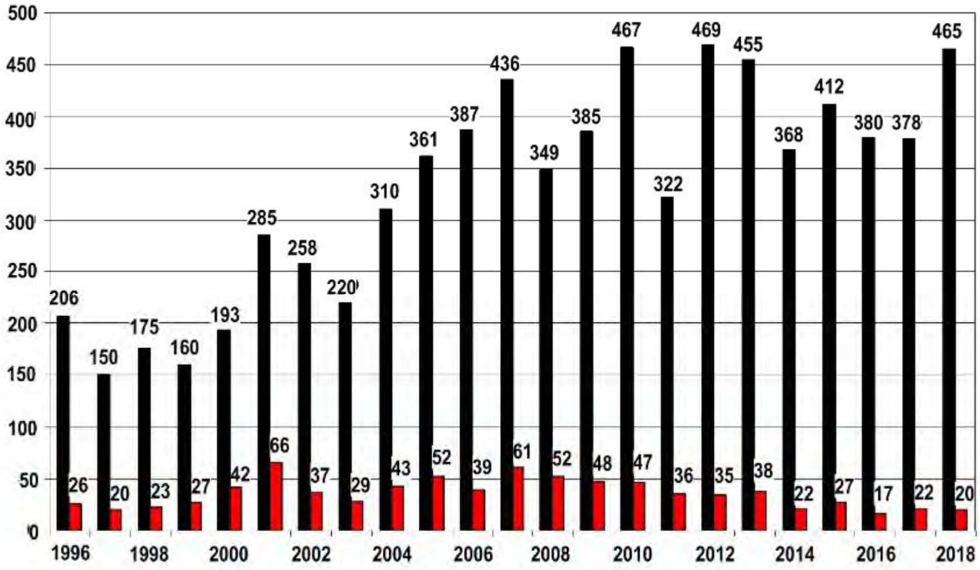

Figure 9.9.9: Annual number of extreme weather events with damage: total number (black) and emergency EWEs (red)[264]

According to the observation data for the period 1991-2015, 73% of the total number of EWEs occurred during April-October, in 2006-2010 – 73.8%, in 2011-2015 – 78%. It is expected that the growth trend of the proportion of EWEs during warm season will continue in the next decade.

The most severe damage in 2018 was caused by heavy precipitation (snow, rain, showers), high wind (including squall), hailstorms, as well as blizzards and abnormally cold weather in winter, and high level of fire hazard that affected multiple regions and lasted for several months.

The total number of meteorological EWEs and combinations of weather events (CWEs) reported in Russia in 2018 is 580. This was the second largest annual number of EWEs and CWEs over past 21 years.

Table 9.9.2 shows distribution of meteorological EWEs and CWEs by months and Federal Districts of Russia. All extreme weather events in the Russian Federation are included regardless of reported damage. The data shows that Sibirsky Federal District is the country's leading area in terms of the number of reported meteorological EWEs during 2017-2018, where the most common events were heavy precipitation, high wind, frost and combinations of EWEs.

[263] Report on the Climate Risks at the territory of the Russian Federation, Roshydromet. - Saint Petersburg, 2017

[264] Report on climate conditions in the Russian Federation, Roshydromet. – Moscow, 2018

Table 9.9.2: Meteorological EWE split out by Federal Districts, 2018

No	Event	Federal District								
		NWFD	CFD	PFD	SoFD	NCFD	UFD	*SiFD*	FEFD	Total
1	Strong wind	5	3	18	11	7	13	***55***	17	129
2	Heavy precipitation	1	11	8	38	24	11	***21***	23	137
3	Blizzards and heavy snow	1	3	2	-	1	2	***6***	13	28
4	Mixed precipitation	-	-	-	2	1	-	***1***	3	7
5	Tornado	-	-	-	1	-	-	***-***	-	1
6	Severe frost	-	-	1	-	-	3	***5***	-	9
7	Abnormally cold weather	3	1	2	-	-	4	***4***	-	14
8	Severe heat	-	9	2	4	4	-	***3***	-	22
9	Abnormally hot weather	2	2	-	2	-	1	***3***	1	11
10	Hail	-	-	4	7	5	1	***3***	-	20
11	Glaze	1	1	3	4	3	3	***1***	4	20
13	Frost	9	19	15	11	3	17	***10***	4	88
14	Fog	-	-	-	-	-	-	***-***	1	1
16	EWE and CWE	1	6	6	16	12	-	***39***	13	93
Total in 2018		*23*	*38*	*61*	*96*	*60*	*55*	***151***	79	*580*
Total in 2017		*30*	*38*	*67*	*91*	*50*	*42*	***146***	89	*553*

According to observation data from the Kirensk weather station, the long-term wind velocity over the period 1961-2013 is 6.5 km/h, with an overall increase trend at ~1 km/h during the same period. The average annual number of days with thunderstorms during the period 1961-2013 is 10.9 and demonstrates the rising trend of 0.61 days / 10 years. The number of thunderstorm events is increasing.

It should be noted that major part of the most severe economic losses worldwide is not attributed to natural phenomena like volcanic eruptions, seismic seawaves or earthquakes, but is rather caused by more “ordinary” events: high water, flooding, strong wind, rainstorms, hailstorms, droughts.[265]

According to the RF Ministry of Civil Defence, Emergencies and Disaster Relief, for Russia the most distractive events are floods, forest fires and abnormal heat. Severe flooding events pose risk to human life, activate epidemiological hazards, induce mental disorders, cause injuries, destruct buildings, structures and infrastructure, and provoke industrial disasters. The increasing number and intensity of precipitation events means higher risk of dangerous consequences due to destabilisation of slopes - landslides, avalanches.

Summary of the expected climate changes is provided in Section 9.9.5.

9.9.3.4 Flood risk assessment for the Project area

The information on the hydrographical and hydrological conditions of the Lena River, its banks and tributaries is provided in Section 7.5.

The river is fed by a combination of sources: about 40% of melt water, 35% - runoff, 25% - ground water. In general, the water-logged drainage area (refer to Section 9.9.3.2), significant terrain gradient and weak evaporation (190 mm per year) create good conditions for river flow, but

[265] Report on the Climate Risks at the territory of the Russian Federation, Roshydromet. - Saint Petersburg, 2017

proportions of seasonal drainage areas are prone to significant variations depending on weather conditions each year. The concerned river section is characterised by instability of water level.

Spring high water period is the main phase of the Lena River flow regime. In the study area this period is distinctly manifested with maximum water levels which in most cases correspond to the annual peak levels (25-50% of annual flow during May-June). The level rise starts at the end of April – first decade of May and reaches its peak during the first days of May. The end of spring high water period normally the end of May - beginning of June.

The summer high water conditions fed by heavy rains and melting of snow in the upstream areas develop immediately after decline of the spring high water period and sometimes overlap it. The significant and rapid rises of water may repeat 5-10 times before the beginning of cold season (30-60% of annual flow during June-October).

The winter season in the Upper Lena is characterized by the lowest water flow rate with a relatively low and stable water level (10-25% of annual flow).

The extent of level rises during the spring high water period is determined by ice jamming, and in summer and autumn - by the high flow conditions. During summer-autumn high-flow period, the Lena River level in the area of Ust-Kut city may rise by 3.2 m and decline by 1.2 m, maximum. As the level rises, water overflows to the floodplain which often results in the area flooding. Ust-Kut like few other cities in Irkutsk Region is exposed to small floods with a high repeatability - every 4-5 years. On the other hand, upper reaches of Lena are also prone to low water conditions during dry periods in summer when navigation is complicated due to the river shallowness[266].

On the Consultant's request, the Irkutsk Department for Hydrometeorology and Environmental Monitoring provided the following monitoring data from the hydrological station on the Lena River in Ust-Kut (Appendix 6):

- high water level with 1% probability (HWL 1%) – 893 cm;
- high water level with 10% probability (HWL 10%) – 716 cm;
- peak water level – 934 cm in 2001[267].

The elevations are measured from the hydrological station zero level - 281.47 m BS-77.

Based on the available data, ESIA materials and documentation related to the Project and associated facilities, the Consultant assessed potential risk of flooding of the Project area with 1% and 10% probability and presented the results in the schematic map Figure 9.9.10). The map shows that river flows with 1% and 10% probability may result in flooding of the following facilities:

- water intake facility on the Lena River and process water pipeline;
- treated wastewater pipeline and discharge outlet in the Lena River;
- temporary berth facilities;
- a small section of the reconstructed Vilyui A-331 road.

More details of the elevations and areas exposed to flooding, as well as unaffected facilities are provided in Table 9.9.3 below.

[266] On approval of the Regional Hydrometeorological Network Upkeeping Programme. Resolution of the Head of Irkutsk Region Administration of 28.06.1995 No.96.

[267] "Irkutsk UGMS" reference memo No.1862/32 of 03.06.2019.

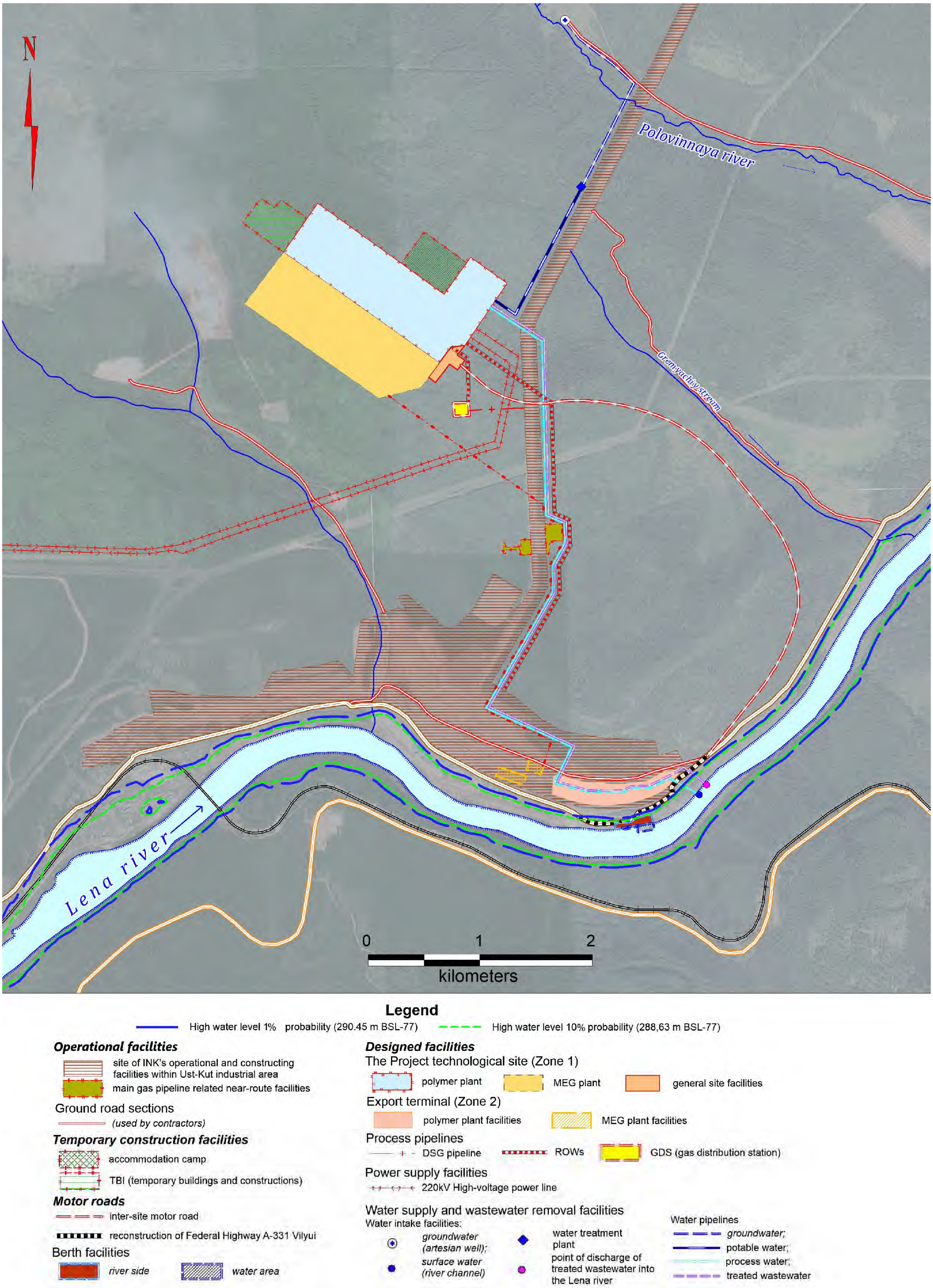

Figure 9.9.10: Map of the Project area flooding with 1% and 10% probability

Table 9.9.3: Information on potential flooding of the Project area at water level in the Lena River with 1% probability

Facility / site	Elevation (m, BS-77)	Rise above 1% HWL[268] (in the lowest point, m)	Notes
The plant site	567 - 621	276.55	
Offloading terminals	296 - 330	5.55	
Water intake facilities on the Lena River (process water) and 1st lift pumping station	Approximately 272 - 274 m	-18.45	Designed as underflow filtering intake at the Lena River bed
Treated wastewater outlet into the Lena River	272.29	-18.16	Designed as underflow filtering outlet at the Lena River bottom
Water intake facilities on the Polovinnaya River (drinking water)	340	49.55	
Berth facilities	285.4 – 285.7	- 5.05	The design is based on the quay elevation of 285.4 m. The berth is located within the area exposed to flooding
Communication corridors			
Process water pipeline from the Lena River	274 - 589	- 16.45	The pipeline lower part is under water
Treated wastewater pipeline to the Lena River	273 - 589	- 17.45	The pipeline lower part is under water
MEG pipeline	341 - 577	50.55	
Interfacility road	297 - 592	6.55	
Reconstructed section of the Vilyui A-331 road	288 - 297	- 2.45	A small part in the centre of the reconstructed section is within the potential flooding area. The road will be constructed on a fill with a height of 0.5-1.5 m, and three drainage pipes will be provided under the pavement.

The temporary berth facilities are located within the area exposed to flooding. In accordance with i.4.4.4 of the Process Design Regulations for Ports on the Inland Waterways (1997)[269], the designed elevation of the berth facilities area is 0.2 m above the highest water level during the ice-movement with 2% probability considering the ice-jamming effect and is set at 285.4 m BS. The design berth head elevation is 285.7 m BS, considering the rain water drainage requirements (minimum gradient 5‰ toward the rear side of the berth). A water rise to the levels of 10% and 1% probability the quay will be completely flooded. The design shall provide for quick preservation of the berth facilities in situation of flooding risk, or adopt a higher elevation for the main site of the berth facilities. Considering the temporary need for the berth facilities, the flooding risk is assessed as moderate.

The process water intake is designed as underflow filtering intake at the river bed. The water intake facilities also include the 1st lift pumping station on the river bank (tentative elevation 280-285 m BS) and an additional pumping station in an underwater position. The exact location of the 1st lift pumping station is not known, therefore its flooding risk cannot be assessed properly.

The treated wastewater outlet is designed for operation during the low water period in winter when water rises and dangerous consequences are unlikely. Alternatively, the discharge to the River Polovinnaya is considered (see section 9.4). In this option, the flooding of the treated wastewater outlet is unlikely.

Assessment of the flooding risks and respective Project adaptation measures are covered in Section 9.9.6.

9.9.3.5 Forest fires

Forest fires are among the most significant weather and climate risks for forestry, economic activities, human health and biodiversity. In average, Russia lost about 600 thousand ha of forest land each year during the period 2000-2014. 70 % of the forest losses were due to fires, 20 % were caused by extreme weather conditions (wind storms, ice rains, etc.), and 10 % of the losses were attributable to activity of

[268] 290.45 m BS-77 (information of the Irkutsk UGMS)

[269] Process Design Regulations for Ports on the Inland Waterways - Moscow: Ministry of Transport of the Russian Federation. - 1997

pests and diseases[270]. The above proportions vary significantly between years, depending on weather conditions.

According to the information reported by Rosleskhoz in the interdepartmental information system, more than 2.2 million ha forest land area was affected by fires during the first half of year 2018, i.e. twofold as much as in the previous year, resulting in a total damage of 5 billion rubles.[271] It should be noted that the detailed statistical information on forest fires at the federal level is controversial and incompatible with current reporting from the emergency response services, probably due to the difficulty of accounting for this spontaneous phenomenon. In general, the federal services highlight an increase in burnt forest areas in their reports.

In Irkutsk Region, 632 forest fires were reported in the serviced designated forest land areas in 2018; the fires affected the total area of 88,130.2 ha including 7,034.4 ha of forests. Further 128 fires in the total area of 225,061 ha were reported in the forest fires control zone, including 207,173.9 ha of forests.[272]

The number of forest fires decreased by 1.7 times compared to the previous year, and the affected area was by 3.2 times smaller. Last year, 1,061 fires were reported during the fire risk season and affected the total area of 284,554.4 ha (including 235,925.2 ha of forests).

The main causes of forest fires are distributed as follows: careless handling of fire (49.2%), thunderstorms (41.1%), fire spread from other land categories to the designated forest land (7%), and other causes (2.7%). The spread of fires is supported by climatic variations and weather events and their combinations: high temperature, deficiency of water in rivers, strong wind, early disappearance of snow cover, shortage of precipitation - all these factors are regularly observed in Ust-Kut district, particularly in spring.

The forest fires prevention and response measures include monitoring for early detection of fire outbreaks, communication arrangements and response preparedness, comprehensive fire safety measures at the industrial sites, awareness campaigns with explanation of causes of fire, etc. Assessment of the forest fires impact is provided in Section 9.9.6.

9.9.4 Greenhouse gases

The Project is designed to minimise the greenhouse gas (GHG) emissions by using appropriate efficient equipment and applying adequate measures to minimise fugitive emissions of GHG. Nevertheless, emissions of GHG including methane and nitrogen oxide (I) are expected at all stages of the Project. It should be noted that the Company's Gas Programme (where the current Project is an important element) is intended to provide high-efficiency treatment and utilization of associated gas as an alternative to its reinjection to formation.

According to the ESIA report, the main sources of GHG emissions at the Project operation phase will be the boiler house and the main production facilities where gas will be used. In addition, the Project will cause indirect GHG emissions due to the use of purchased electric power, however, this contribution will be small. GHG emissions will gradually increase in the course of construction and commissioning of the new production capacities.

The GHG emissions volume during the whole Project lifecycle (including associated facilities) shall be assessed when the final Project design is available. The assessment should also include a high-level review of alternatives in terms of GHG emissions and energy efficiency, and verification of the design compliance with BAT.

9.9.5 Expected climate changes

In terms of further climate changes in 21st century, IPCC[273] projections indicate temperature growth under all scenarios, considering the solar radiation and greenhouse gas levels in the atmosphere. With various man-caused impact scenarios, the most likely estimated global temperature rise in 2081–2100

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[270] Report on the Climate Risks at the territory of the Russian Federation, Roshydromet. - Saint Petersburg, 2017

[271] https://iz.ru/788263/aleksandra-rykova/ognennaia-statistika-ploshchad-sgorevshikh-lesov-uvelichilas-vdvoe

[272] http://irkobl.ru/region/economy/forest/

[273] Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535 p. http://ipcc.ch/report/ar5/wg1/.

compared to the level 1986–2005 in 5–95 % of all models will be within the range from 0.2–1.8°C to 2.6–4.8°C. The differences between precipitation quantities in wet and dry regions, and between wet and dry seasons will increase, although some exceptions are possible in few regions. The Atlantic meridional circulation will most probably diminish, however it is unlikely to change abruptly or cease. The world ocean level is predicted to increase by 0.26-0.55 m to 0.45–0.82 m in 2081-2011 compared to the end of 20th century, and its acidification will continue.

The latest climate models predict climate warming in Russia in 21st century at a higher rate than global average warming. The greatest rise in surface level air temperatures is projected in winter, with the rates increasing from south to north and peaking in Arctic. The summer temperature rise will hardly demonstrate any distinct zone-specific patterns. Early in the 21st century climate warming in most regions of Russia already exceeded the standard deviation that describes the range of outputs from different models. The quantitative differences between the warming scenarios rapidly grow starting from the middle of 21st century[274].

By the middle of 21st century, average summer temperatures in Russia are expected to rise by 1–3ºC to 3–4ºC compared to the end of 20th century, depending on scenario. The inter-scenario variations significantly increase by the end of 21st century: the predicted temperature rise is from 3-4ºC to 5-7ºC. The predicted temperature rise and variations between scenarios for winter period are greater. By the middle of 21st century, the rapid growth of winter temperatures will affect major part of Russia’s territory, with the increasing rate of change towards the Arctic coast where the temperature rise of about 5–6ºC is predicted. Based on the minimum scenario, by the century end winter temperatures will increase by 3–4ºC in the south and by 6–8 ºC in the north of Russia. According to another scenario, the predicted range of temperatures at the end of 21st century is from 5-8ºC in the south to 10-12 ºC or higher in the north.

The expected increase of average annual temperature in Cisbaikalia is 1.4-2°C by year 2050 and 4.5-7.5°C by 2100, compared to the period 1986-2005.[275] Simulation in AR5 using Climate Time Series Browser model produced a similar range of potential rise in temperatures based on records from five weather stations in the vicinity of the Project area with the longest observation period (for the purpose of data normalisation and combination): +1.5-4°C by 2050 and +5.5-8.5°C by 2100.

It is expected that total precipitation in Russia will increase during 21st century, with a more extensive growth trend in winter period. The rate of changes in winter and summer precipitation will significantly vary between geographic areas. Winter precipitation in all regions of Russia is predicted to grow, first at a low rate and more intensively by the middle of century. The increase in summer precipitation is of greater significance, especially in the north and east of Russia.

A statistically significant long-term growth trend of precipitation is reported in Cisbaikalia at the mean rate of 1.2 mm / 10 years, however the observed local trend of precipitation development is minor negative. Analysis of the long-term precipitation data indicates that winter precipitation in Cisbaikalia is growing while summer precipitation is almost stable.

The global warming may result in changes in the occurrence rate and/or intensity of extreme weather events and adverse combinations of weather conditions. A growth of annual maximum and minimum air temperatures is reported in most parts of Russia; the number of days with abnormally high air temperatures tends to increase while the number of events with extremely low night-time air temperature is diminishing. Projections for the whole area of Russia including Cisbaikalia predict increasing intensity of precipitation events (distinct showers or snowfalls), increase in the number of severe flooding and high water events, wind storms, varying weather conditions with consecutive series of cold and warm periods, warm and cold temperature waves, droughts, wildfires.

Assessment of potential changes in maximum water flow rate with low probability is an important element of flooding risk prevention in rivers’ catchment areas. Assessment of flooding risk in Cisbaikalia should include a forecast of potential changes in river flow rate and its comparison with the development trends of other climatic factors (since precipitation and other contributing factors of floods can be

[274] Report on the Climate Risks at the territory of the Russian Federation, Roshydromet. - Saint Petersburg, 2017

[275] AR5 Climate Model Mapper: CCSM4, CanESM2, NorESM1-M, CSIRO-Mk3-6-0 for surface temperature and precipitation; Climate Time Series Browser output based on 5 stations: Irkutsk, Barguzin, Bodajbo, Kirensk, Vitim, http://climatemodels.uchicago.edu/timeseries

predicted only for a short future period of 4-6 days, their values for longer periods are adopted on the basis of long-time averaged observation data).

The existing hydrological monitoring network in Siberia is scarce, and there is a discontinuity in monitoring records leading to the lack of statistically significant data sets. Due to the above gaps in the input data for analysis of hydrological trends and risk assessment, it is not possible to build a reliable projection model with highly reproducible simulation outputs. No integrated systems for flood prediction and decision-making support at the regional level are existent or planned in Russia.

In general, the predicted warming may result in reduction of overall water availability in the catchment area, therefore, the Lena River flow rate may decrease. A decline in water level in the river is already observed (refer to Section 7.7). Given the increase in weather and hydrological variations between years which is currently observed in the region, and considering the likely growth of EWE and CWE events, it is possible that the river flow rate of low probability (1% or less often) may increase by 2050 or at a later time.

9.9.6 Assessment of the Project impact and adaptation

In a situation of potential occurrence of dangerous and adverse phenomena like adverse weather, extreme hydrometeorological events, or slow gradual changes of climate (growth of average annual temperature, etc.) and presence of sensitive receptors, a climate risk assessment is required. The identified risk receptors may include Project and associated facilities' infrastructure, facilities and processes, personnel, local communities, and ecosystems.

Analysis of the observation data and climate projections indicates the changes in the concerned area climate conditions at the rate which, by a combination of certain parameters, is higher than Russia's average and global trends. The predicted rise of extreme and average annual temperatures, potential increase in frequency and intensity of adverse weather events may invoke climatic factors that will affect the Project in general. The above factors may disturb technological processes, destabilise or destroy structures and infrastructure facilities, disrupt transportation of construction materials, feedstock and equipment, and affect personnel health and safety. As the Project operation is dependent on operability of the auxiliary infrastructure and associated facilities, they are also covered by the assessment of impacts and risks. Summary of the assessment of risks and impacts is provided in Table 9.9.4 below, along with the appropriate adaptation measures.

The increased number and intensity of extreme weather events (floods, forest fires) and rise in average annual and extreme maximum temperatures have been identified as **minor and medium** risk factors for the Project. The likely direct *long-term* effects of such risks may include extreme physical ambient impacts on the Project facilities (uneven and "stressful" loads, sudden temperature changes, etc.), which may cause deformations and loss of stability and integrity of the Project facilities and infrastructure (including the berth, road and water intake facilities). Such risks can be minimized by adopting design solutions that take these factors into account and provide for appropriate positioning and structural design, an increased safety margin for the structures, and by selecting appropriate building materials. After the above adaptation, the risk will be reduced to **minor**.

An increase in extremity of any weather events will have a **cumulative** aggravating effect in terms of the impact on reliability of the facilities' operation, and on health and safety of the Project personnel. The risk and significance of this impact is assessed as **medium/moderate**, however, ensuring response preparedness of personnel, development and implementation of response procedures in case of extreme weather events, and consideration of the current weather conditions when choosing overalls and PPE, developing outdoor work schedules (during construction), selecting the heat supply mode (during operation), will all contribute to reducing the health risk for the Project personnel to **minor**, and the potential impact significance to **low**.

Table 9.9.4: Climate change impact assessment and adaptation measures

Climate factor	Receptor	Impact	Sign	Receptor Sensitivity	Stage	Impact significance	Risk	Adaptation measures	Residual impact
Increase in annual average, annual maximum and minimum air temperatures, and extreme maximum temperatures	Personnel	In winter - better working conditions due to higher average annual minimum temperatures	P	M	O	L	-	Consideration of the current weather conditions when choosing work clothing and PPE, developing outdoor work schedules (C), selecting the heat supply mode (O)	L
		Deterioration of working conditions due to higher extreme maximum temperatures	N	H	O	M	M		
	Resources: natural gas, electric power	Reduction of power consumption due to lower heat demand during cold season	P	M	O	-	-	Introduction of automatic heat supply control system and provision of central generation capacities to serve the changing heat demand Process waste heat recuperation	N, I
		Increased power consumption for cooling of equipment and rooms	N	M	O	L	Mr		
	Facilities and infrastructure	Deterioration of reliability of the main equipment and infrastructure, disruption of processes due to extreme temperature	N	L	O	L	Mr	Selection of design solutions and technical characteristics allowing for the predicted growth of average temperatures during the Project operation	N, I

Climate factor	Receptor	Impact	Sign	Receptor Sensitivity	Stage	Impact significance	Risk	Adaptation measures	Residual impact
Increase in frequency and intensity of extreme weather events: Floods Forest fires	Personnel	Deterioration of working conditions, increased risk of injury, health and life risk	N	H	C, O	M	M	Development of response procedures in case of extreme weather events (floods, forest fires), and for potential evacuation of personnel as appropriate. Organization of EWE response facilities and provision of all necessary resource. Making personnel aware of procedures to be followed in such events. Training. First aid provisions Consideration of EWE forecasts at preparation of work schedules and selection of work clothing	L Mr
	Facilities and infrastructure	Deformation and destruction of structures and infrastructure facilities affected by floods (the list of exposed facilities is provided in Section 9.9.3.4)	N	H	C, O	H	M-Mr	Development and implementation of response procedures and instructions in case of extreme weather events (floods, forest fires) Design solutions for potential preservation of the berth facilities, adoption of a higher elevation for the road surface, reinforcement Development of alternative transport communication options for the Project sites	L-N, Mr
		Breakdowns in construction schedule (C) and Project operation mode (O)	N	H	C, O	M	M-Mr		

9.10 Impacts in emergencies

Production-related explosion and fire hazard overview

The presence of vessels operating under high temperatures and pressure, containing large amounts of gaseous and vaporous products, creates, in the event of an emergency, the risk of gas accumulation with subsequent explosion, combustion or poisoning of the staff.

An emergency may be caused by the following factors:

- departure from the prescribed operation protocols;
- pipeline or vessel flange joints depressurization;
- process signaling or override devices malfunction;
- failure to comply with industrial safety instructions or fire regulations.

Pursuant to 116-FZ[276], the Polymer Production Facility is an operator of hazard class I hazardous industrial facilities (HIF) based on the following criteria:

- Consumption of approximately 300,000 tons of natural gas (methane content 96.19%) per year on all the facility's installations;
- Consumption of the combustible gas ethane as a raw material at the rate of 630,000 tons per year;
- Consumption of liquid propane as a raw material at the rate of 211,000 tons per year.

In addition to natural gas, ethane, and propane, the technology will require the use of other hazardous substances, whose consumption rates and characteristics are listed in Table 9.10.1 below.

Table 9.10.1: Hazardous substances used at the PPF, and their rates of consumption

Substance	Combustible	Explosion hazard	Toxic	Under pressure	Consumption rate (t/yr)
Methanol					24.3 (one off)
Dimethyl disulfide (DMDS)	+		+		168.8
Ethylene glycol			+		23.1 (one off)
Hydrogen	+	+		+	1 000
Zinc stearate	+				150
Ethylene	+		+	+	26 235
Butene-1	+		+	+	24 030
Hexene-1	+		+		9
Isopentane	+		+		1.9
Ethane	+			+	630.8

According to RF Rostekhnadzor[277], 8 emergencies and 4 occupational accidents with lethal outcomes occurred at petrochemical and oil and gas processing facilities over a nine-month period in 2018.

Analysis of the results of technical investigations of the emergencies showed that the main causes of emergencies over the 9 months of 2018 were as follows:

[276] Federal Law No. 116-FZ dated July 21, 1997 "On industrial safety of hazardous industrial facilities"

[277] Report on law enforcement practice of administrative and supervisory activity in Rostekhnadzor while implementing federal state supervision in the field of industrial safety covering a 9-month period in 2018

- internal hazards connected with depressurization and destruction of technical devices;
- human error connected with the failure to comply with regulations for organization and performance of hazardous work or equipment servicing work.

In Russia's petrochemical industry in 2018 background risk of emergencies was $2.7*10^{-3}$, background risk of personnel fatality $1.4*10^{-5}$. Compared to the 2011-2015 period, background risk of emergencies ($2.6*10^{-3}$ in 2015) remained practically unchanged, while background risk of personnel fatality decreased ($1.4*10^{-5}$ in 2015).

In Russia, background risk of personnel fatality at petrochemical facilities is 20 times lower than the risk of fatality as result of a motor vehicle collision[278].

The project provides for architectural-planning, technical, technological and organizational actions to bring down the risk of emergencies to an acceptable level.

Architectural-planning solutions to ensure fire and explosion safety

The general plan was developed in view of the siting requirements for various production facilities, units, buildings, installations which take into account fire and explosion safety regulations.

The site of the proposed facility is divided into the following functional zones:

1. Plant facilities zone which includes administrative buildings, offices, canteens, health care and cultural establishments, and a fire depot. The plant facilities occupy a separate area outside the shockwave impact area
2. Production zone, which includes process units and their auxiliary production buildings and installations. Production zone facilities are positioned in accordance with their functional purpose
3. Auxiliary zone which includes auxiliary production buildings and installations (repair and mechanical, repair and construction, laboratories, motor vehicle repair, motor pool)
4. Storage zone, including storages for chemicals, catalyzers, lube oils (Zone 1), commercial products, equipment base warehouses (Zone 2)
5. Feedstock and commercial products depos zone (Zone 1)

A number of decisions has been taken on siting highly important facilities to lower the risks in emergencies, including:

- Control centers (both human-operated and unmanned) located within the shockwave impact area are constructed as bunkers capable of withstanding the impact of a shockwave
- The facility's flare system is installed on the periphery, in the northwestern part of the facility, based on the dominant wind direction and the minimum possible length of the flare header. The area around the flare stack is surrounded by a circular fence with the radius of 140m as determined by the allowable heat flux density. Flare system buildings and installations are located outside the fence
- The plant facilities zone where people are constantly present is located at a safe distance from the production facilities
- The main site has a rectangular shape divided into districts
- The districts are divided by inter-district roads. The distance between frontage lines should be at least 40 m taking into account the applicable technological, transport, explosion and fire safety requirements

Technical and technological measures to ensure fire and explosion safety

To ensure safe operation of process units and to protect personnel the project documentation includes technical solutions aimed at reducing the probability of, or altogether preventing, emergencies; it provides for process schematics with a high degree of automation which will enable continuous operation of the process equipment and the stability of technological processes.

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[278] Safety Guidelines "Methodology for the establishment of the risk of emergency while substantiating the safety of hazardous industrial facilities of the oil and gas sector", approved by the Order No. 349 dated August 23, 2016 of the Federal Service for Ecological, Technological and Nuclear Supervision, GARANT.RU: http://www.garant.ru/products/ipo/prime/doc/71376516/#ixzz5qXlsX8Mc

To decrease the probability and to mitigate the severity of emergencies the project documentation provides for a series of special actions in accordance with Russian and international requirements.

The following provisions have been made to minimize the unit’s explosion hazard level:

- the units’ process schematics is divided into separate process blocks, and a quantitative assessment of the fire hazard of those blocks has been performed
- high-speed shutoff devices (pneumatic shutoff valves) are installed at the borders of the process blocks, whose switching times correspond to the explosion hazard category of each of the blocks
- the process schematics ensures emergency release of vaporous and gaseous phases into a closed flare system, and release of liquid phase into an emergency tank or nearby vessels; the sequence of operations to be performed in the event of depressurization of any block affected by an emergency
- an automated anti-emergency system (AAS) is used to achieve a safe state in an emergency
- in the event of the absence of instrumentation air, “normally open” or “normally closed” versions of automated adjustment valves are used to prevent pressure and temperature from rising inside vessels with gaseous products, to ensure flow of liquids from vessel to vessel, supply of water for spraying the columns, and to disconnect the unit from the facility’s combustible product lines
- the technological process is taking place in pressurized equipment, the materials of which the equipment is made were chosen in consideration of the corrosive medium

The units’ technological process and vessel design were chosen to prevent explosions inside the vessels if the prescribed parameter values are maintained.

To prevent the process parameters from exceeding the established thresholds, signaling devices and process overrides were provided for based on the critical parameters.

To ensure the explosion safety of the process system during the start-up or shutdown of the units, special measures have been provided for preventing the formation of explosive mixtures inside the system or the formation of stagnant zones, such as purging with an inert gas and steaming.

To protect the vessels from overpressure, a system of safety valves has been provided for, consisting of a working and a backup valve with a switching device.

All gaseous hydrocarbon discharges from the unit’s safety valves (except for steam or inert gas), emergency discharges caused by shutdown of the blocks, and gaseous discharges caused by purging, are sent to the closed flare system through a separator.

The pumps of the fire and explosion hazardous production blocks, whose shutdown due to a voltage drop or a short-term power outage may cause the process parameters to reach critical levels and may lead to accidents, have been chosen for being capable of automatic restarts and being equipped with autostart systems.

The unit’s vessels and equipment, in which liquid hydrocarbons circulate, are drained into a closed drainage system with subsequent removal of collected products as substandard.

All centrifugal pumps, depending on the class of the explosion hazardous zone in which they are located and the properties of the medium being transferred, are fitted with double mechanical seals.

For combustible product pumps, remote-controlled pneumatic shutoff devices are installed on the suction and discharge lines.

To signal the presence of explosive gases in circulating water a system of sensors is installed on the hot water pipeline.

To minimize the operation of safety valves installed on devices and pipelines carrying explosive products, automatic regulators are provided for the parameters associated with an increase in pressure or temperature, and an alarm system which issues warnings when the prescribed limits are reached; if necessary, overrides are triggered if the parameters reach critical levels.

In the places of possible release and accumulation of combustible gases and vapors of highly flammable liquids (HFL), warning devices are installed for pre-explosive concentrations of combustible gases and HFL vapors.

To secure the external heat insulation of the vessels and pipelines against entry of combustible products from outside, protective covers made of galvanized or aluminum sheets are installed.

The project documentation provides for various fire safety systems to lower the risk of fires and reduce damage in the event of an accident, including:

- Remotely controlled water spraying systems for columns, tanks and structures;
- Automated foam fire suppression systems to protect tanks;
- Automatic fire alarm systems;
- Fire warning and evacuation management system
- Automated powder fire suppression systems (cabling levels of buildings)
- Fire water supply system, including fire water storage tanks (with a total capacity of at least 12,000 m^3), fire water pipelines, fire water pumping stations.

All of the above makes it possible to minimize the likelihood of explosion hazardous emergencies and reduce damage in the event of an accident.

Organizational measures

Since the enterprise is a hazard class I explosion and fire hazardous production facility (HPF) it should have a license to operate an explosion and fire hazardous HPF.

During the operation of hazard class I hazardous production facilities (HPF), the operator should develop and implement an industrial safety management system that includes the following key elements:

- Organization of production control over the compliance with industrial safety regulations
- Development of action plans to ensure industrial safety
- Development of regulations on the investigation of the causes of accidents and emergencies during the operation of an HPF
- Organization of personnel training in the field of industrial safety regulations
- Organization of training sessions on the personnel preparedness to act in an emergency at a HPF

The company has been developing an emergency containment and response plan (hereinafter referred to as ERP), which envisages the actions of personnel to prevent emergencies and, should they occur, to contain them and minimize the severity of their consequences, as well as technical systems and tools to be used in such events.

The company should arrange for maintaining a reliable and safe level of operation and repair of its process and auxiliary equipment, pipelines and fittings, control systems, emergency prevention systems, communications and warning systems, power supply systems, and its buildings and installations; dividing duties and areas of responsibility among its technical services (technological, mechanical, energy, instrumentation and automation) to ensure compliance with the technical safety requirements.

Impacts in emergency

Assessment of the risk of occurrence and development of emergencies and accidents is based on the identification of emergency development scenarios, assessment of their possible consequences, and the calculation of emergency risk indicators.

In an emergency, the following development scenarios are possible:

- Instant release of hazardous substances with inflammation
- Leakage of gas (liquid) producing an explosion hazardous gas-air mixture, its inflammation and explosive transformation
- Explosion of a fuel-air mixture (FAM) in a tank with subsequent spillage, inflammation of combustible liquids and their burning (in the form of a fire)

- Leakage of combustible, thermodynamically stable liquid from a vessel, a tank, or a process pipeline producing a spill with evaporation of the liquid from its surface; inflammation of a FAM cloud from an ignition source (a car with a running engine, faulty electrical equipment or an open source of fire) either within or outside the industrial site
- Leakage of thermodynamically unstable liquid from a vessel, a tank, a process pipeline producing spill and intense evaporation of light fractions, formation and transport of (heavier than air) product vapors near ground in the downwind direction, as well as inflammation of an explosion and fire hazardous cloud from an ignition source

A preliminary risk analysis showed that the most severe consequences are associated with accidents at the main process units located in Zone 1, less severe consequences are associated with accidents in tank farms, and the least severe consequences are associated with accidents at the offsite facilities.

In any emergency development scenarios, there is a risk of personnel fatality, and the frequency of the most severe accidents causing the death of at least one person will be approximately $3*10^{-3}$ per year. At the same time, the individual risk of personnel fatality (taking into account the working pattern) is $1*10^{-6}$ per year, which corresponds to the regulatory requirements

Due to the significant distance (over 4 km) separating the industrial site of Zone 1 from residential areas and places where crowding is possible (recreation areas, fishing spots, mushroom and berries picking areas, etc.), the risk of fatality due to an occupational accident at the enterprise is almost zero.

Considering the fact that the largest volumes of storage and use for technological purposes are occupied by gases and easily evaporating liquids, the likelihood of significant pollution of soil or groundwater is low, and pollution of surface water bodies can be practically ruled out for Zone 1, which is located at a considerable distance from such water bodies.

At the same time, chemicals and finished products storages in Zone 2 can be potentially hazardous in terms of pollution of the Lena river, since they are located at a distance of 210-280 m from the Lena river waterline.

To prevent entry of pollutants into surface water bodies during accidents at the sites located in Zone 2, a number of actions have been taken, including:

- Tank farms are surrounded by a dyke, which prevents the spreading of fluids outside the tank;
- The territory of the industrial site is equipped with storm drains, which ensures collection and treatment of wastewater at local treatment facilities.

The implementation of these and other measures listed above will minimize the risks of an adverse impact on humans and the environment during emergencies at the proposed facilities.

Assessment of impact from natural and human-caused emergencies

An emergency response system for natural and human-caused emergencies which are not directly or indirectly associated with the production activity at the PPF is essential for trouble-free operation of the enterprise.

When assessing the risk of natural emergencies, taking into account the area’s natural features, priority should be given to:

- forest fires;
- floods; and
- earthquakes

Forest fire

The company site is located on a land plot surrounded by merchantable forests of the Ust-Kut and Osetrovsky forestries. According to the Forest Development Project, 68% of forests are fire hazard class 2 forests (high natural fire hazard), 32% are fire hazard class 4 forests (low natural fire hazard).

Depending on the fire hazard class, measures have been identified for ensuring forest fire prevention, which include the requirement for keeping the project area for the construction and operation of the facilities cleared of deadwood, branches and other combustible waste.

In addition, the PPF should store fuel and lubricants in closed containers, clear storage areas from vegetation, garbage and other combustible materials during the fire danger season. Storage areas for fuel and lubricants should be separated from the adjacent territory by a mineralized belt of at least 1.4 m wide.

Besides, the PPF must create a reserve of fire prevention and suppression tools and keep them ready during the fire danger season, ensuring the possibility of their immediate use.

Mobile fire extinguishing tools include:

- Motor vehicle with a set of firefighting and technical gear
- Fire pump
- Removable cisterns or rubber tanks for water with the capacity of 1000-1500 liters
- A set of fire hoses
- Chainsaws, axes, shovels
- Backpack forest sprayers
- Communications and warning systems, etc.

Members of the fire brigade should be provided with PPE, first aid kits, drinking water bottles, etc.

If a forest fire is detected, it should be reported to the specialized dispatching service, and steps should be taken to prevent the spread of the forest fire.

Prior to the commencement of the fire danger season, all the company's employees as well as the contractors' employees should be additionally instructed on the observance of fire safety rules in forests.

Floods

The project sites within Zones 1 and 2 are located outside the area of possible flooding caused by rising waters of the Lena river and its tributaries.

Earthquakes

According to the survey materials[279], the intensity of seismic impact within the area is 6.

The requirements as to the construction of buildings and installations with regard to seismicity were taken into account when designing the PPF's main and auxiliary facilities, ensuring a reduction in seismic loads, including the installation of seismic isolation systems, dynamic damping systems and other effective systems for controlling seismic response.

Human-caused emergencies

Technogenic emergencies may arise as a result of accidents accompanied by explosions and fires at industrial enterprises located close to the PPF's production sites:

- Zone 1: explosions and fires at the Irkutsk gas and chemical plant
- Zone 2: explosions and fires at UKGFK, at the LPG/LGC RSSTs

At the operation stage, emergency action plans will be developed and agreed upon with the Emergencies Ministry and other stakeholders; those plans will outline:

- The list of potential hazards in the enterprise and the surrounding area
- A brief assessment of the situation in the enterprise in the event of an emergency, including:
    - The risk of accidents at the enterprise
    - The risk of accidents at other enterprises
    - Natural disaster risk
    - Assessment of the affected area and possible casualties among the personnel and the population

[279] Technical report No. 13237 submitted by ZAO Eastern Siberian Trust of Engineering Surveys for Construction, "Construction and Installation Work. Seismic Microzoning".

- Measures to protect employees and the population, including:
  - improving the warning and communications system in emergency situations, setting up a local warning system at potentially hazardous facilities (where it has not been set up yet)
  - reviewing on a regular basis the availability and constant readiness of personal and collective protective equipment
  - preparing workers and employees for evacuation, making annual updates to the evacuation plan
  - providing all workers and employees with personal protective equipment for the respiratory organs and with medical protective equipment
- Measures to improve the stability of the facility’s operation:
  - preparing the facility for an accident-free production shutdown, providing a procedure for the preparation of the process trains and workshop equipment for an accident-free shutdown
  - preparing the boiler room for running on reserved fuel, creating a three-day supply of such fuel
  - accumulating feedstock and materials in quantities that ensure uninterrupted operation of the facility
  - installing automated lines and fire extinguishing devices
  - ensuring reliable communication with the facility’s most important production areas
  - setting up dispatch centers and radio centers, if possible, inside the most durable structures and basements
  - creating a reserve of autonomous sources of electricity and water
- Preparations for carrying out emergency response and rescue operations and other urgent work on the site:
  - maintaining the facility’s rescue units in constant readiness
  - accumulating small-scale mechanical devices, rescue equipment and tools at the facility
- Training the facility’s workers and employees to act in emergency situations:
  - providing staff training on the annual basis
  - conducting comprehensive on-site exercises once every three years in relation to the actions of the management and the facility’s workforce in emergency situations
  - holding quarterly training sessions for emergency rescue teams (for potentially hazardous facilities)

The implementation of a series of technical and organizational measures to monitor and manage emergency risks will minimize possible damage and casualties among the population and the personnel.

9.11 Assessment of the area of influence of the proposed activity

According to the IFC terminology, the area of influence of the Project on the natural and social environment is comprised of the following:

(1) land plots and water areas directly involved in the implementation of the Project;

(2) other lands and water areas used or controlled by the Project operator and its subcontractors;

(3) lands and water areas on which associated facilities are constructed;

(4) lands and water areas which may be affected by cumulative impacts from the Project;

(5) lands and water areas potentially exposed to impacts from unplanned but predictable developments caused by the project that may occur later or at a different location.

IFC's Performance Standard 1 (PS1) specifies that an area of influence also encompasses lands and water areas that may be affected by impacts from the proposed main and associated activities. At the same time, any areas affected by impacts that are possible in the absence of or regardless of the presence of the Project should not be included in the area of influence.

9.11.1 Land plots and water areas directly involved in the implementation of the Project

The central part of the area of influence of the Irkutsk Polymer Plant, including the Polymer Production Facility (PPF, PE) and the MEG plant, is the footprint and the adjacent land and water area on which the Project itself and its associated facilities (listed in Section 5.7) will be constructed.

The PPF footprint comprises the land plots listed below intended for the construction of areal and linear facilities (Figure 9.11.1):

- process site (Zone 1, "upper" zone) with the area of approximately 110 ha (III.1a in Table 9.4.1 and in Figure 9.4.2) intended for the Plant's process units;
- auxiliary facilities area (adjacent to Zone 1) with the area of approximately 4 ha (III.3a);
- export terminal (Zone 2, "lower" zone") with the area of approximately 20 ha (III.1b);
- land plots for the proposed construction of linear infrastructure facilities associated with the PPF's process, with the total area of 357 ha[280] (III.3e, III.3f, III.3g, III.4b, III.4g, III.5, III.9, III.12);
- land plots sized 0.9 ha intended for the installation of a technical water conduit and a treated wastewater sewer in two parallel ROWs, from the Lena River waterline to the PPF's Zone 2 (III.1b), crossing Federal Highway A-331 "Vilyui" and access railway tracks to the Alrosa facilities.

During the PPF's construction phase temporary facilities will include:

- three sites adjacent to the PPF's Zone 1: a rotation accommodation camp for 7,000 people with the area of 16.4 ha; a rotation accommodation camp for 700 people with the area of 27.5 ha (the site will house a water treatment plant, a water supply pumping station, local wastewater treatment plant, a complete transformer substation, and a number of other areal facilities); and a TBI site sized approximately 62 ha;
- a berth on the Lena River for unloading large-sized equipment with the land area of 1.8 ha and the used water area of 1.1 ha;
- a 10 kV PTL to supply electricity to the TAC facilities, with a footprint of approximately 2.9 ha.

Thus, the overall size of the PPF footprint can be tentatively assessed at **584 ha** (100 %), of which the process sites will account for **134.0 ha** (23 %), the linear facilities will account for **358 ha** (61 %), and the temporary construction facilities will account for **92 ha** (16 %).

[280] Those land plots, unlike the process sites, will not be used in their entirety for the construction of any installations. Their borders have been set in consideration of possible re-routing of the corresponding linear facilities during the design phase and will encompass the ROW for the construction of facilities and permanently acquired lands for the construction of above-ground installations (PTL towers, inspection manholes – for water conduits and sewers, identification signage – for underground pipelines of all categories, etc.)

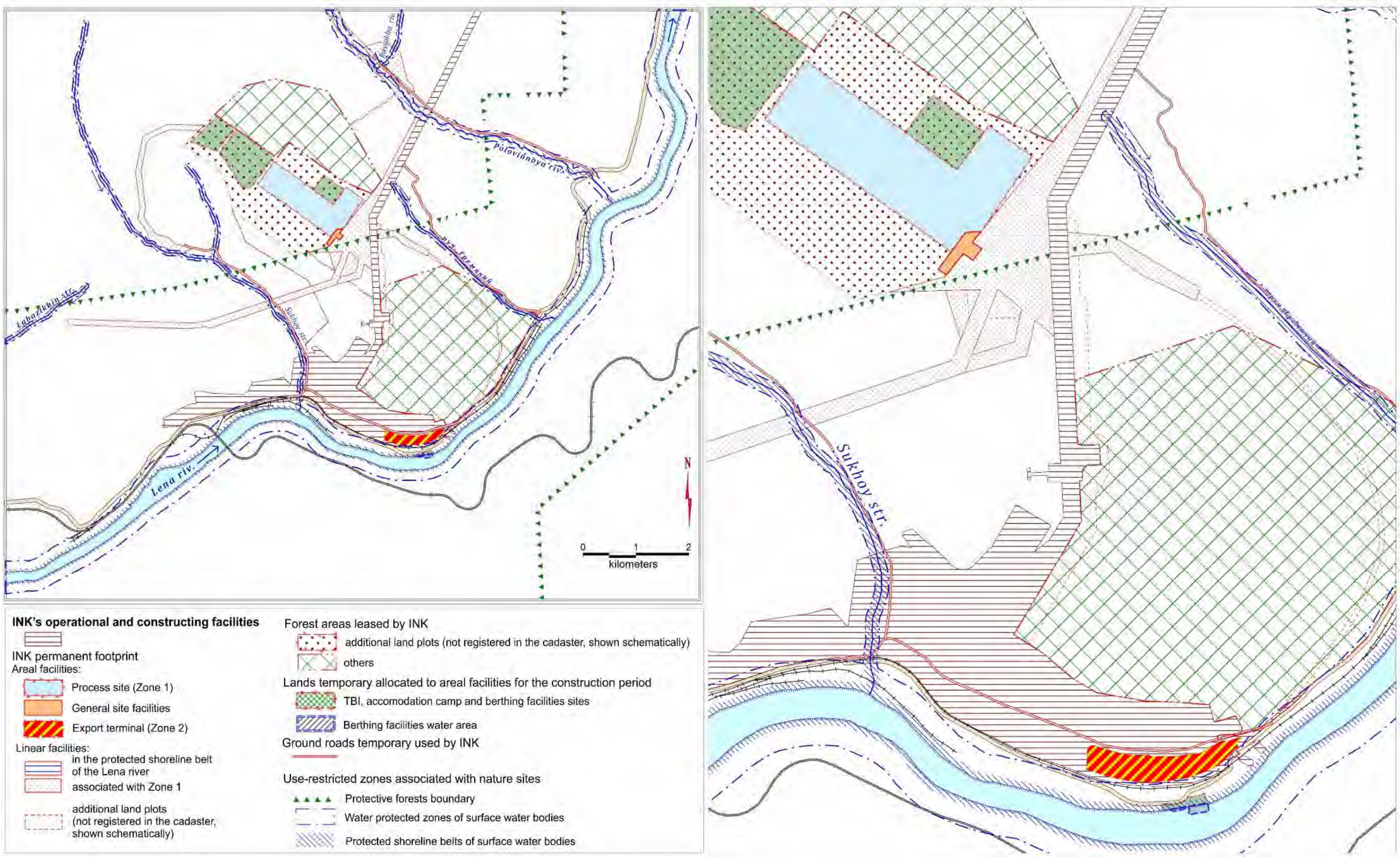

Figure 9.11.1: Land plots and water areas directly involved in the implementation of the Project

9.11.2 *Other lands and water areas used or controlled by the project operator and its subcontractors. The PPF's environmental impacts*

Land use conditions outside the land and water areas directly affected by the construction will also change due to the setting up of a sanitary protection zone (SPZ). According to the sanitary classification of industrial facilities in SanPiN 2.2.1/2.1.1.1200-03, the Polymer Production Facility is a Class I facility required to have a 1,000 m SPZ. The SPZ borders are shown in Figure 9.11.2: for the process ("upper") zone the total SPZ area will be approximately 965 ha, and more than a half (up to 60%) of that area will fall within the footprint of the Project, the nearby facilities of INK's Ust-Kut industrial area, and the production facilities of third-party organizations (Table 9.11.1).

The setting up of a sanitary protection zone around the PPF will not entail any land use limitations in the city of Ust-Kut. At the same time, approximately 10% of the SPZ area will be occupied by spawning protection forests of the Osetrovsky forest district and approximately 30% by merchantable forests (Figure 9.11.2)[281].

The PPF's export terminal will be located within the "lower" zone of INK's Ust-Kut industrial area and are not expected to require adjustment of the borders of the pre-designed SPZ with the area of approximately 1200 ha (Figure 9.11.2)[282]. Nearly 22 % of the area of the existing SPZ of the LPG/LGC RSST and the GFU is located within the Ust-Kut city boundaries but the land use limitations caused by excessive concentrations of air pollutants extend solely to industrial, transport/warehouse, and communal zones of the city.

Along with the SPZs and, mostly, within their bounds, other zones with special land use conditions (SLUC zones) will be set up. The limitations imposed by those zones will be connected with the safety of operation of the proposed PPF facilities[283]. Most of the zones with natural resources management limitations will extend to industrial and forest lands (the yellow contour in Figure 9.11.2). Most of them will require firebreaks and clear-cut strips with removal of trees and shrubs. The total estimated area of such zones is approximately 310 ha.

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[281] A part of the Ust-Kut industrial area (214.4 ha) is located within the bounds of the city of Ust-Kut, and the remaining part within the nature territory on lands taken from the forest fund and partly recategorized as industrial lands. The Ust-Kut municipality's territorial planning documentation does not identify the territory of the Ust-Kut industrial area located beyond the Ust-Kut city limits as a zone intended for production and transport infrastructure. The updating of the general plan of the Ust-Kut municipality (urban settlement) commenced in Quarters III and IV of 2018 and hasn't been completed as yet (the work is being performed by PPM Master Plan)

[282] New air emission and harmful physical impact sources will in any event require making changes to the SPZ design previously developed and agreed upon with Rospotrebnadzor prior to the commissioning of the facilities of the "lower" IPP zone. A calculation of dispersion of pollutants emitted by the existing and potential sources in the "lower" zone will determine whether it is necessary to adjust the SPZ borders that have been previously set and registered in the stated cadaster.

[283] Pursuant to Article 1.4 of the Urban Development Code of the Russian Federation SLUC zones encompass: buffer zones, sanitary protection zones, protection zones of cultural heritage sites, water conservation zones, flooded and waterlogged areas, sanitary buffer zones of potable and domestic water supply sources, zones of secure facilities, restricted development zones, and other zones set up in accordance with Russian Federation laws

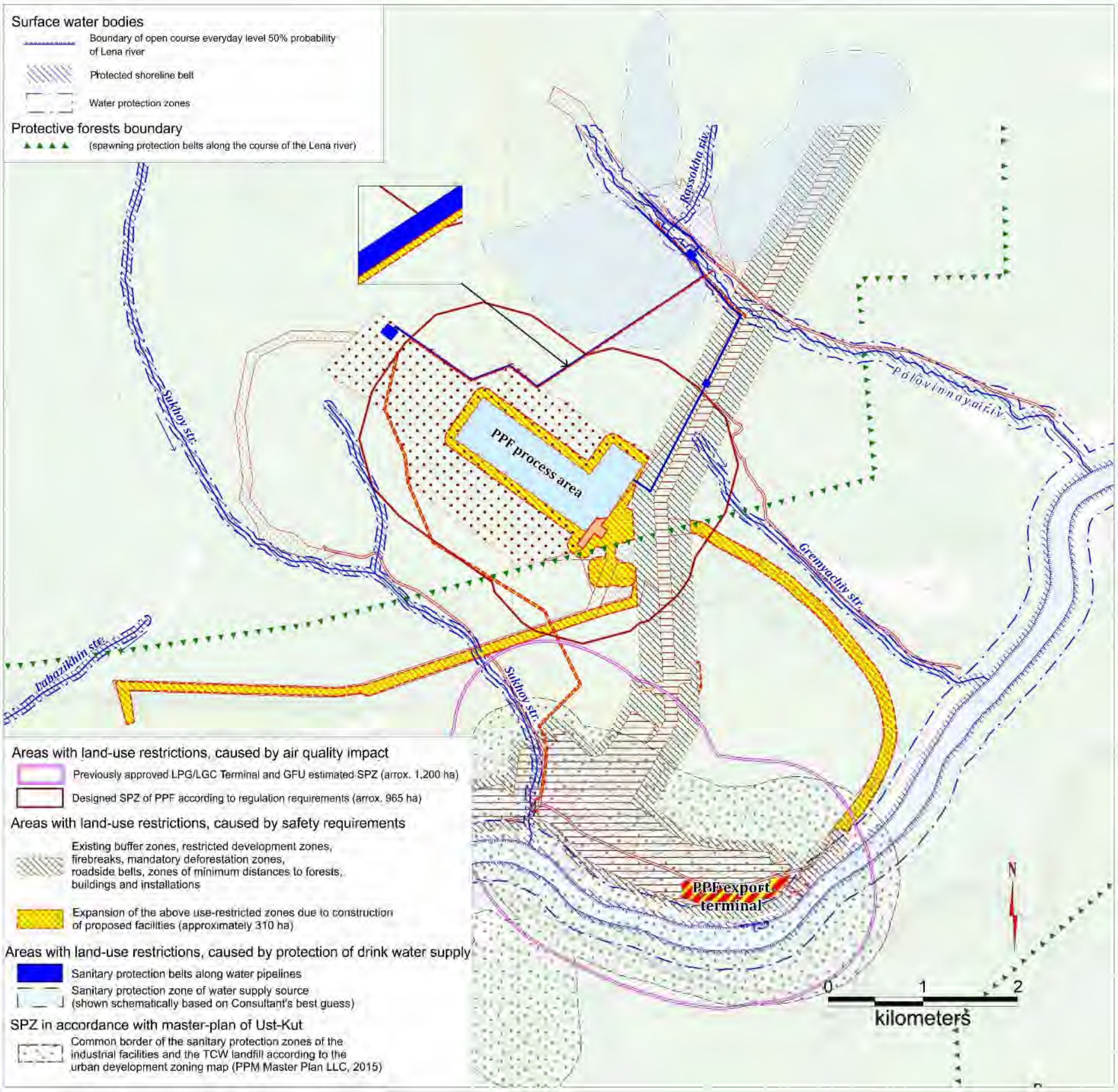


Figure 9.11.2: Special land use conditions zones associated with the proposed PPF facilities

(the labels in this figure have been defined elsewhere in the report)

Table 9.11.1: Lands of sanitary protection zones: the existing one (LPG/LGC RSST and GFU) and the one being designed (PPF)

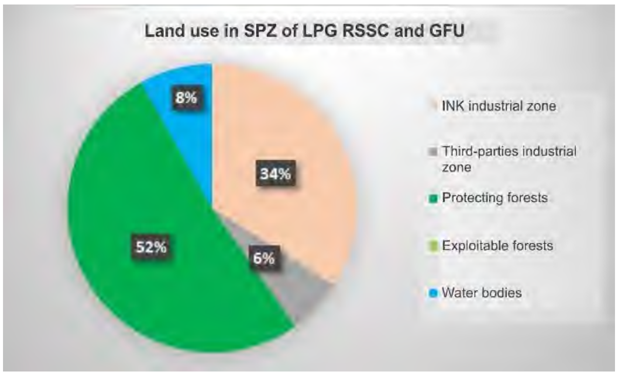
Functional zones and intended use of land	Area within SPZ			
	LPG/LGC RSST and GFU[284]		PPF[285]	
	ha	%	ha	%
1. Ust-Kut municipality (urban settlement) functional zones				
Population center "City of Ust-Kut", including:	267.8	22.3	0.0	0.0
Medium-rise residential development zones	0.0	0.0	0.0	0.0
Low-rise (single-story) residential development zones	0.0	0.0	0.0	0.0
Subsidiary household plots	0.0	0.0	0.0	0.0
INK's production, communal/warehouse zones, engineering and transport infrastructure zones	192.4	16.0	0.0	0.0
Third-party organizations' production, communal/warehouse zones, engineering and transport infrastructure zones	75.4	6.3	0.0	0.0
Population center "Village of Polovinka", including:	0.0	0.0	0.0	0.0
Low-rise (single-story) residential development zone	0.0	0.0	0.0	0.0
Farmlands	0.0	0.0	0.0	0.0
Nature territory (forest lands belonging to the Ust-Kut forestry), including:	935.4	77.7	965.1	100.0
Merchantable forests	0.0	0.0	122.6	12.7
Protective (spawning protection) forests	428.8	35.6	94.7	9.8
Non-forest lands disturbed by activities of third-party organizations	41.8	3.5	34.0	3.5
Farmlands occupied by gardening associations	0.0	0.0	0.0	0.0
Surface water bodies, including:	98.8	8.2	<0.1	<0.01
Water area of the Lena river	98.8	8.2	0.0	0.0
Water areas of small watercourses	<0.1	<0.01	<0.1	<0.01
2. INK's Ust-Kut industrial area				
Sites of facilities operated or constructed by INK	292.7	24.3	31.6	3.3
INK's proposed facilities' footprint, including:	40.5	3.4	324.8	33.7
PPF process zone	0.0	0.0	109.5	11.3
Common plant facilities zone	0.0	0.0	4.0	0.4
PPF shipping zone	19.8	1.7	0.0	0.0
Land plots intended for linear facilities associated with the PPF's process zones	17.3	1.4	115.3	11.9
Forest lands outside the project footprint to be recategorized as industrial lands (minus the territories to be developed)	0.0	0.0	155.0	16.1
Reserved forest lands leased by INK, including:	191.4	15.9	179.1	18.6
Merchantable forests	0.0	0.0	179.1	18.6
Protective (spawning protection) forests	191.4	15.9	0.0	0.0
Sanitary protection zones of other INK facilities	8.2	0.7	0.0	0.0
Total SPZ area:	1203.2	100.0	965.1	100.0

Air quality outside SPZs. For the next level of assessment of the external boundary of the area of influence, whose central part consists of the project footprint, the water area used, the sanitary protection zone and other SLUC zones associated with the PPF, the corresponding dispersion calculation methodology (DCM-2017) criteria should be used: an isoline of 0.05 times the maximum allowable concentration (MAC) of the pollutant with the greatest estimated dispersal from emission sources (without considering the background) and ten times the distance between the pollutant sources and the area of maximum air-ground concentrations of pollutants. Based on analogous facilities it is possible to

[284] Estimated sanitary protection zone for the LPG/LGC RSST and the GFU (Combined sanitary protection zone for the LPG/LGC RSST and GFU facilities (expansion)), LPG RSST – Irkutsk: Baikal EcoAudit, 2018 (Sanitary-Epidemiological Report #38.ITs.06.000.T.000021.01.19 dated January 17, 2019.

[285] Prescribed sanitary protection zone sized extending 1000 m from the borders of the PPF's process zone and auxiliary facilities zone.

give a tentative estimate of the size of the area of influence (from 5 to 10 km depending on the direction) and to identify the pollutant whose dispersal will determine the area of influence boundary (nitrogen dioxide). All other air impacts, including acoustic ones, will be of any significance solely within the area.



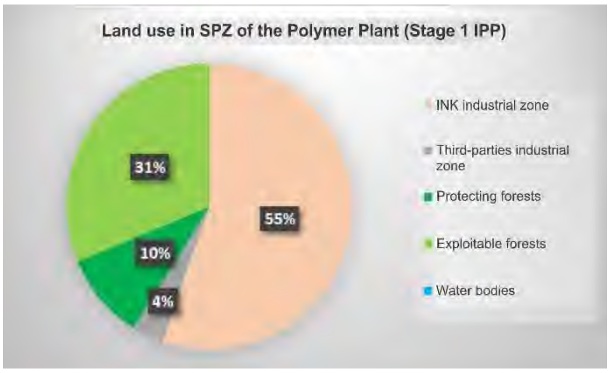


Figure 9.11.3: Lands comprising sanitary protection zones – the existing one (LPG/LGC RSST and GFU) and the one being designed (PPF)

Preliminary dispersion calculations for the pollutants emitted by sources at the polymer plant were performed in 2017 for an alternative PPF site located 2 km southeast of the current location. According to those calculations the minimum size of the plant's area of influence will be approximately 5 km; in such event the concentrations of most of the emission components will be reduced to threshold values, 0.05 times the MAC.

The northwest relocation of the PPF process zone increased the distance between emission sources and the nearest controlled areas (primarily, the Kedr 2 gardening association), which, on the whole, will have a favorable effect on the sanitary and ecological situation in Ust-Kut. At the same time, the 5km area of influence (Figure 9.11.4) will not only extend to the association's land, it will also encompass the eastern residential suburbs of Ust-Kut – the microdistricts Mostootryad and Yakurim. With regard to a number of pollutants, whose emissions will be the most massive (primarily, nitrogen dioxide), 0.05 MAC concentrations may even occur beyond the 5km area (as far as 8 km away according to the 2017 preliminary calculations); a detailed assessment of the PPF's impact on the atmospheric air will become possible based on the engineering survey materials containing the analysis of the current air pollution levels and the project documentation containing parameters of controlled and fugitive pollutant emissions from all the plant's emission sources.

The main set of the Project impacts on the geological environment and exogenous processes will be confined to the area enclosed by Sukhoi and Gremyachiy streams and the left bank of the Lena River between the extreme points of the "lower" zone of INK's Ust-Kut industrial area (see Figure 9.11.4). Soils and subsoil resources of the neighbouring territories will only be exposed to a minor degree, and within a limited area. Particularly, the construction of a 220 kV power transmission line will partly affect the interfluve area between the Yakurim River and Sukhoi stream, west of the main territory of the industrial hub. Besides, a series of effects connected with the construction and operation of the groundwater intake structures and the water conduit connecting the wells and the water treatment plant will be confined to the Polovinnaya river valley. To prevent groundwater aquifer pollution in the vicinity of the artesian well to be constructed in the Polovinnaya river valley, a sanitary buffer zone (SBZ) will be set up, consisting of 3 belts with different land use conditions. In the absence of a corresponding project, the Consultant can only assume that the SBZ belts will extend up the Polovinnaya river valley slopes and encompass a catchment area of hundreds of hectares (see Figure 9.11.4).

As regards the topsoil and vegetation cover, physical-mechanical and pyrogenic effects will be confined to the area between Sukhoi and Gremyachiy streams, whereas the effect of its chemical pollution will correspond to the abovementioned project area of influence on the quality of air as the main contact medium.

For the surface water body which is considered as a future source of process water supply, a recipient of treated wastewater, and a site for temporary berthing facilities, the boundaries of the influence area will be defined in terms of mostly downstream propagation of polluting substances and physical impacts (warming effect, turbulence, reduction of water flow, agitation of bottom sediments, ice regime transformation, etc.). The government authorities identified two basic locations for background and reference monitoring stations associated with the future discharge sewer of the LPG Terminal on the Lena River: 500 m upstream and 500m downstream of the proposed discharge point. The proposed activity in the valleys of Sukhoi and Gremyachiy streams and the Polovinnaya river valley will result in a substantial expansion of the area of influence of the Ust_kut industrial area on the Lena River, and therefore the lower point of reference monitoring should be moved downstream to the point where the population center Polovinka is located (about 6 km downstream of the proposed water intake facility and the discharge sewer).

Impacts from the proposed activity on biodiversity will comprise transformation of habitats – topsoil and vegetation cover, water, air, bottom sediments, harmful physical impacts (noise, vibration, light and heat radiation) – and also direct impacts on aquatic organisms and terrestrial fauna. For the former category of impacts, the area of influence boundary will correspond to the propagation of a particular factor – air or water pollution, physical-mechanical disturbances of the topsoil and vegetation cover, etc. – and, consequently, can be associated with the abovementioned boundaries of those categories of impacts. Less predictable is the propagation of effects on specific populations of terrestrial vertebrates due to apparent seasonal pattern of presence or activity of many a local species, for which areas in the upper reaches of the Lena are but a tiny fraction of a lengthy migration route which its specific interannual variability reflecting, among other things, global climate change.

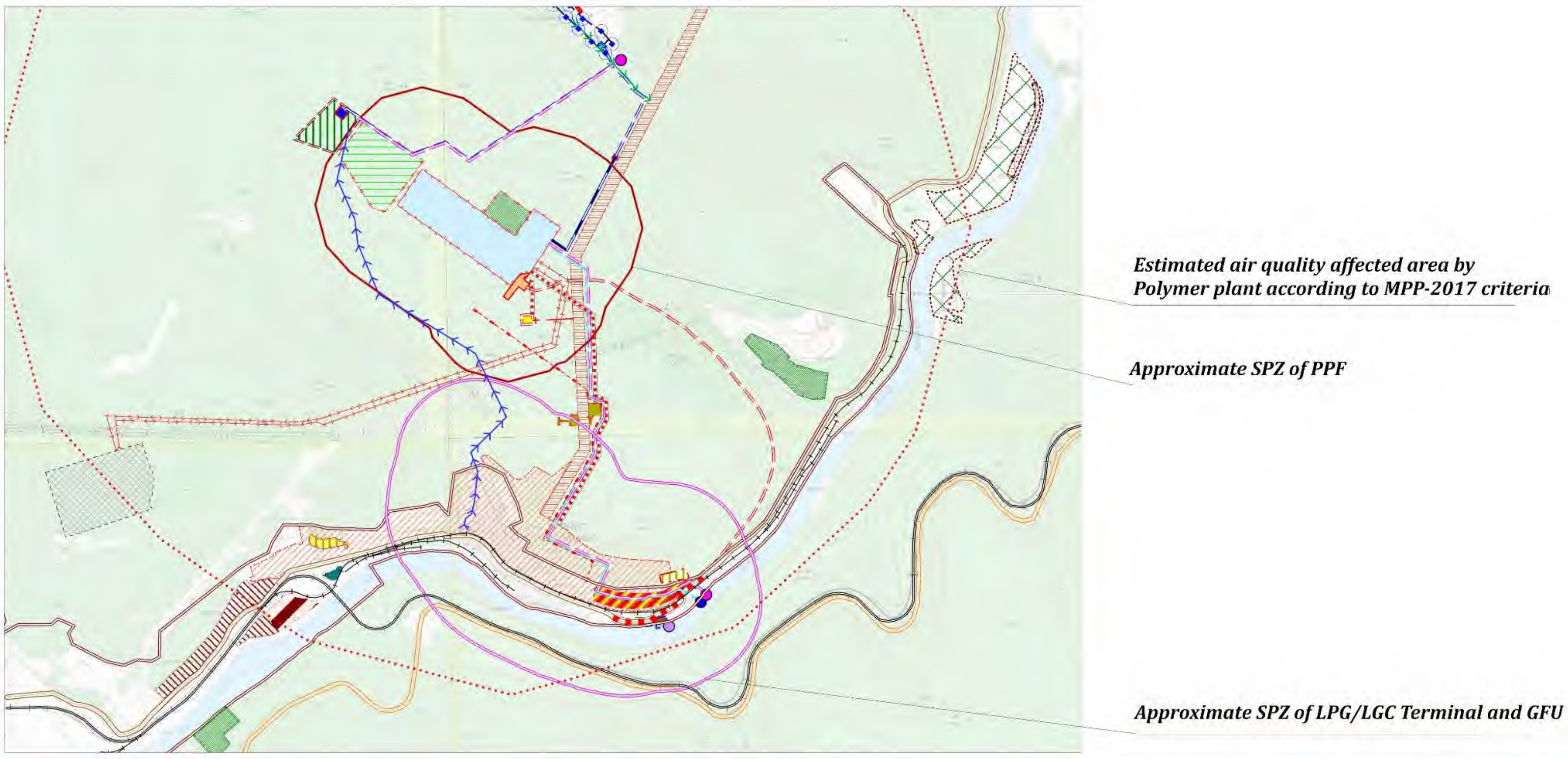
Expected impacts of the Project on socio-economic situation in the area will primarily affect the eastern part of Ust-Kut municipality (urban settlement) including the residential areas of the Mostootryad and Yakurim microdistricts and the adjacent subsidiary household plots as well as industrial, transport and logistics facilities on the left bank of the Lena river. The forest lands affected by the project are managed by the Ust-Kut Forestry Department of the Ministry of Forest Resources of the Irkutsk Region. Other areas encompassed by the polymer plant's area of influence described above will include the rural settlements of the Ust-Kut Municipality (municipal district) and the gardening associations with the majority of their land users apparently residing in the city of Ust-Kut. A more detailed characteristic of the project's area of social influence is given in Chapter 10.

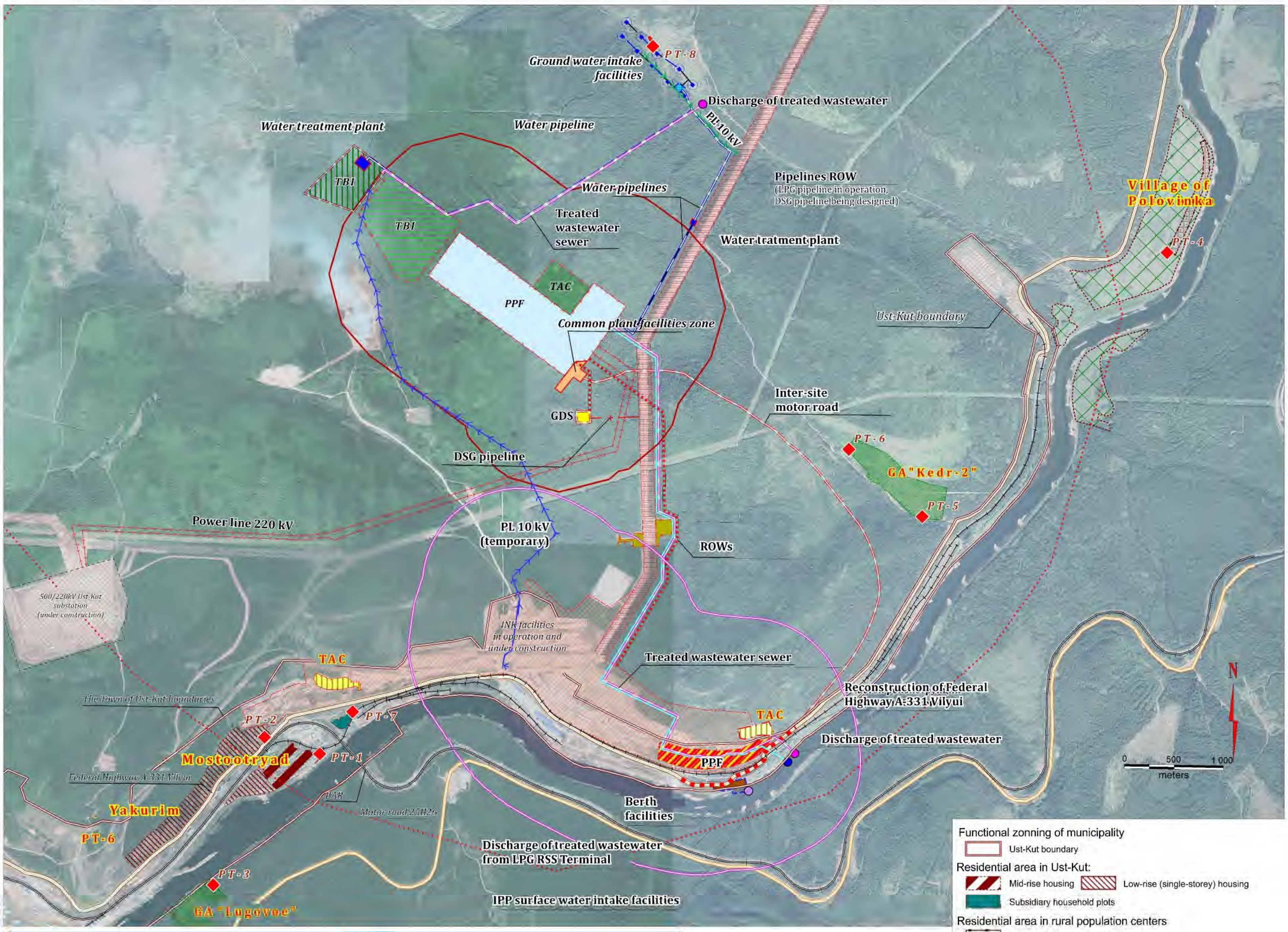
9.11.3 Lands and water areas intended for, and affected by impacts from, associated facilities

Chapter 5 states that according to the IFC terminology the following facilities and types of activity may be deemed as project-associated:

- construction and operation of water supply and wastewater removal systems, and accommodation camps of Irkutsk Oil Company;
- construction and operation of the inter-site motor road (road to the IPP between Federal Highway A-331 "Vilyui and the IPP's Zone 1 border);
- renovation and use for the project's needs of a segment of Highway A-331 "Vilyui" between kilometer markers km19+300 – km20+500, between the points where the road connects to IPP's Zones 1 and 2;
- construction, operation and dismantling of berthing facilities on the Lena River;
- construction and operation of twin 220 kV power transmission lines from the PS-500/220 kV Ust-Kut substation to the 220 kV Polymer substation (within the IPP's Zone 1).

Impacts from the facilities listed above are considered in conjunction with the impacts the ESIA focuses on, and the corresponding areas of influence have common boundaries described in Sections 9.11.1-9.11.2.





Index	Reference				
	Address	Cadastral number	Master-plan of municipality	Coordinate referencing (false grid system, meters)	
				X	Y
Monitoring points within the town of Ust-Kut area					
PT-1	2nd Naberezhnaya Street, 1 (apartment block)	38:18:070201:50	Ж3102	18559409	6299919
PT-2	2nd Tayozhnaya Street, 8 (single-story housing)	38:18:070101:413	Ж3104	18558849	6300079
PT-7	Household plots at 2nd Lesnaya Street, 13	Without cadastral number	Unmarked	18559733	6300351
Monitoring points outside the town of Ust-Kut area					
PT-3	GA "Lugovoe". Plots are not registered with State Cadaster Registry	ЧЗУ 38:18:000000:777	Unmarked	18558360	6298579
PT-4	Village of Polovinka	38:18:000010:1422	Unmarked	18567853	6305124
PT-5	GA "Kedr-2". Land plot No. 15	38:18:194501:21	Unmarked	18565434	6302418
PT-6	GA "Kedr-2". Land plot No. 311	38:18:194501:1	Unmarked	18564685	6303085
PT-8	Polovinka lodge (subsidiary household plot)	38:18:000010:1373	Unmarked	18562636	6307118

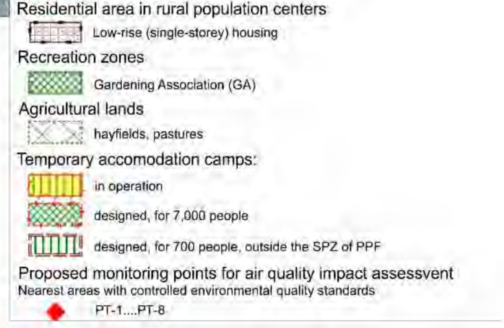


Figure 9.11.4: Area of influence of the Project on the quality of air. Controlled areas nearest to the Project footprint

9.11.4 *Lands and water areas which may be affected by cumulative impacts from the proposed activity*

Of the cumulative effects associated with a combined impact of the proposed activity and third-party activities the most distinct are effects on land and forest resources whose propagation is determined by the project footprint (Section 9.11.1) and the land use limitations (Section 9.11.2).

Impacts on air and water in the Lena river are also predictable and potentially mappable during the subsequent stages of design. In particular, mutual reinforcement (cumulation) of impacts will be significant if the polymer production facility's area of influence on air determined based on the dispersion calculation methodology (DCM-2017) criteria is superimposed on similar areas of influence of the nearest facilities of INK's Ust-Kut industrial district and third-party organizations, particularly Ind Timber (TSLK's legal successor) which operates a sawmill residue disposal site near the PPF's process zone and a major timber processing facility in the vicinity of the LPG/LGC RSST and the shipping zone of the PPF.

The general plan of Ust-Kut contains information on the borders of sanitary protection zones of most of the production, transport, warehouse and communal facilities located within the city boundaries, and of the Solid Communal Waste Landfill. It was updated in 2015 to include a 1km regulatory SPZ for the LPG RSST. The northward expansion of the sanitary protection zone (see Figure 9.11.4) is caused by inclusion of impact sources on the gas fractionating unit located northwest of the LPG Terminal. The southern part of the estimated SPZ of INK's facilities (LPG/LGC RSST and GFU) and the SPZ of SpetsAuto's SCW Landfill overlap each other. No displacement of excessive air pollution zones in the direction of the controlled areas (residential and recreation zones) is expected, but cumulative effect from multiple sources of emissions and physical impacts in the eastern industrial zone of Ust-Kut should be taken into account in the development of an environmental monitoring program for INK's Ust-Kut industrial area.

Air dispersion modeling at subsequent design stages will make it possible to more accurately assess the effects of individual emission sources and groups thereof and determine the location of the area of influence boundary in accordance with the DCM-2017 criteria. Taking into account the high concentration of a large number of stationary and mobile emission sources in the vicinity of the proposed PPF, it seems expedient to form a common calculation module for the entire Ust-Kut industrial area.

Impacts of the Project on the water use conditions and the quality if water in the Lena River will be superimposed on the effects of the activities of a large number of water users of the Ust-Kut district and neighbouring areas located in the Lena basin. According to forecasts, the rate of abstraction of the Lena's water resources will be increasing regardless of the Project and, in particular, will reach 28,134,000 m^3/year (total rate of water abstraction from surface water bodies of the Lena basin) in the Irkutsk region by 2025, which is 2.7 times higher than in 2015. The region's mining industry and public utilities account for the largest water consumption volumes; most of those consumers are located below the project site. Impacts from the Project, as shown in Section 9.5, are not capable of significantly affecting the river's water content and, accordingly, the amount of water supplied to consumers within the region, even in years with the most difficult water situation. Impacts from the PPF on the quality of water and the state of bottom sediments, may potentially combine with the effects of activities of multiple river basin water users and, as is the case with the ground-level atmosphere, should be subject to environmental monitoring throughout the Project's life cycle.

A detailed analysis of cumulative impacts is given in Chapter 13 below.

9.11.5 *Lands and water areas potentially exposed to impacts from unplanned but predictable developments caused by the Project that may occur later or at a different location*

One of the prospects for the successful implementation of Stages III and IV of INK's Gas Program will be to ensure the supply of natural gas (it is planned to use DSG in this capacity) to consumers in three cities - Ust-Kut, Zheleznogorsk-Ilimsky and Ust-Ilimsk. To that end, the construction of two gas transportation systems is planned, whose starting point will be the gas distribution station of the Ust-Kut industrial hub. Neither the Company nor the Consultant has any technical information on those facilities. The initial sections of the routes of two main gas pipelines - in Ust-Kut and Ust-Ilimsk - are schematically shown on the map in Figure 9.11.5: from the GDS site they are supposed to run in the western direction inside parallel ROWs, whose exact routes will not be chosen any time soon.

More definite are the prospects for the construction of two accommodation camps – a temporary one for 700 people, and a permanent one for 3,000 people. The need for the former will arise after the commissioning of the polymer plant and the decommissioning of the temporary accommodation camp for 7,000 people inside the plant's regulatory sanitary protection zone. The location and the borders of that facility are yet to be determined; it is known only that it will be located outside the polymer plant's SPZ, but within the bounds of the land plots already leased by INK. These criteria, in particular, are met by the western part of the project footprint, a forest land which has been approved for being recategorized as an industrial land, near the point where it connects with the proposed road (see Figure 9.11.5).

A residential microdistrict for 3,000 people is being designed to accommodate the personnel of the companies operating the IPP facilities. Currently, with the participation of the contractor Research Institute "Zemlya i gorod" (Nizhny Novgorod), a corresponding feasibility study is being developed (the deadline is July 15, 2019). Three main siting options for the neighbourhood are being considered: (1) within the existing Mostootryad microdistrict; (2) within the bounds of the existing Staraya REB microdistrict; (3) on the undeveloped land plot adjacent to the YaGU microdistrict. The options marked on the map as Mostootryad-2, REB-2 and YaGU-2 (Figure 9.11.5) differ by their distance from the Ust-Kut industrial area and Ust-Kut's main transport hubs - the railway station and the airport.

After the commissioning of both the Polymer Production Facility and the MEG Plant, INK's Ust-Kut industrial area will retain the potential for further expansion, mainly in the northern direction, which is ensured by the sufficiency of the previously leased land plots (Figure 9.11.5). The Consultant has no information about any plans or technical parameters of such an expansion.

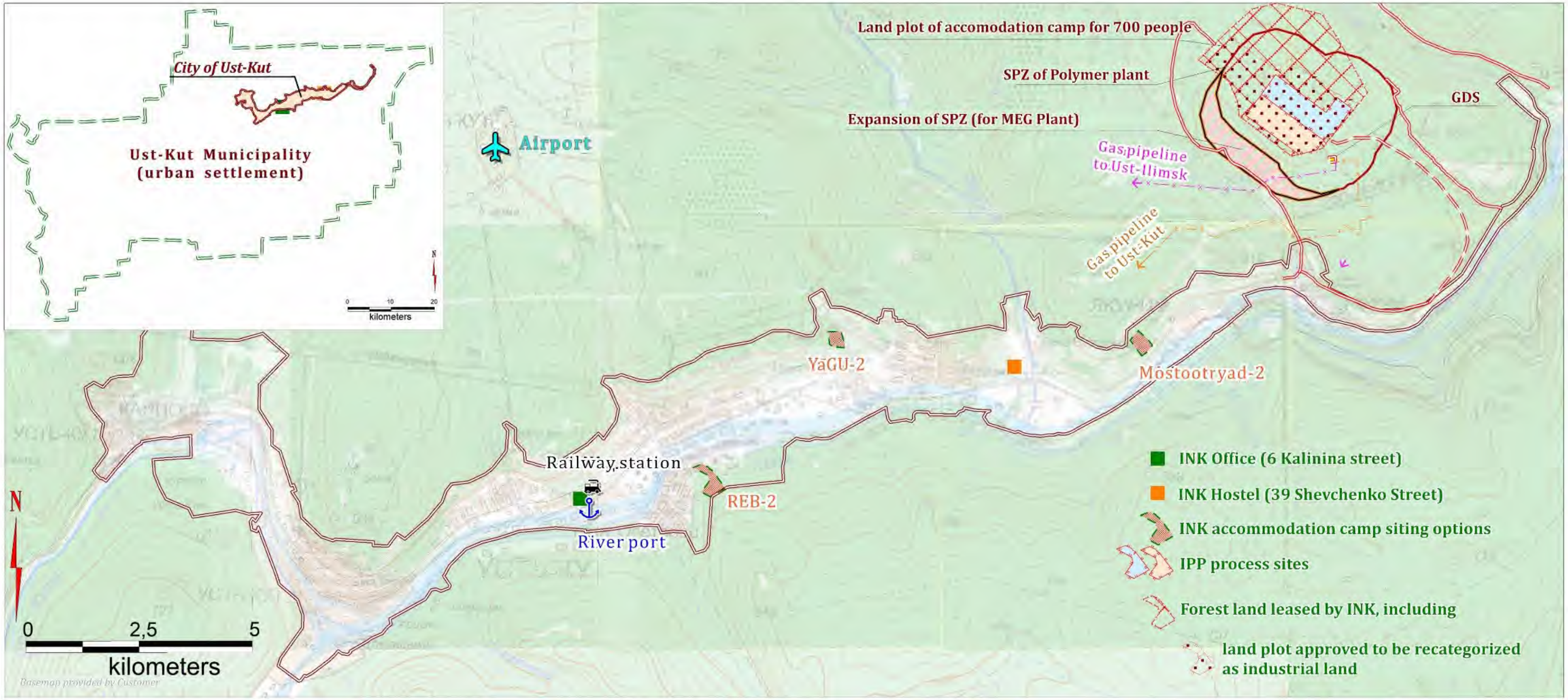


Figure 9.11.5: INK's prospective facilities within the Ust-Kut municipality (urban settlement)

10. SOCIAL IMPACT ASSESSMENT

10.1 Identification of Social Impacts Area of Influence

In accordance with Performance Standard 1 (PS1) of the International Finance Corporation (IFC), social impacts are assessed within the Project's Social Area of Influence (PSAoI). The PSAoI is identified for the territories and communities which will be subjected to significant social impacts at various stages of the Project, and subdivided into two types:

- Area of immediate (direct) influence;
- Area of consequential (indirect) influence.

The following territories and communities have been included into PSAoI, based on the Project description, in particular location and boundaries of the Project facilities, as well as on information on potential impacts of various components of the Project:

- Area of immediate (direct) influence:
  - Kedr-2 Gardening Association (receptors - local land users of the gardens, including vulnerable communities);
  - Mostootryad neighbourhood including users of the land plots in 2nd Lesnaya Street (receptors - local residents);
  - Yakurim neighbourhood (receptors – local residents);
  - Section of the Vilyui motor road of federal significance (receptors – users of the road);
  - Forest areas adjoining the Project sites (receptors - local hunters);
- Area of consequential (indirect) influence:
  - Population of Ust-Kut city in general (receptors – users of social infrastructure, other municipal infrastructure, job seekers, business owners, potential beneficiaries of the Company's corporate social responsibility activities);
  - Population of Ust-Kut district in general (receptors – users of social infrastructure, other municipal infrastructure, residents of villages downstream the Lena River, job seekers, business owners, potential beneficiaries within the framework of the Company's corporate social responsibility activities).

10.2 Overview and Assessment of Positive Social Impacts

Positive impacts are related to the economic and social benefits the Project may create for the communities in PSAoI which are now in need for socio-economic development as confirmed by the baseline study. The Project will generate significant and long-term benefits for local communities via new employment opportunities for young people and other social groups, attracting additional workforce, creating sales opportunities for local businesses through the Project procurement system, and providing support as part of corporate social responsibility programmes. However, significance of these positive impacts may be enhanced and increased through specific corrective actions described in Section 10.3.1 which in particular include implementation of the Local Recruitment Policy and the Local Procurement Policy.

Summary of the anticipated key positive effects of the Project is provided below.

- Increased tax revenues at various levels of public budgets;
- Increased investment attractiveness of Ust-Kut District and Irkutsk Region;
- The Project may facilitate development of gas distribution system in Ust-Kut city;
- Corporate social responsibility efforts of INK enhance the ability of local communities to adapt to the changing socio-economic conditions and enhance their cultural and human capital;
- The Project will support in-migration of young professionals and retention of local young specialists;
- Increased standard of living through provision of additional Project-related income opportunities may potentially improve overall living conditions and public health status in general;

- With specific corrective measures applied, the Project may increase the level of incomes of certain vulnerable groups.
- Indirect positive impact of the Project on development of educational programmes in Ust-Kut district;
- Induce development of local small and medium businesses, both direct (through contracting of local companies) and indirect (provision of new product sales markets due to attraction of workforce);
- Increased employment of local residents;
- The employment opportunities will decrease the level of unemployment among local residents and may contribute to reduction of out-migration of young people which is one of the key problems in the Project area (according to the demographic studies);
- Local procurement opportunities will be beneficial for local businesses and indirectly support additional job generation.

Sensitivity of all receptors of the positive impacts is assessed as *medium* to *high* (for the vulnerable groups and receptors of high intensity impacts), and as a rule the positive changes produce *long-term* effect. The scale of the positive impacts will vary from *local* (at the level of Ust-Kut district and Ust-Kut city) to *regional*. Therefore, significance of the positive impacts of the Project is assessed as **high**.

Some of the above positive impacts have been assessed in more detail, namely: employment opportunities (Section 10.3.1), economic benefits for local businesses (Section 10.3.2) and demographic changes (attraction and retention of young professionals - Section 10.3.9).

10.3 Assessment of Selected Positive and Negative Social Impacts

10.3.1 Employment opportunities

<u>Impact description</u>

The Project may have a positive impact on local residents' employment in the extractive sector, which is the most important sector of the district and regional economy. The Company is committed to increase local employment share. In 2016, 74% of INK employees were residents of Ust-Kut city or Ust-Kut district. In 2019, the Company confirmed high share of local residents working in the Ust-Kut branch of INK.

The Company can influence the level of local communities' employment directly (by employing local residents), via its contractors or by procuring local small and medium businesses for Project needs. The Polymer Production Facility Project is expected to provide employment for 7,000 persons during construction and create 881 positions at the operation stage. The MEG Plant will employ 4,000 construction workers and create 837 positions for operation.

The impact is assessed as *moderate* due to its *regional* extent and *long-term* duration. It should be noted that the Project will create a significant number of jobs in the extractive sector which plays an important role in the local labour market. Importantly, the Project will offer long-term employment for residents of the district and region. The impact significance is assessed as **high**.

<u>Measures to enhance significance of the positive impact</u>

To maintain the high significance of the Project benefits, it is proposed to implement a system of measures aimed at increasing the share of local qualified professionals in the personnel structure of the Company and its contractors:

- job fairs in Ust-Kut;
- where possible, cooperation with local employment centres and recruitment agencies for more detailed analysis of labour market and diversification of recruitment channels for potential employees;
- disclosure of the Company's HR policy including preferences for local candidates (all other conditions being equal);
- at recruitment, it is recommended to employ representatives of vulnerable groups, provided that all other professional characteristics of the job seekers are equal;

- cooperation with education establishments in Ust-Kut city and district, including facilitation of the following:
    - internships for students;
    - site visits to the Project facilities for students;
    - participation of the Company's specialists in the training process as guest lecturers or mentors.

As a corrective measure, it is recommended to develop and implement a so-called Local Recruitment Policy for the construction stage. The Local Recruitment Policy will be applicable to the Company and its contractors/subcontractors with certain number of personnel on the Project sites (e.g. more than 50 employees engaged on site). The Policy will provide an accurate definition of "local personnel" (e.g. a person registered in Ust-Kut city or Ust-Kut district, or in Irkutsk region) and establish the ratio of local and non-local employees for each category of personnel, e.g.:

- unskilled[286] labour: 80% of local personnel;
- semiskilled labour: 40% of local personnel;
- skilled labour: 10% of local personnel.

The Policy will further define the recruitment and employment procedures. The recommended practice provides for preparation of a local workers database well in advance using the information available at employment agencies, and recruiters (within the Company and its contractors/subcontractors) must be obliged to use the database for selection of personnel of the respective categories in accordance with the definition above. The Policy will clearly prioritize candidates' qualification for recruitment.

In accordance with current best practice in oil and gas industry, special focus at recruitment shall be on residents of areas nearest to the Project (e.g. Mostootryad and Yakurim).

Assessment of residual impact

The impact significance after implementation of the suggested mitigations will remain **high**.

10.3.2 *Economic benefits of engaging local contractors for the Project*

Impact description

As discussed above (in Section 10.2), the Project may produce a significant positive impact on development of local (Ust-Kut city and Ust-Kut district) and regional (Irkutsk region) economy. Contracting local businesses for the Project implementation is expected to be one of the main components of this impact.

Probability of the impact to occur is assessed as *high*. The impact scale is assessed as *regional* (business community of Ust-Kut district and Irkutsk region). The impact is expected to be *medium-term*, primarily during the Project construction. The impact intensity is assessed as **high**.

Measures to enhance significance of the positive impact

In order to maintain the high level of significance of the impact, it is proposed to develop and implement a Local Procurement Policy.

The mechanism of the Local Procurement Policy is similar to the Local Recruitment Policy: preference will be given to contractors registered within the Company's area of operation (i.e. in Ust-Kut district, Ust-Kut city, and Irkutsk region). Once implemented, the Procedure will be applicable to all contractors and subcontractors engaged on site.

Assessment of residual impact

The impact level after implementation of the suggested mitigations will remain **high**.

[286] These categories must be clearly defined in the Policy, in compliance with the categories recognized by the Labour Code of the Russian Federation, or adopted by the Russian oil and gas industry.

10.3.3 *Potential resettlement and economic displacement*

The PreESIA studies in 2017 included a preliminary assessment of potential resettlement of residents or temporary occupants of the Kedr-2 Gardening Association. However, currently the Project is not expected to result in resettlement or economic displacement, as the main construction site has been moved further away from the concerned areas.

Economic displacement is possible due to potential limitation of hunting and fishery activities. This potential impact is considered below (see Section 10.3.15).

10.3.4 *Public health risks in Ust-Kut city and district related to Project construction and operation of the Polymer Plant*

10.3.4.1 Community physical health risks

Impact description

Potential risks for community physical health in Ust-Kut city and Ust-Kut district may be caused by the following factors:

- dust emissions at the Project construction activities;
- air emissions at the Project operation phase;
- contacts between Project personnel and local communities;
- impacts related to community safety caused by the Project vehicles traffic.

Analysis and assessment of Project impacts on air quality is provided in Section 9.2. Furthermore, in Section 9.2 specific measures are proposed in order to reduce significance of air emissions. It should be noted that no temporary or permanent residence of people fall within the Project SPZ.

Dust emissions at the Project construction phase will be associated with earthworks on the site and movement of heavy machinery (e.g. transportation of loads and personnel). It is anticipated that the main receptors of this impact may be residents of Mostootryad neighbourhood (including owners of the plots in 2nd Lesnaya Street) and Yakurim neighbourhood. Probability of dust emissions from the above operations is assessed as *high*.

The risk of contacts between Project personnel (at the construction phase) and local residents is associated with sexually transmitted diseases. HIV/AIDS morbidity in Ust-Kut district and Irkutsk region is a matter of special concern. Another issue which deserves additional attention is the lack of qualified personnel and equipment in the local healthcare institutions.

The impacts on community safety due to the Project vehicles traffic are considered and respective mitigations are proposed in Sections 10.3.13 and 10.3.14.

Probability of the impact to occur is assessed as *high*. The receptor sensitivity is assessed as *medium* (residents of Ust-Kut city and Ust-Kut district in general) or *high* (if vulnerable stakeholder groups are affected). Prior to implementation of corrective measures the impact is expected to be *long-term*, *irreversible* and *local* (population of Ust-Kut district). The impact level is assessed as **high**.

Mitigation measures

Significance of the impact on physical health of communities in Ust-Kut city and Ust-Kut district can be reduced by the following measures:

- measures described in Section 9.2, covering the impacts of pollution and dust emissions;
- introduction of a Code of Conduct for Project personnel to be followed by contractors and subcontractors. The Code will include the following:
  - respectful attitude towards cultural and behavioural norms of local communities;
  - prohibition of hunting, fishing and gathering for all personnel of the Project;
  - refraining from any activities which may have adverse consequences for local communities, and any types of behavior which may be destructive for the local norms of conduct;

    - demonstration of neutral and "non-involvement" attitude, and avoidance of disputes in case of potential conflicts;
- disciplinary sanctions applicable in case of breaches of provisions of the Code, depending on severity of violation.
- informing the Project personnel about the risk of sexually transmitted diseases, in particular HIV/AIDS;
- provision of STD prevention devices (contraceptive sheaths) accessible at the Project medical stations where any worker may obtain it anonymously;
- regular activities for promotion of healthy lifestyle and sports (e.g. competitions between groups of Project personnel);
- development of Workers' Accommodation Policy and Plan;
- arrangement of recreational and leisure activities for Project personnel in the accommodation camp.

Assessment of residual impact

After the mitigations are implemented, significance of the residual impact will be reduced to a **moderate** level.

10.3.4.2 Public psychological well-being risks

Impact description

Risks to psychological well-being of residents of Ust-Kut city and Ust-Kut district may be caused by conflicts/social tension due to contacts between local community (including hunters and fishers) and Project construction personnel, and raised expectations of local residents in relation to the Project (psychological health).

It is anticipated that at the peak of construction phase (2019-2021) the Project will engage about 7,000 persons, mainly non-resident (shift) personnel employed by construction contractors of INK.

In case of conflicts with the Project personnel, the main recipients of the impact will be residents of Ust-Kut, in particular local hunters and fishers, residents of Yakurim and Mostootryad neighbourhoods and users of the Kedr-2 Garden Association.

Assessment of the impact takes into account the long presence of INK in Ust-Kut district and Ust-Kut city, as well as regular social activities of the Company which provides support to local communities in the city and rural settlements of the district. This may include the following:

- support of local educational and cultural institutions (purchase of furniture, multimedia equipment, sports equipment, refurbishing activities, financial aid, grants for students, etc.);
- targeted aid to local residents (e.g. multi-child families);
- provision of fuel for for heating of dwellings (e.g. gas);
- assistance to local organizations of indigenous small-numbered peoples of the North.

The above measures facilitate local resident's satisfaction about presence of the Company in the district, ease tensions between groups of migrant personnel of the Company and local communities, and in general reduce significance of the negative impact on psychological well-being of local communities.

Impact on psychological well-being is further lessened by provision of the Company public grievance mechanism and the Rules of Conduct for INK personnel in the areas of traditional activities of indigenous small-numbered peoples and similar ethnic groups of the Mid-Siberian North.

The receptor's sensitivity is assessed as *medium*. The impact will be *mid-term, local* and *reversible*. In view of the above, the impact significance is assessed as **moderate**.

Mitigation measures

Significance of the impact on psychological well-being of local communities can be reduced by the following measures:

- employment of local residents as far as possible;

- introduction of check-in-check-out system at all Project sites including the accommodation camp;
- introduction of a Code of Conduct for Project personnel to be followed by contractors and subcontractors;
- arrangement of recreational and leisure activities for Project personnel;
- provision of a shop at the accommodation camp.

Assessment of residual impact

The mitigation measures will reduce the impact significance to a **low** level.

10.3.5 Community dependence on social support from INK

Impact description

The Company takes an active part in the life of Ust-Kut district and Irkutsk region by implementing a range of social activities financed by INK. Such activities are regarded by the Company as support for socio-economic development of Irkutsk region. In 2019, the Company planned to spend over 20 million roubles on social activities in Ust-Kut district including support for construction and rehabilitation of leisure and entertainment facilities, provision of storm water drainage system in the city's main street, financial aid to Veteran Councils, etc. The total amount allocated by the Company for social activities in Irkutsk region in 2019 is more than 100 million roubles.

It should be noted that financial support provided to various organizations and public institutions may be of dual nature. On the one hand, the aid provided to healthcare institutions, development and support of energy sector at the district and regional level, provision of finance for various cultural and social events (e.g. festivals, clean-up events), purchase of equipment for modernization of local education system improve relationships between the Company and widest range of stakeholders, and at the same time improve quality of life of local communities.

On the other hand, the above actions on the part of the Company may also cause certain negative social effects. This practice may be perceived as a "fast-track" to obtain so-called "social license to operate", i.e. public encouragement of INK activities. The Company's press releases and social reports often refer to financing of various projects which as a rule relate to purchase of equipment and furniture for various municipal institutions. Such activities, although important, may in a long term induce the effect of "continual donation" where public authorities and local communities will perceive this kind of social contract as a norm for years to come. This activity is not fully consistent with the concept of sustainable development which is specified, *inter alia*, in EBRD documents (e.g. in the Project Requirement 7, item 21).

In view of the practice currently adopted by the Company, probability of this negative impact is assessed as *medium*. Scale of the impact is identified as *regional*. Its duration is assessed as *long-term*. Its receptors include local communities, regional and district administrations and have *medium* sensitivity. Therefore, significance of the potential impact is assessed as **moderate**.

Mitigation measures

It is recommended that the company revises its social responsibility approach and focus the efforts on incentivizing and encouraging development of human, cultural and social forms of capital of local communities. Such an approach will decrease direct provision of finance to communities and organizations; however it will still support a variety of activities developing a potential of local communities. Examples of such activities include training and re-training programs for local residents, internships at the Company's projects, business development support programmes, sports events, clean-up events and other forms of collaboration between the Company and local communities aiming at enhancing the territory of Ust-Kut city. This strategy will be oriented to development of local communities and opportunities for future generations.

In addition, the programmes of support to local communities will be agreed with local authorities (e.g. administrations of Ust-Kut city and Ust-Kut district) well in advance, in order to ensure more efficient planning and eliminate reliance on INK in case of unforeseen issues.

It is further recommended to develop a corporate Social Investment Plan / Community Development Plan in line with the IFC requirements and best practice. This document will help to ensure that the adopted social measures match the principles of sustainable development and the Company's business objectives. The document should be developed with due account for existing territorial development documents and plans, as well as local resources and development needs identified through consultations with local communities.

Assessment of residual impact

The above mitigations will reduce the impact significance to **low**.

10.3.6 *Negative impact on social infrastructure of Ust-Kut city and Ust-Kut district municipality*

Impact description

As mentioned above, at the construction phase the Project will engage personnel from local communities, and also from other regions of the Russian Federation.

As the number of personnel at the construction sites of the Project and associated facilities will grow, the load on local healthcare infrastructure may also increase. Additional load on the healthcare institutions may be created as a result of traffic accidents, as well as other accidents or emergency situations (e.g. mass food poisoning) in the Project area. Another risk is associated with sexually-transmitted diseases which might spread as a result of contacts between the Project personnel and local communities (refer to Section 10.3.4).

However, probability of this impact is significantly reduced by several factors. Firstly, the approach adopted by INK at other projects in Ust-Kut district demonstrates that the Company's facilities are adequately equipped to ensure safe and healthy accommodation and working conditions. Those include heated portable accommodation units, a canteen which is regularly inspected for compliance with sanitary norms, medical station with the required medicines, skilled doctors, and gyms available at some sites. Health and safety trainings are provided on a regular basis in order to minimize the risk of occupational injuries. It is anticipated that the Company will follow the established practices also for Project subject to this assessment.

It is also probable that the load on local education infrastructure (schools and kindergartens) will increase if personnel of the Polymer Plant will move to Ust-Kut with their families.

However, the above impacts will be minimised by construction of the INK residential quarters which is expected to include all required social infrastructure (according to the FS Report prepared by NII "Zemlya i gorod").

Probability of the impact is assessed as *low*, its scale is *local*, and duration is *long-term*. Considering the planned construction of residential quarters and associated infrastructure, the impact intensity will be *low.* Sensitivity of the receptors (local residents) is *high*, as the social infrastructure is used, *inter alia*, by vulnerable groups. Therefore, significance of the risk is assessed as **moderate**.

Mitigation measures

The impact can be mitigated by the following corrective measures:

- continuation of the Company's current practices in the sphere of health and safety of Project construction and operation personnel;
- provision of transport at the Project sites (where needed) for transportation of patients to the central hospital of Ust-Kut;
- in case of in-migration of employees' families at the operation phase it is recommended to consider implementing joint projects with Ust-Kut city administration for extension of social infrastructure capacities (schools, kindergartens and out-patient medical center);
- liaison with Ust-Kut City Administration and management of the educational and healthcare institutions to clarify actual load on the facilities and design capacity of the social infrastructure associated with the Company's residential quarters;

- Development and reconstruction (as appropriate) of social infrastructure in the areas of Ust-Kut adjoining the REB-2 site - the preferred location for residential area at the Project operation phase (according to the FS report prepared by NII “Zemlya i Gorod”);
- implementation of measures in the sphere of traffic safety (Section 10.3.13), public health (Section 10.3.4), occupational health and safety (Section 10.3.10).

Assessment of residual impact

It is expected that the above corrective measures will reduce significance of the residual impact significance to ***low***.

10.3.7 Labour conditions

Impact description

Potential negative impacts in the sphere of labour conditions may be triggered in case of Company’s failure to comply with specific requirements of Russian law and international standards, resulting in:

- violation of employees’ rights (e.g. with respect to overtime work, ensuring rest and holidays, salary payment, workers’ unions, confidential treatment of personal data of employee);
- lack of control over contractors’ performance in the sphere of labour relations;
- any type of discrimination of employees;
- tensions between various groups of personnel and the Company management;
- failure to provide healthy working conditions for Project personnel.

Although the above consequences are not totally improbable, the desk and field studies have identified that the Company’s practice in the sphere of labour and working conditions is in general compliant with the requirements and spirit of Russian law (primarily the Labour Code of the Russian Federation) and international requirements adopted by the financing institutions (e.g. EBRD Performance Requirement 2). In particular, the Company is implementing the following activities (as part of a range of corporate policies and agreements, including the Collective Bargaining Agreement and Rules of Conduct) which are intended to prevent the above consequences:

- provision of safe and healthy conditions for work, including full information about health and safety requirements, working conditions, and provision of adequately arranged and equipped medical station at the Project construction site;
- provision of refresher training and opportunities for skills improvement;
- training of personnel on health and safety requirements and internal regulations of the Company;
- timely salary payments based on skills and professional capabilities, without any bias relating to employer’s preferences or personal characteristics of employee other than related to her/his direct duties. Employee is familiarized with all internal regulations of the Company (e.g. Regulations on Compensation which specifies, *inter alia*, potential additional payments and allowances);
- guaranteed annual paid leave for all personnel;
- protection of employee’s personal information;
- overtime work is paid and/or compensated for in compliance with provisions of the latest version of the Labour Code of the Russian Federation;
- maximum duration of a rotation shift (if applicable) is one month;
- minimum duration of annual paid leave is 28 calendar days and can be extended to up to 51 days (in certain situations, e.g. in case of potentially harmful and/or hazardous conditions of work);
- guarantee of mandatory health insurance and social insurance in case of accidents at works and occupational diseases;
- prohibition of all types of discrimination at work;
- provision of a wide range of social guarantees (in accordance with INK Regulation on Guarantees and Compensations) including:
    - financial aid;
    - free medical services and consultation as part of voluntary health insurance;
    - payment of health resort or rehabilitation treatment costs;

- arrangement of recreational and sports activities (including compensation of cost of season tickets for fitness clubs, swimming pools, gyms);
- cash compensation on resignation of employees who reached retirement age.

It should be noted that INK adopts a responsible approach to recruitment of women, securing their rights and prevention of discrimination based on gender. In 2016, the Company employed 549 women (18.52% of the total number of personnel) which correlates well with the global trends and practices[287]. It is also notable that the head of INK is female.

The Company has introduced a Procedure "Internal and external communication as part of Integrated Management System" which regulates the grievance procedure relating to employment relations (including occupational health and safety issues) and potential environmental impacts. The procedure is intended for both internal and external stakeholders.

Potential impacts may be caused by labour conditions-related offences committed by contracted organizations. However, the Company has issued a Standard "Requirements in the sphere of occupational health and safety and environmental safety" which requires that contractors and subcontractors to abide the applicable requirements in the sphere of occupational health and environmental safety requirements.

Taking into account the Company's activities, practices and capabilities (including its corporate Policies) in the sphere of management of labour relations and prevention of related violations, the impact (if any) will be *short-term* and *local*, and its probability at the operation phase is assessed as *low*. However, during the Project construction its probability will be *medium*, in view of engagement of large numbers of workforce and multiple contractors. Receptor's sensitivity is assessed as *medium*. Overall significance of the risk is assessed as **moderate** for the Project construction and **low** for operation.

Mitigation measures

Description of proposed measures to reduce probability of potential negative impacts in the sphere of labour relations is provided below.

It is recommended that INK requires the Project contractors and subcontractors to comply with the labour law of the Russian Federation as a special clause in the service and supply contracts. INK will monitor contractors and subcontractors at the Project sites for compliance with requirements of the Labour Code of RF.

INK should make sure that the Procedure "Internal and external communication as part of Integrated Management System" is fully functional, alongside with provision of other grievance mechanisms for contractors and subcontractors. Management of contractors and subcontractors should be aware of the need to allow for anonymous submission of grievances from their personnel.

It is anticipated that INK will include the requirements in the sphere of labour relations into all supply and service contracts (the Standard "Company requirements in the sphere of occupational health and safety and environmental safety" can be used as an example). Contractors, in turn, will be obliged to apply the same requirements to their subcontractors. INK will monitor compliance with the requirements at all stages of construction and operation.

Assessment of residual impact

It is expected that after the corrective measures are implemented, residual impact significance will be reduced to ***low*** at the construction phase and **negligible** during operation.

10.3.8 Demographic impact of temporary and permanent immigration in Ust-Kut

Impact description

The PPF construction is expected to attract 7,000 workers, while MEG Plant will engage circa 4,000 workers; the vast majority of the workforce will be men at the age from 18 to 40-50 years (by the time

[287] World Economic Forum. Closing the Gender Gap in Oil & Gas: A Call to Action for the Industry

of reporting, total number of INK personnel in Irkutsk Region was 5,000). It should be noted that total population of Ust-Kut city is circa 41,000.

The main worker's inflow is expected during the short-term period of construction of the Project and associated facilities. Therefore, the following situation is anticipated during that period:

- population number in Ust-Kut city and Ust-Kut district will increase;
- the balance of male and female population will change as the proportion of men will increase;
- the age group between 18 and 40/50 years will increase in number;
- out-migration of young people may decrease due to the employment opportunities offered by the Project and associated facilities, as well as other businesses in the city.

This impact cannot be perceived as definitely positive or negative as it may have both negative and positive consequences for local communities and potential of Ust-Kut city. This ambiguity is reflected in the proposed corrective measures (see below). The Project will attract young professionals to Ust-Kut and create jobs for local young residents. Thus, it will weaken the out-migration trends among the young age groups of population, and local administration will be able to plan their activities based on a larger share of young people and population of employable age.

After construction activities are over, demobilization activities will be implemented.

At the operation phase, PPF will employ 881 persons and the MEG Plant will employ 837 persons (partially on a rotation shift basis). It is expected that local residents will fill in part of the positions generated by the Project. Therefore, no significant impact on the city's demographic struture is anticipated in relation to the labour immigration at the operation phase.

The impact scale is assessed as *local* (communities in Ust-Kut city and Ust-Kut district). The impact duration will be *mid-term*. Receptor's sensitivity is *medium*. The impact will be *reversible*. Significance of positive effects of the impact is assessed as **high**, and significance of negative consequences is assessed as **moderate**.

Mitigation measures

The impact can be mitigated by the following corrective measures:

- measures directed to control contacts between the Project construction personnel involved on rotation shift basis and local communities, and promotion of respectful attitude of Project personnel to local communities, their norms of conduct and traditions. Such measures may include:
    - introduction of check-in-check-out system at all Project sites including the accommodation camp;
    - introduction of a Code of Conduct for Project personnel including contractors and subcontractors (see Section 10.3.4.1);
    - provision of training to inform personnel about specific attributes of local culture, as well as important economic and leisure activities of local communities (e.g. fishing and hunting);
    - informing the Project personnel about the risk of sexually transmitted diseases, in particular HIV/AIDS;
    - provision of contraceptives (condoms) for all Project personnel (at the construction and operation phases);
    - arrangement of recreational and leisure activities for the Project construction personnel in the rotation camp;
- cooperation with educational institutions of Ust-Kut city and Irkutsk region to attract young professionals to the Project.

Assessment of residual impact

It is expected that implementation of the above measures will reduce the level of negative consequences of this impact to **low**. Significance of positive consequences will remain **high**.

10.3.9 *Tensions and potential conflicts between groups of workers at the Project construction sites and the rotation camp*

Impact description

Experience of implementing major projects in the Russian Federation indicates possibility of regular conflicts between shift workers. Conflicts and tensions can be caused by various factors of which the most important are:

- drinking of alcohol and drug consumption by personnel;
- congested accommodation camps;
- poor living conditions in accommodation camps;
- dissatisfaction with working arrangements (e.g. in case of regular working overtime);
- tension caused by temporary detachment of workers from family and friends;
- lack of entertainment for Project workers.

This impact should be assessed taking into account the experience gained by INK in the sphere of control of relationships between various groups of personnel. It is known that the Company regularly arranges sports events (e.g. INK Olympics – sports competitions with representatives of local communities involved), various cultural events for personnel and local communities (concerts, festivals, performances), provides adequate rest and leisure facilities for personnel (special rooms for rest, gyms, wi-fi, libraries). It is expected that the same high level of recreational and leisure arrangements will be maintained in the Project workers’ camp.

On the other hand, during the visit to accommodation camp of a contractor of INK in March 2019, Ramboll observed the living conditions which do not comply with international requirements (inadequate residential facilities, toilets and showers, scarce area per occupant in bedrooms, presence of stray animals in the camp, etc.). These observations indicate a risk that personnel accommodation services (especially those provided by (sub)contractors) may fail to comply with international standards.

The impact of potential tensions and conflicts between groups of workers will be *local* in scale. The impact duration will be *mid-term*, related to construction of the Project and associated facilities. Magnitude of this impact is assessed as *moderate*. Sensitivity of the receptor (workforce) is *medium*. Therefore, significance the impact is assessed as **moderate**.

Mitigation measures

In order to minimize the impact, it is recommended to develop a Construction Accommodation Management Plan that will describe:

- applicable requirements and standards;
- arrangement of the accommodation facilities (including safety and security, access to accommodation and catering facilities, quality of food, medical services, etc.);
- management of impact of construction labour migration;
- grievance mechanism, etc.

To minimise the impact, the Company should further introduce a Code of Conduct for the Project personnel which will also cover contractors and subcontractors.

Assessment of residual impact

After the above mitigation measures are implemented, the residual impact significance will be **low**.

10.3.10 *Occupational health and safety risks*

Impact description

Experience of similar projects in Russia and elsewhere shows that the Company and its employees are exposed to certain risks in case of failure to adequately manage occupational health and safety risks in compliance with Russian law and provisions of IFC Performance Standard 2. Potential impacts and impacts may include:

- occupational injuries as a result of failure to comply with safety requirements, in particular when working at height, handling heavy loads, working in confined spaces, and performing hazardous operations, e.g. welding (the list is not limited by the mentioned aspects), as well as potential industrial accidents;
- occupational diseases, including respiratory diseases due to exposure to impact of chemicals;
- transport risks at the Project sites and on the routes between the Project sites and workers' accommodation facilities, or external sites, e.g. river berth, etc. which are related to the Project in one way or another (e.g. LPG Terminal).

Experience of similar projects indicates that personnel of the project Company and its main contractor are bound with strict rules and receive adequate health and safety training, and the main risks are commonly related with the contracted organizations which may be less aware of the statutory requirements and best practices in the sphere of occupational health and safety.

It should be noted that selected site of one of the accommodation camps (the main one) is situated in the future sanitary protection zone of the Project facilities. According to Russian law, people may not stay within SPZ longer than two weeks.

The main hazard at the construction phase is related to handling gaseous substances, which, according to similar projects' experience, is typically carried out by skilled personnel of the project company and its main contractors (in the case of the Project, by INK and main contractors).

Regular monitoring of occupational health and safety performance by INK is provided by means of preparation of regulatory statistical reports (e.g. Form 7 – Injury Rate), and in accordance with internal corporate regulations, including the Standard on Organization of Interaction in the Sphere of Occupational Health and Industrial Safety. As mentioned in Section 10.3.7, the Company closely monitors contractors' activities as specified in the internal regulations of which the main one is the Standard "Company requirements in the sphere of occupational health and safety and environmental safety".

The Company has developed adequate institutional capacities for management of occupational health and safety issues and is focused on application of the best international practices, which is also reflected in the organization structure of INK. In particular, the Company has an OHS Department with the following units:

- Occupational Safety Unit;
- Operational Control Unit;
- Expert Review and Best International Practices Unit;
- Accidents Analysis and Investigation Unit;
- Transport Safety Unit;
- Fire Suppression Unit;
- Fire Safety Supervision Unit;
- Civil Defense and Emergency Preparedness and Response Unit.

Functions of each unit are clearly defined in the document "Organization Structure of Units Subordinated to Deputy General Director for OHS".

In addition, INK signed an agreement with Municipal Public Institution "Unified Operations Control Service" of Ust-Kut municipality (MKU EDDS UKMO) which regulates interaction between the Company and MKU EDDS UKMO in case of fires, accidents and emergency situations at INK facilities in Ust-Kut district. The agreement strengthens the Company's capability to provide a timely and adequate response to industrial and other incidents.

The expected impact (if any) will be *mid-term* and *local*, and its probability is assessed as *medium.* Receptor's sensitivity is assessed as *medium*. Overall significance of the risk is **moderate**.

<u>Mitigation measures</u>

It is expected that the Company will aim to minimize occupational risks and hazards for personnel working at the Project sites. In particular, the following measures are recommended:

- INK will oblige its contractors to develop occupational health and safety plans for various phases and components of their work;
- responsible contractors will prepare analysis of the extent of hazard related to specific types of works which are considered as potentially hazardous (e.g. construction activities related to working at height, working in confined space (e.g. in tanks), etc.) and submit it to INK for approval;
- INK will provide workers accommodation in conformity with the applicable sanitary norms of the Russian Federation and the best international practice (in particular IFC and EBRD Guidance "Workers' Accommodation: Processes and Standards" and associated sanitary norms). Similarly, INK will require that contractors and subcontractors observe the same accommodation standards;
- in view of the tuberculosis and HIV/AIDS morbidity rate in the Project's area of influence, INK will oblige its contractors to provide examination of their personnel for the above diseases on recruitment and further at least once per year.

Assessment of residual impact

Implementation of the above corrective measures will reduce the impact level to **low**.

10.3.11 Project sites security risks

Impact description

Security services at the Project sites are provided by a licensed contractor, with guards armed with non-lethal weapons (rubber truncheons). There are no plans for use of firearms by security personnel[288]. Behaviour of security personnel may potentially affect safety of local communities in the following situations:

- exceeding of the guard's authority (e.g. use of physical force in conflicts with local hunters and fishers);
- use of force by guards in case of wrongful acts of local residents (e.g. theft of Project equipment or machinery).

At present, security services at the Company's sites are provided by OP Obereg, LLC (contract of 2016) which holds a license issued by the Department of the Ministry of Interior for Irkutsk Region. According to the Company, all activities of the security contractor (including handling and use of non-lethal weapons and arms, as required) are regulated by law of the Russian Federation (the Law "On Private Detective and Security Activity in the Russian Federation" of 11.03.1992 No.2487-1, Government Resolution of RF of 14.08.1992 No. 587 "Issues of private detective and security activities" with amendments and revisions, and several other acts). Representatives of the security contractor reported the following violations that were identified by the guards contracted by INK:

- INK and contractors' personnel under influence of alcohol and drugs;
- unauthorized access to sites and living sites on vehicles;
- transportation of unauthorized objects (by hand or vehicles);
- theft of property;
- violation of vehicle traffic rules on sites.

The above violations were prevented without use of fire arms or non-lethal weapons, and no injury or lethal incidents have happened.

Impact assessment

The impact is *long-term* and *local* in scale. Its magnitude is assessed as *low*. Receptor's sensitivity (local communities) is assessed as *medium*. Significance of the potential impact is assessed as **low** or **moderate**.

Mitigation measures

The security impact can be further mitigated by the following measures:

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[288] Interview with Director of security contractor OP Obereg in March 2019.

- additional training for the Project security guards with the main focus on observation of the Voluntary Principles on Security and Human Rights;
- the preferred method to protect the Project property shall be prevention (provision of safe cabinets, locks, fences, etc.);
- development of a Code of conduct and familiarization of security personnel with its provisions at the time of recruitment (against signature), and provision of additional training (if required) on customs and cultural norms of the local communities.
- provision of means to prevent unauthorized access to the construction and operation sites (fences, checkpoints, etc.);
- grievance mechanism.

Assessment of residual impact

The residual impact on safety of local community after the proposed mitigation measures is assessed as **negligible**.

10.3.12 Impact on infrastructure of Ust-Kut city and district

Impact description

The Project may affect certain elements of infrastructure in Ust-Kut city and Ust-Kut district which will be exposed to increased load, including:

- transport system of Ust-Kut city;
- municipal water networks.

At the Project construction and operation, the Company and its contractors will use the Vilyui motor road of federal significance and the road network of Ust-Kut city and Ust-Kut district for the following operations:

- delivery of goods to (e.g. building materials) and from (e.g. wastes) the construction site;
- transportation of end products at the operation phase;
- potentially – cargo transportation by the Lena River (during construction and operation phases);
- transportation of loads (including stock materials for the Polymer Plant) by railway (at the operation phase);
- transportation of personnel involved in the Project construction and operation.

Therefore, the Project may potentially result in deterioration of the transport infrastructure (deterioration of road pavement, restricting traffic on public roads, etc.). In particular, the road along the Kedr-2 Gardening Association may be damaged (at the time of reporting, the road is used for loads transportation by trucks of the Company and contractors). However, it is expected that the road will not be actively used at the Project operation phase, as the interfacility road (associated facility of the Project) will be constructed by that time.

At the consultations in May 2017, local stakeholders expressed their concerns about the local roads condition and noted the lack of rehabilitation activities from other projects in the city and the district. These concerns highlight sensitivity of the receptor.

Drinking water supply for the Project construction and operation will be provided from the well in the Polovinnaya River valley. Therefore, the Project will not increase the load on municipal water networks.

The Project impact on transport system will be *site-specific/local*. The impact will be present during the construction and operation phases, i.e. its duration will be *long-term*. The impact magnitude is assessed as *high* for the construction and *medium* for the Project operation phase. Receptor's sensitivity is *medium* (*high* if vulnerable groups are affected). Therefore, the impact significance at the construction phase is assessed as **high**, at the operation phase - **moderate** (high, if vulnerable groups are affected).

Mitigation measures

The impact can be mitigated by the following measures:

- Development and/or reconstruction of municipal infrastructure in relation to construction of residential area in the REB-2 site - the preferred location for development of the residential area, according to the FS report;
- analysis of transport infrastructure of Ust-Kut city and Ust-Kut district (preferably by a traffic engineer) including:
    - identification of transport routes and modes required for the Project;
    - identification of rush hours and seasons when roads are most busy;
    - key routes of public motor transport (including routes used by local communities for trips to their country houses and gardens, and routes used by vulnerable communities);
    - baseline survey of the road network, including assessment of pavement quality and maintenance schedule;
    - assessment of resources of the road maintenance companies, Ust-Kut city and Ust-Kut district Administration to maintain roads in adequate state;
    - additional traffic which will be generated by the Project;
    - distribution of the Project traffic by routes and modes of transport;
    - alternative routes and modes of loads transportation;
    - assessment of traffic generated by other projects planned for implementation in Ust-Kut city and Ust-Kut district. This information can be obtained through liaison with local business community and public authorities;
- provide (at least at the construction phase) worker's accommodation at the facilities located as close as possible to the Project construction and operation site;
- manage the Project transportation activities so that municipal roads are used when traffic intensity is low;
- ensure observance of traffic safety rules, including speed limits;
- regular inspection of vehicle fleet to avoid breakdowns during trips and prevent consequential traffic jams on the municipal roads;
- make timely compensation payments to the city or district budget for any damage of municipal roads caused by the Project;
- develop a Traffic Management Plan to address the above issues.

Assessment of residual impact

After the above mitigation measures, significance of the residual impact is assessed as **moderate** for the Project construction and **low** for operation.

10.3.13 Community safety risks

Impact description

Safety risks for local communities may be caused by the following:

- transport operations at the Project construction and operation phases;
- potential accidents, industrial accidents and other emergency situations at the Project sites during construction and operation (refer to Section 10.3.10 for details);
- presence of security guards at the Project facilities (refer to Section 10.3.11 for details).

The Project will use passenger vehicles and heavy trucks for transportation of personnel and cargoes. Transportation of large machinery is also possible. These factors will increase the risk of traffic accidents in the district involving other road users including pedestrians.

Transportation of Project cargoes and personnel will be provided by the Vilyui road of federal significance. Transport traffic is also possible on the main road routed through Ust-Kut city, particularly if REB-2 area is selected for construction of the Company's residential quarters. During the Project construction, the road along the Kedr-2 Gardening Association may be damaged by construction vehicles (at the time of reporting, the road is used for loads transportation by trucks of the Company and contractors). However, it is expected that the road will not be actively used at the Project operation phase, as the interfacility road (associated facility of the Project) will be constructed by that time.

The public Vilyui road located in the Project's area of influence requires regular maintenance, which may cause unsafe conditions for transportation. Closure of the roads for maintenance at the construction phase may have a short-term impact on traffic and local communities. The negative effects may also include more difficult and less safe crossing of road on the way to social infrastructure facilities, shops, cafeteria, friends/neighbours, etc. The negative impact will have stronger effect on old people, children, persons with disabilities and parents with small children which, due to their physical capabilities, may be unable to cross the road quickly and safely.

Transport operations at the construction phase (and to a lesser extent at operation) may cause significant impacts without the corrective traffic management measures described in Section 10.3.12.

The impact will be *local* and potentially *long-term*. Receptor's sensitivity is assessed as *high*. The impact significance is assessed as **high** for the construction and **moderate** for the Project operation phase.

Mitigation measures

The impact can be mitigated by the following measures:

- implementation of mitigations described in Section 10.3.10 and Section 10.3.11;
- mitigations listed in Sections 10.3.12;
- strict control of compliance with traffic safety rules, including speed limits;
- regular technical inspection of the Project vehicles and elimination of identified faults;
- encouragement of joint trips (car-sharing) by the Project personnel in order to minimize the number of passenger vehicles, and use of large-capacity cars;
- support for development of pedestrian infrastructure and pedestrian crossings which would ensure adequate spatial cohesion;
- development of a Traffic Management Plan.

Assessment of residual impact

After the above mitigation measures are implemented, significance of the residual community safety impact is assessed as **moderate** for the Project construction and **low** for operation.

10.3.14 Land use and natural resource

Impact description

The Project will not affect any areas with presence or permanent residence of people. Most of the Project and associated facilities will be constructed in the designated forest land (categorisation by the time of reporting). Designated forest land of Ust-Kut district is used for hunting and gathering. The ESIA studies in the Project area did not identify any territories actively used by local communities for wild crops gathering. Gathering is practiced in forest land throughout the District area, however, mostly in the territories immediately near settlements.

The hunting provider is Ust-Kut city branch of Irkutsk Region Association of Hunters and Fishermen. The construction sites of the Project and associated facilities are located within or in the direct vicinity of 12 forest quadrants controlled by the Ust-Kut Forestry Department (IRAHF). Two amateur hunters make annual agreements with Ust-Kut city branch of Association of Hunters and Fishermen for fur animals hunting. Furthermore, 20-50 amateur hunters produce upland game (capercaillie, black grouse) and water fowl (cock duck and goose) in the area during the spring hunting period.

It should be noted that, according to the local administration and the representative of the Ust-Kut city branch of Irkutsk Region Association of Hunters and Fishermen, the Polovinka lodge area is periodically used by one of the local hunters as a warehouse as part of his hunting activities in the forest. At the same time, there is no hunting activity directly on the territory of the Polovinka lodge. The interests of this hunter should be taken into account during drilling and operation of 10 wells and the pumping station, which are planned for construction on the territory of the Polovinka lodge (see Figure 7.4.12).

Therefore, the Project will affect hunting activities of the above land users by limiting or precluding hunting within the 12 concerned quadrants (due to construction of industrial facilities within certain quadrants and migration of gaming animals to other territories).

Other hunters in the district may be affected as a result of displacement of hunters from the 12 quadrants mentioned above, and respective increase of hunting load on other quadrants. Also, other hunters may be exposed to negative impact of migration of gaming species under the pressure of nuisance factors induced by the Project (noise, light, etc.).

It should be noted that during the interview the Head of Ust-Kut city branch of Irkutsk Region Association of Hunters and Fishermen (IRAHF) expressed specific concerns in relation to the Project and other industrial activities in the district, including the following most important items:

- habitats fragmentation with the linear facilities;
- hare, capercaillie and hazel grouse are the most vulnerable species in view of the potential hunting by personnel of construction contractors of INK;
- increasing load on fresh water ecosystems of the Lena River and decrease of its water content;
- permanent odours in the area, including the odour of hydrogen sulphide and mercaptane;
- reduction of sable population as a result of disposal of territories, fragmentation of habitats, and disruption of migration routes;
- forest felling in the Project area will affect local fauna, in terms of both habitats and migration;
- noise and light impacts from the project construction site may also cause negative effect on local fauna, etc.

The impact may be caused by the influx of workforce in to the Project area and Ust-Kut city at the construction phase, which may increase the load on natural resource. In particular, it is assumed that some hunters and fishers may be present among the migrant workers (mainly male), which may increase the load on surface and water fauna and disturb the current practice of using forest and water resource by local communities. According to the opinion of the Head of the Ust-Kut branch of Association of Hunters and Fishermen consulted in 2017, construction workers involved in other INK projects engage with hunting and fishing.

Also, the representative of Association of Hunters and Fishermen is strongly against construction of any facilities in the River Lena valley, as this may produce negative impact on local fishing practices and presence of commercial fish species. In particular, the Project provides for construction of the large equipment unloading berth at the Lena river.

Any of the problems listed above may affect hunting and fishing activities.

The impact is *long-term* and *local* in scale. Sensitivity of the receptor (hunters and fishermen) is *medium*. Overall significance of the impact is assessed as **moderate**.

Mitigation measures

The impact can be mitigated by the following measures:

- arrange regular consultations with local Association of Hunters and Fishermen to receive feedback from local hunters and fishers;
- introduction of a Code of Conduct for the Project personnel including contractors, with explicit prohibition of activities related to hunting, fishing and gathering by the Project personnel (including possession of hunting and fishing gear);
- prohibition of keeping dogs in the Project territory;
- preparation of a Livelihood Restoration Plan (if needed; the need is to be identified in liaison with Association of Hunters and Fishermen, depending on availability of alternative hunting areas for the affected persons, and on the actual impact on hunters and fishermen).

Assessment of residual impact

The proposed mitigations will reduce the impact significance to **low**.

10.3.15 Cultural heritage

Impact description

As mentioned in Chapter 8, not all parts of the Project area have been covered by archaeological and historical-cultural surveys. On the other hand, it is known that archaeological chance finds are occasionally encountered during construction activities in Ust-Kut city and Ust-Kut district, i.e. chance finds are still possible at the Project sites (in particular during excavations and soil movement).

In case of chance finds, a potential impact may be triggered in the form of their damage, relocation or destruction. Probability of the impact to occur is assessed as *low/moderate*. Receptor's sensitivity is assessed as *medium*. The impact (if any) will be *local* and *short-term*. The level of the impact is assessed as *medium*. Significance of the potential impact is **moderate**.

Mitigation measures

The Company should develop and adopt a Chance Finds Procedure for all types of earth works, so that any archaeological finds will be adequately inspected, protected and preserved as appropriate depending on their cultural and historical value.

It is also advisable to make a request to the Heritage Conservation Service of Irkutsk Region for information on any known heritage sites within the areas not covered by the previous archaeological surveys, and to arrange further archaeological studies if needed.

Assessment of residual impact

The above mitigations will reduce the impact level to **negligible**.

10.4 Impacts Summary

Table 10.1 below provides summary of identification and assessment of social impacts, based on the assessment and subsequent socio-economic studies. Description of measures to manage the impacts is provided in Section 10.3.

Table 10.1: Social Impact Assessment

No.	Aspect / Issue	Direct/Indirect impact	Potential social impact	Project phase	Receptor of impact	Estimated significance of impact before and after mitigation
Positive effects						
A1	*Employment opportunities*					
	Employment and economic development of the district	Immediate (direct)	Employment of local workforce will enhance incomes and level of life of the local communities	Construction Operation	Employable age residents within the Project's area of influence and beyond its boundaries	High (Positive)/ High (Positive)
	Employment and migration	Consequential (indirect)	As mentioned in Chapter 8, there is a strong trend towards out-migration of young people of employable age from Irkutsk region. This is mainly caused by economic reasons and employment situation. Situation in Ust-Kut district can be improved in case of the Project implementation and creation of additional jobs (according to preliminary estimation, the PPF and MEG projects will create 11000 jobs at the construction phase, and approximately 1700 jobs at the operation phase).	Construction Operation	Employable age residents within the Project's area of influence	

No.	Aspect / Issue	Direct/Indirect impact	Potential social impact	Project phase	Receptor of impact	Estimated significance of impact before and after mitigation
	Employment and vocational training	Consequential (indirect)	It is mentioned in Chapter 8 that vocational training institutions are reducing their programmes due to lack of demand for certain professions. The Project development, implementation of specific measures (refer to Section 10.3.1) and employment of young local workforce will help to restore and/or create new vocational training, including programmes tailored for the Project needs.	Construction Operation	Young professionals in Ust-Kut city and Ust-Kut district	
	Employment, living conditions and community health	Consequential (indirect)	Increased life level of community as a result of additional earning opportunities may help to improve living conditions and community health in general	Construction Operation	Employable age residents within the Project area of influence	
	Employment and vulnerable groups	Consequential (indirect)	With certain corrective measures, the Project may increase the level of incomes of certain vulnerable groups.	Construction Operation	Vulnerable groups	
Positive effect on economic situation						
A2	Economic benefits	Immediate (direct)	Procurement from local suppliers may be beneficial for local businesses and indirectly support creation of new jobs	Construction Operation	All residents in the Project area of influence	High (Positive)/ High (Positive)
	Economic benefits	Consequential (indirect)	Taxes paid by the Company will produce positive impact on the local system of public administration and may contribute to the local infrastructure development	Construction Operation	All residents in the Project area of influence	
	Economic benefits	Consequential (indirect)	The employment opportunities will decrease the level of unemployment among local residents and may	Construction Operation	All residents in the Project area of influence	

No.	Aspect / Issue	Direct/Indirect impact	Potential social impact	Project phase	Receptor of impact	Estimated significance of impact before and after mitigation
			contribute to reduction of out-migration of young people which is one of the key problems in the Project area (according to the demographic studies)			
	Economic benefits	Immediate (direct)	Tax revenues for public budgets at various levels.	Construction Operation	Administration of Ust-Kut district, Ust-Kut city and Irkutsk Region	
	Economic development	Consequential (indirect)	Increased investment attractiveness of Ust-Kut municipality and Irkutsk Region	Construction Operation	Administration of Ust-Kut district, Ust-Kut city and Irkutsk Region	High (Positive)/ High (Positive)
Positive effects of the Company's corporate social responsibility activities						
A3	Corporate social responsibility	Consequential (indirect)	Benefits for local communities provided as part of the Company's corporate social responsibility activities that are expected to enhance cultural and human capital of the local communities	Construction Operation	All residents in the Project area of influence	High (Positive)/ High (Positive)
Positive effects for infrastructure development						
A4	Infrastructure development	Consequential (indirect)	The Project may facilitate development of gas distribution system in Ust-Kut city (alongside with other INK projects which are regarded by the City Administration as contribution to development of Ust-Kut gas supply system).	Operation	Residents of Ust-Kut city	High (Positive)/ High (Positive)
Positive demographic changes in Ust-Kut district and city						
A5	Demographic structure	Immediate (direct)	The Project will attract young professionals to Ust-Kut district and Ust-Kut city, create jobs for young people, which will weaken the out-migration trends among young	Construction Operation	Young people in Ust-Kut district and Ust-Kut city; Administration of Ust-Kut district and Ust-Kut city	High (Positive)/ High (Positive)

No.	Aspect / Issue	Direct/Indirect impact	Potential social impact	Project phase	Receptor of impact	Estimated significance of impact before and after mitigation
			population, and local administration will be able to plan their activities based on a larger share of young people and population of employable age.			
Negative impacts and social risks						
Impact on livelihood and resettlement of communities						
B1	Potential resettlement	Excluded				
B2	Economic displacement	Excluded				
Employment related impacts						
B3	Employment relations	Immediate (direct)	Potential violation of the RF labour law and international standards (including by contractors and subcontractors)	Construction Operation	Project workforce including (sub)contractors' personnel	Moderate/Low (at operation) Low/Negligible (at operation)
	Employment relations	Immediate (direct)	Tensions and potential conflicts between groups of workers at the Project construction sites and the accommodation camp	Construction	Personnel of INK, contractors and subcontractors	Medium/ Low
Impacts related to immigration of Project personnel from other cities and regions of the Russian Federation						
B4	Immigration/ Conflicts	Immediate (direct)	Impact on psychological well-being of local communities due to tensions and potential conflicts between local residents (including hunters and fishers) and migrant Project personnel	Construction	Hunters and fishermen Land users within the Kedr-2 Gardening Association Residents of Mostootryad neighbourhood Residents of Yakurim neighbourhood	Moderate / Low
B5	Immigration/ Load on existing social infrastructure	Immediate (direct)	Potential load on the existing social infrastructure, due to immigration of workers and job seekers	Construction Operation	All residents in the Project area of influence	Moderate / Low

No.	Aspect / Issue	Direct/Indirect impact	Potential social impact	Project phase	Receptor of impact	Estimated significance of impact before and after mitigation
B6	Immigration/ Demographic structure	Immediate (direct)	Demographic structure in Ust-Kut city may change due to temporary in-migration with potential misbalance of population age and gender structure.	Construction	All residents in the Project area of influence	Medium/ Low
Impact on community health and safety						
B7	Community health	Immediate (direct)	Community physical health risks in Ust-Kut city and Ust-Kut district	Construction Operation	All residents in the Project area of influence	High / Moderate
B8	Community health	Immediate (direct)	Community psychological well-being risks in Ust-Kut city and district	Construction Operation	All residents in the Project area of influence	Medium/ Low
B9	Community safety / traffic on public roads	Immediate (direct)	Risks to community health due to heavy machinery and passenger transport traffic on the local public roads	Construction Operation	Residents of Ust-Kut (including Yakurim and Mostootryad neighbourhoods), land-users in the Kedr-2 Gardening Association, users of the Vilyui road	High / Moderate (construction) Moderate / Low (operation)
	Community safety / emergency situations	Immediate (direct)	Community safety risks related to hazardous industrial operations and potential emergency accidents at the Project sites	Construction Operation	Residents of Yakurim and Mostootryad areas, land-users in the Kedr-2 Gardening Association	Moderate / Low
B10	Community safety / security of Project sites	Immediate (direct)	Project sites security risks	Construction Operation	All residents in the Project area of influence	Low/Moderate / Negligible
Occupational health and safety risks						
B11	Occupational health and safety/ Personnel health	Immediate (direct)	Occupational injuries, diseases, industrial accidents	Construction Operation	Company's personnel Personnel of contractors and subcontractors	Moderate / Low
	Occupational health and safety / Transport	Immediate (direct)	Transport risks to the Project personnel	Construction Operation	Company's personnel Personnel of contractors and subcontractors	

No.	Aspect / Issue	Direct/Indirect impact	Potential social impact	Project phase	Receptor of impact	Estimated significance of impact before and after mitigation
Impacts on socio-economic development of Ust-Kut city and Ust-Kut district						
B12	Participation of INK in socio-economic development of the territory	Consequential (indirect)	Community dependence on social support from INK	Construction Operation	Administrations Local communities	Moderate / Low
Impacts on infrastructure of Ust-Kut city and Ust-Kut district						
B13	Deterioration of the transport infrastructure	Immediate (direct)	Deterioration of road pavement, traffic restrictions on public roads Local traffic may be disrupted or restricted due to construction activities near the public roads; quality of local roads may be affected	Construction Operation	Residents of Yakurim and Mostootryad neighbourhoods, land-owners in the Kedr-2 Gardening Association, users of the Vilyui road	High / Moderate (construction) Moderate / Low (operation)
Impact on land-use practices						
B14	Land-use/ Hunting and fishing	Immediate (direct) and consequential (indirect)	Impact on hunting and fishing as a result of land acquisition, inflow of workforce, and influence on the population of valuable fishing and hunting species	Construction Operation	Hunters and fishermen (including the Ust-Kut branch of Irkutsk Region Association of Hunters and Fishers)	Moderate / Low
Heritage impact						
B15	Cultural heritage	Immediate (direct)	Potential damage to tangible cultural heritage (archaeological finds and other material objects)	Construction	All residents in the Project area of influence, academic community	Medium/ Negligible

11. DECOMMISSIONING

The lifecycle of the project facilities shall be determined by a set of external and internal factors, such as industrial and associated development of the district hosting the polymer plant, the economic status, socioeconomic and environmental conditions, etc. At present, it does not appear to be possible to accurately predict a detailed timeframe for the decommissioning of the Project facilities, as the process solutions have not been developed to the required level of detail.

It is anticipated that the main process facilities of the Polymer Plant will be operated for at least 25-30 years, and the need for renovation or decommissioning should be assessed closer to that time (or at an earlier time, if needed). Nevertheless, the lease period of the Project site allows for its use during 49 years.

The Russian law does not require preparation of a design for conservation or for demolition (dismantling) of capital facilities at the time of the original project design development. A separate design should be developed for such activities in the future, including appropriate preliminary engineering surveys, and the closure design is subject to governmental expert review. One of the information sources for the engineering environmental survey for this phase of the Project will be the results of the operational environmental monitoring conducted throughout the entire operation phase of the Project. The environmental survey program for the Project closure phase should include, amongst other requirements, an assessment of changes in the natural and technogenic environment during the operation phase of the Project (including changes caused by the Project impact), an assessment of the consequences of environmental deterioration and their effect on the public health, an assessment of the contamination parameters of used or removed soil, recommendations relating to the dismantling (demolition) methods, as well as proposals for rehabilitation of the natural environment.

Considering the duration of Project construction period and due to differences in the lifecycle of various project facilities, their decommissioning and closure will also take several years. At present, the requirements to the design development for the Polymer Plant decommissioning cannot be fully appreciated for the following reasons:

- Changes in the applicable regulatory and legal framework by the time of the decommissioning and closure of the Project facilities;
- Changes in the Project during its planned lifecycle and its condition by the time of the closure; and
- Development of new technologies and methods for conservation and closure of facilities, which would be available at the time of the closure, including also the experience gained from similar facilities elsewhere.

The actual conservation and closure procedures can be designed and implemented through the development of a Decommissioning and Conservation (Closure) Plan for the Project facilities, which will reflect Russian regulations and the best international industry practices. The latter is currently represented by the IFC's Performance Standards which in general require that the decommissioning and closure (conservation) process should comprise the following stages:

- Safe shutdown of the production / technologic processes on a step-by-step basis;
- Removal of liquid and solid products/wastes for their treatment and disposal; in case of pipelines, reservoirs and process vessels, they should be washed and cleaned to remove residual petroleum products and other industrial liquids and wastes;
- Assessment of potential use of the empty and cleaned vessels, structures and equipment to take the best decisions from the environmental, social and economic perspective, in conformity with the good international industry practices;
- Dismantling and removal of decommissioned aboveground and underground vessels and process piping; and
- Additional research is to be conducted to assess the extent of the environment pollution caused by the Project operations, and development of a plan for reinstatement of the original conditions in conformity with the good international industry practices.

The Reference Document on Best Available Techniques (BREF) in production of polymers (August 2007) specifies the following aspects of waste management design for decommissioning phase:

- Giving consideration to the environmental impact from the eventual decommissioning of the unit at the stage of designing a new plant, as forethought makes decommissioning easier, cleaner and cheaper;
- Preventive techniques to avoid generation of large quantities of solid wastes, including:
  - Avoiding underground structures;
  - Incorporating features that facilitate dismantling;
  - Choosing surface finishes that are easily decontaminated;
  - Using an equipment configuration than minimizes trapped chemicals and facilities drain-down or washing;
  - Designing flexible, self-contained units that enable phased closure;
  - Using biodegradable and recyclable materials where possible.

IOC will as far as possible adopt the above approaches in the process of design, and review the waste management systems on a regular basis, to identify more environmentally sound methods compliant to the BAT and IFC PS. Like the materials/demolition wastes which can be considered for reuse, certain Project facilities and buildings, parts of its infrastructure can be reconstructed for further use for industrial purposes or as part of infrastructure systems. Materials can be also transferred for recycling, where possible. Due to the anticipated large number of procedures required to comply with the applicable international and local requirements in the sphere of waste management, a structured approach based on best practices can be defined in a Waste Management Plant for Decommissioning Phase.

The Project closure is expected to result in release of workforce (tentatively 650 persons, according to current estimations). Thus, a Retrenchment Plan must be developed 12 months before shutting down the main equipment. The Plan must consider alternative employment for the released personnel of the Polymer Plant during the period preceding final closure of the Project.

According to current Russian legislation, the main part of the work associated with demolition (dismantling) of buildings and structures with subsequent technical reclamation of the affected area is classified as construction activities and in this context, it is not different from any other construction operation with regard to the environmental protection measures to be taken. The general regulatory requirements to the design development for demolition (dismantling) of capital facilities, except for the linear facilities, are presented in par.24 of the Regulation on the structure of the project design documentation and requirements to its content (approved by RF Government's Decree No.87 of 16.02.2008). In particular, the textual part of Section 7 "Design for organization of work for demolition or dismantling of capital facilities" should contain the following information:

- Basis for development of a design for organization of work for demolition or dismantling of capital buildings, structures and facilities;
- List of capital buildings, structures and facilities subject to demolition (dismantling);
- List of measures aimed at decommissioning of capital buildings, structures and facilities;
- List of measures preventing access of people and animals to the capital buildings, structures and facilities subject to demolition (dismantling) and protecting the existing vegetation;
- Description and justification of the adopted demolition (dismantling) methods;
- Calculation and justification of the dimensions of the zone affected by demolition and hazardous zones depending on the adopted demolition (dismantling) method;
- Assessment of the probability of damage inflicted to engineering infrastructure facilities, including operating underground utilities, in the process of demolition (dismantling);
- Description and justification of measures and devices to be used for protection of engineering networks agreed upon with the network owners;
- Description and justification of solutions proposed for safe execution of demolition (dismantling) operations;
- List of measures aimed at ensuring the safety of the local communities, including their warning and evacuation (if required);

- Description of solutions relating to waste removal and disposal;
- List of measures aimed at land reclamation and site improvement (if required);
- Information relating to networks, structures and facilities remaining after demolition (dismantling) underground and in water bodies; information relating to existing permits issued by the relevant supervisory agencies for preservation of such networks, structures and facilities installed underground and in water bodies, if such permits are required by the RF law;
- Information relating to approvals issued by the relevant supervisory agencies for the technical solutions adopted for demolition (dismantling) of a facility by blasting, burning or any other potentially hazardous method, as well as a list of additional safety measures when using potentially hazardous demolition methods.

In addition, the graphical part of the project design documentation for demolition (dismantling) of capital facilities should be prepared including:

- Schematic layout of the site and adjacent areas with indication of the facility to be demolished, associated engineering network, hazardous zones in the process of demolition, areas to be used for short-term storage of dismantled materials, structures, parts and equipment;
- Drawings of protective devices of the engineering infrastructure facilities and underground networks; and
- Process flow diagrams indicating the sequence of operations for demolition (dismantling) of building structures and equipment.

In accordance with the Federal Law No. 116-FZ of 21.07.1997 “On industrial safety of hazardous industrial facilities" (art. 8), documentation for preservation and liquidation of hazardous operational facilities is subject to the state industrial safety expert review. Upgrading, preservation and liquidation of a hazardous industrial facility may not be implemented without an approval from the State Industrial Safety Expert Review Board which should be duly recorded in the Register of conclusions of the State Industrial Safety Expert Review Board, or in case of a hazardous facility upgrading design included in the design package of such facility - without approval of the facility design package by the Expert Review Board.

During implementation of the construction, reconstruction, capital repair, upgrading, preservation or liquidation of a hazardous industrial facility, developers of the respective design documentation provide designer's supervision in accordance with the establishedpractice.

Requirements to preservation and liquidation of hydraulic structures are defined by the Rules for Preservation and Liquidation of Hydraulic Structures (approved by the RF Government Resolution of 20.10.2014 No.1081).

RF Government Resolution of 10.07.2018 № 800 «On land remediation and conservation” sets the rules for land reclamation and conservation. Reclamation shall be provided to restore land to a condition adequate for its use for designated and permitted purpose, by means of bringing land quality to compliance with the environmental quality standards and legal requirements of the Russian Federation in the sphere of community health and safety.

Development of a reclamation project is provided by persons whose activities have led to land degradation. The Regulations paragraph 8 requires that reclamation activities are conducted on the basis of approved reclamation project design. The reclamation project shall be prepared as a separate document included in the design package for construction/reconstruction of permanent facilities which may result in land degradation or diminishing of fertility, or as an independent document in all other situations (Regulations paragraph 10).

The development of a land reclamation project is conducted considering:

- The area of disturbed land, the extent and nature of their degradation identified as a result of the land survey;
- Requirements in area of environmental protection, sanitary and epidemiological requirements and requirements of technical regulations as well as regional natural and climatic conditions and location of a land plot;
- Purpose and permitted use of disturbed lands.

Taking into account the abovementioned uncertainties, it is not possible to determine potential environmental and social impacts associated with the decommissioning and closure at this stage of the Project, however it can be assumed that some impacts will be equivalent to those at the construction phase. Furthermore, the impacts can be mitigated and reduced to the acceptable levels through the use of the good international industry practices.

12. TRANSBOUNDARY IMPACTS

12.1 Transboundary Impact Criteria

In accordance with IFC Guidance Note 1[289], transboundary impacts are impacts that extend to multiple counties, beyond the host country of the project, but are not global in nature.

In the Convention on Environmental Impact Assessment in a Transboundary Context (Espoo, 2001[290]), the notion of "transboundary impact" is defined as any impact, not exclusively of a global nature, within an area under the jurisdiction of a Party caused by a proposed activity the physical origin of which is situated wholly or in part within the area under the jurisdiction of another Party.

In accordance with the ESIA methodology adopted by Ramboll (Chapter 3), transboundary impact is an impact that affects receptors, beyond the boundaries of the country in which the project is located and produces transboundary effects, including global effects.

Location of the proposed polymer plant site in relation to the national frontier of the Russian Federation is shown in Figure 5.3. The nearest land frontiers of other countries are located at a distance of 650 km (Mongolia to the south), 1010 km (China – to the south-east) and 1470 km (Kazakhstan to the south-west).

12.2 Potential Transboundary Impacts

Considering the Project location, scale and nature of impacts, the potential transboundary impacts from the polymer production can be assessed and summarized as follows:

- All the Project activities will be entirely located within the RF and the major potential impacts will be of local scale and will not extend further than 5-8 kilometers from source (Section 9.3).
- The low levels of sulphur in the feed gas and the proposed processes mean that emissions of SO_2 generated by the operation of the polymer plant and infrastructure facilities will be low. The Project contribution to background levels of the above substance will have insignificant effect at the regional level, which will not have transboundary effect.
- The effects of nitrogen emissions from the Project's combustion of natural gas are possible, but given the location of the Project, its emissions are not expected to make any significant contribution to pollution levels beyond national boundaries.
- IOC will dispose the Project wastes at its own landfills and disposal facilities, and at third party waste treatment facilities (also see Section 9.7). All above facilities are in the RF (only facilities with all relevant licenses will be used).
- The impact assessment did not reveal risks of spreading exposure over long distances (including beyond the territory of the Russian Federation) in case of unplanned events and emergencies (Section 9.10).

Transboundary impacts are therefore not anticipated. However, it should be noted that GHG emissions through the lifecycle of the Project will contribute to the global problem of climate change. These impacts are addressed in Section 9.9.

[289] International Finance Corporation's Guidance Notes: Performance Standards on Environmental and Social Sustainability, 2012

[290] The document was signed by the Russian Federation on 06.07.1991 and took effect on 10.09.1997.

13. CUMULATIVE IMPACTS

13.1 Introduction

This Chapter presents a cumulative impact assessment (CIA) on the natural and social environment associated with the existing or planned activities, taking into account also other types of commercial activities carried out within the subject area and in adjacent territories. The approach to assessment of cumulative impacts is provided in Section 3.7.

For the purpose of this ESIA, the CIA will draw from the following information:

- PreESIA studies for the Irkutsk Polymer Plant, 2017;
- Design documentation for associated and other facilities under the INK's Gas Programme;
- Environmental survey data for the Project and neighbour facilities used for characterization of the Project's area of influence;
- Data and information received during the site visit in March 2019,
- Publications and information from other open sources - to characterize the area in a wider regional scale, i.e. beyond the boundaries of the Project's area of influence.

The following program documents relating to development of the subject area have been examined as part of the cumulative impact assessment:

- Long-term Socio-economic Development Concept of the Russian Federation for the period till 2020 (RF Government Decree of 17.11.2008 No. 1662-r);
- Far East and Baikal Region Socio-economic Development Strategy for the period till 2025 (RF Government Decree of 28.12.2009 No. 2094-r);
- Siberia Socio-economic Development Strategy for the period till 2020 (RF Government Decree of 05.07.2010 No. 1120-p, rev. of 26.12.2014);
- Irkutsk Region Socio-economic Development Concept for the period till 2020 (Irkutsk Region Governor Decree of 04.06.2010 No.34-r);
- Irkutsk Region Investment Strategy for the period till 2025 (Irkutsk Region Government Decree of 28.08.2014 No.701-rp);
- Irkutsk Region Investments and Infrastructure Projects Development Plan for the period till 2022;
- Irkutsk Region Territorial Planning Scheme (Irkutsk Region Government Decree of 02.11.2012 No. 607-pp, rev. of 06.03.2019);
- Irkutsk Region Fuel and Power Sector Development Strategy for the period 2015-2020 and until year 2030 (Irkutsk Region Government Decree of 12.10.2012 No.491-rp);
- Draft Irkutsk Region Socio-economic Development Strategy till 2030;
- Irkutsk Region Forest Plan (approved by Irkutsk Region Governor Decree of 26.11.2014 No.445-ug, rev. of 12.12.2017);
- Irkutsk Region State Programme "Housing and municipal services development and energy efficiency improvement" for the period 2019-2024;
- Integrated management scheme for water bodies within the catchment area of the Lena River (approved by Rosvodresursy Lena River Basin Authority, Order of 19.06.2014 No. 78-p);
- Ust-Kut Municipality Socio-economic Development Strategy for the period till 2030 (approved by Ust-Kut Municipal Duma Resolution of 20.12.2018 No.181);
- Ust-Kut City Municipality Integrated Socio-economic Development Programme 2017-2022;
- Ust-Kut Municipality Territorial Planning Scheme (approved by Ust-Kut Municipal Duma Resolution of 30.04.2013 No.145) (rev. of 28.11.2017);
- Ust-Kut City Municipality Master Plan;
- Municipal Programme "Ust-Kut city municipal infrastructure modernization" for the period 2017-2021 (approved by the Head of Municipal Administration, Resolution of 28.10.2016 No. 2507-p);
- Ust-Kut City Municipal Infrastructure Integrated Development Programme 2017-2028 (approved by the Head of Municipal Administration, Resolution of 17.01.2018 No. 17-p);

- Ust-Kut Municipality Water Supply and Wastewater Disposal Scheme (approved by the Head of Ust-Kut City Municipal Administration, 29.12.2014);
- Ust-Kut City Sanitation Master Plan. NPF "Ecosistema", 2012.

13.2 Scoping Phase I – VECs, Spatial and Temporal Boundaries

Based on the residual significance of the Project impact on VECs (Chapters 9 and 10), probability of cumulative effects, analysis of the impacts generally recognised as important on the basis of scientific concerns and concerns from the affected communities (Table 13.1), including results of stakeholder consultations, the following VECs have been identified for further CIA analysis:

- Atmospheric air;
- Surface water;
- Forest resource and natural habitats;
- Aquatic ecosystems and biological resource;
- Community health and safety;
- Local infrastructure.

Table 13.1: Environmental (ecological) issues within the Project area (for the Project cumulative impact assessment)

Description	Characteristics	Parties/sources assessing the impact or issue significance	Comment by Ramboll (Project residual impact, potential overlapping with the Project impact)
Dangerous and adverse hydrological phenomena	The lack of rains in the Upper Lena catchment area during summer and autumn 2017 resulted in a dangerous hydrological phenomenon - low water with levels in different sections varying between 20% and 60% of normal water level. Reported levels in the navigable sections Ust-Kut - Podymakhino - Kirensk - Zmeinovo between June and the end of navigation period were low - 50-95 cm below the design levels for navigation, which affected the river fleet operations and cargo transportation in relation to the "Severny Zavoz" (deliveries of goods to the Northern Territories). Reoccurrence of this event has been reported in the upper reaches of the Lena River during the past decade, due to the climatic (decline of precipitation in the drainage area) and geological (fractured river bed rock) conditions.	Irkutsk Region Ministry of Natural Resource and Environment (State Report "On Environmental Conditions and Environmental Protection in Irkutsk Region in 2017". - Irkutsk: Ministry of Natural Resource and Environment of Irkutsk Region, 2018. 250 pp.)	Considering the insignificant (compared to total river flow) volume of water abstraction from the Lena River and the water recycling arrangement, the residual impact of the Project water abstraction on the water body is assessed as negligible. The impact cumulation is possible, however, it has not been included into the CIA scope, due to the negligible level of the residual impact.
Forest fires	In 2017, 69 forest fires were reported in Ust-Kut District which affected 153,032 ha of forest areas. The investigations identified the following most common causes of fires: careless handling of fire (54 %), lightning (29 %), fire spread from other land categories to the designated forest land (15 %), short circuiting of HV power transmission lines (about 1 %), sparking at railway transportation facilities (0.5 %).	Rospotrebnadzor (State Report "On sanitary and epidemiological welfare of the population in Irkutsk Region, 2018". - Irkutsk: Rospotrebnadzor Department for Irkutsk Region, 2019)	The inflow of migrant workforce for construction of all planned development projects will increase the risk of fires. The Project plans include fire prevention measures that will reduce the risk to a moderate level.
Depletion and contamination of ground water aquifers used for drinking water supply	Ust-Kut is listed among the region's cities with most extensive ground water production for drinking water supply. In 2017 municipal water abstraction facilities (Slopeshniy, Melnichniy, Rechniki, Fedotyevskiy, Osetrovskiy and other ground water well sites) produced 19,500 m^3 of drinking water per day. In terms of water quality in central and local distribution systems, Ust-Kut city occupies a medium position in the rating of Irkutsk Region municipalities: on the average, 2 to 5 % of samples from the central water distribution systems and 12 to 22 % of samples from local water supply systems failed the permissible quality limits. The most common ground water quality issues in Ust-Kut city are: for local water supply systems (wells, etc.) - microbiological contamination (problems reported in up to	Integrated management scheme for water bodies within the catchment area of the Lena River (approved by the Orders of the Rosvodresursy Lena River Basin Authority) Scientific research organizations	Daily ground water abstraction of about 500 m^3 for the Project needs will not have a significant impact on ground water resource, as this volume is within the limits of natural replenishment and drawdown of so called elastic reserves of ground water. Therefore, the boreholes can be continuously operated for 27 years.

Description	Characteristics	Parties/sources assessing the impact or issue significance	Comment by Ramboll (Project residual impact, potential overlapping with the Project impact)
	30% of water samples); for ground water abstraction boreholes - a relatively high repeatability of excessive alpha activity indicating presence of radon and its decay products.	Municipal Administrations (Ust-Kut Municipality Socio-economic Development Strategy for the period till 2030 - Appendix 1 of the Ust-Kut Municipal Duma Resolution of 20.12.2018 No. 181) Irkutsk Region mass media (including local media in Ust-Kut city and district) Stakeholder consultations	The expected impact of the polymer plant construction and operation on the geological environment will be local, i.e. the affected area will include only the technical facilities sites and strips along the routes of the utility lines, and will be of low significance given the scale of the subject engineering geological area.
Depletion of the fish resources in the catchment area of the Lena River	Commercial fishery activities in the Lena River section between the settlements of Zhygalovo and Ust-Kut are reported to have stopped. Before 2005, long-time average catch in this section was 4.1 ton, with the following content of various species (%): taimen – 0.2, lenok – 0.4, grayling – 42.4, perch – 3.7, burbot – 2.3, roach – 31.4, pike – 18.9, dace – 0.7. In 2005, catch in the same area increased to 6.5 tons including 5.6 tons of grayling (about 85 %). No commercial fishery activity was reported over the period 2006-2014 in this section. In 2014 fishery activities were partially relocated to the relatively large tributary streams - Vitim (within the boundaries of Irkutsk Region, 1 user, total catch - 0.23 tons of grayling, pidschian and lenok) and Kirenga (3 users, 3.71 tons of grayling, whitefishes, lenok, taimen, small ordinary fish, pike); one user practiced fishery in the Lena River - near Zhygalovo (total catch of 1.85 tons of grayling, lenok, taimen, small and big ordinary fish). The quotas for production of grayling and whitefish that were issued on the basis of recommendations of authorities subordinated to the Federal Agency for Fishery[291] (in year 2013 - 10 tons and 1 ton, respectively) have not been taken up during several years, due to relatively low economic efficiency of commercial fishery in the Lena River compared to the regional water reservoirs (particularly the Bratsk reservoir) that demonstrate		Considering the local extent and short duration of impact (most impacts will be present only during the period of construction), overall intensity of the Project impact on aquatic life is assessed as moderate. Implementation of the special mitigation measures and compliance with the technology specifications will reduce the pollution impact on the hydrobionts down to the low level. The chance that the Project activities may cause a significant impact on populations of rare and valuable commercial fish species in the Lena River catchment area is negligible.

[291] Assessment of aquatic biological resources, recommendations for their management, forecast of total allowable catch (TAC) and potential catch in 2013 in the inland waters controlled by FSUE "Gosrybtsentr". Stage 2. Book 1. Supporting materials for TAC 2013 for the aquatic biological resources in fresh waters of Irkutsk Region. - Ulan-Ude: Baikal branch of FSUE "Gosrybtsentr", 2012. 36 pp.

Description	Characteristics	Parties/sources assessing the impact or issue significance	Comment by Ramboll (Project residual impact, potential overlapping with the Project impact)
	higher yield fish. Commercial fishery was suspended during 2015-2016 for the purpose reasonable use and conservation of fresh water ecosystems.		
Chemical contamination of water in the Lena River	Ust-Kut city occupies the first place in Irkutsk Region, in terms of its input to contamination of water in the Lena River. Local water utility - UK Vodokanal-Servis, LLC - is referred to as one of the main sources of wastewater discharges to the Lena River. Due to the high extent of wear of municipal wastewater treatment facilities in Ust-Kut, wastewater is not sufficiently treated before discharge to surface water bodies. Among other things, it is reported that inadequately treated domestic waste waters have been for many years discharged to the Kuta River in the area of Ruchei village (about 50 km upstream of Kuta confluence with the Lena River). The second largest source of river water contamination are wastewater and waste discharges from river fleet, oil tank farms and ports. In particular, a petroleum product plume was detected in 1992 in the area of Ust-Kut oil tank farm located 8.5 km upstream of the designed IPP water abstraction facilities, within the capillary fringe zone of the shallowest aquifer, with immediate discharge into the Lena River. Ground water quality at the oil tank farm site is characterised by a high mineral content (1.2-1.5 g/l), and accumulation of iron (5 to 20 mg/l), manganese, and ammonium ions. During multiple years, local media regularly published information on oil contamination of the Lena River including photographic evidence and interviews with officials (including management of Ust-Kut District Department of MES, Deputy Head of Municipality, management of the oil tank farm). According to the latest publications of 23 June 2019, the issue has not been solved and may even have worsened: oil film was observed during a day on water surface in a large area near Mostootryad residential neighbourhood[292]. The third significant cause of water quality deterioration in the Lena River is related to uncontrolled transport of pollutants with snow melt and storm water		The planned Project will not increase the load on the municipal wastewater treatment facilities, and its contribution to pollution of the Lena River with wastewater discharges will be minor. In fact, it is planned that the process-and-storm, process and domestic wastewater from the Project facilities will be treated to meet the fishery water quality standards, i.e., for a number of parameters, quality of treated wastewater discharged to the river will be better than the source water abstracted from the Lena River for process needs. Potential excessive levels of pollution in river water (e.g. in case of emergency discharge, failure of a part of wastewater treatment facilities, etc.) will be detected by the planned quality monitoring system of treated wastewater discharged to the Lena River, and by the river water quality monitoring within the scope of INK's operational monitoring and control

[292] Rosneft branch in Ust-Kut pollutes River Lena with oil again. - Ust-Kut 24 information portal. 23.06.2019 Online publication http://www.ust-kut24.ru/?p=56168

Description	Characteristics	Parties/sources assessing the impact or issue significance	Comment by Ramboll (Project residual impact, potential overlapping with the Project impact)
	runoff from a vast area, including residential communities, industrial sites and logistics facilities in Ust-Kut city and adjacent territories. The priority contaminants of the water environment in the Lena River and tributaries are suspended solids, chlorides, sulphates, nitrates, ammonium ions, phosphorus, synthetic surfactants, nitrites, iron, petroleum products, phenols, and other organic compounds that enhance the water COD and BOD levels. On the other hand, the main polluters of water in the whole Lena River catchment area are the ore mining enterprises, especially the gold mining sites which are located at a significant distance from the Project area. The results of water quality monitoring in the Lena River (0.05 km upstream and 0.1 km downstream of Kachug village; 1.6 upstream of and in Ust-Kut city; 2 km upstream and 1 km downstream of Kirensk city) and the Kuta River (in the Ruchei village) indicate failure of fishery water MPC standards for BOD5 and COD, nitrites, petroleum products (up to 34 times or 500*MPC) and phenols (integral assessment of water pollution level in the Lena and Kuta rivers: Class 2 - "mild contamination").		system, therefore, pollution sources will be promptly eliminated. Storm water drainage systems will be provided at all sites of the planned facilities, for collection of all snow-melt, rain and watering/washing water flows that will be treated locally and utilised for replenishing the process water supply systems. The Company selected a site for the plant process area outside the spawning protection forest belt, therefore, disturbance caused the Project will be reduced to unavoidable minimum level. This will ensure conservation of the water protection function of the forests in the Lena River valley and minimisation of indirect impact of the Project on surface water quality. The Project facilities located immediately near the river (technical water pipeline, treated wastewater pipeline, berth facilities) will be designed to comply with the applicable regulations for water protection zones (WPZ) and shore protective belts (SPB).

Description	Characteristics	Parties/sources assessing the impact or issue significance	Comment by Ramboll (Project residual impact, potential overlapping with the Project impact)
Poor air quality in Ust-Kut city	This issue is caused by a combined impact of several different categories of emission sources. In the planned IPP area (industrial area in the east of Ust-Kut city) the dominant source of air pollution is the wood processing waste dump of IND Timber where biomass materials have been burning openly for multiple years causing pollution of ground level air with combustion products that are spread omnidirectionally to a distance of several dozens kilometres. The air contamination issue in Ust-Kut city and district is mainly due to the extensive use of solid fuel (coal, wood chips), heavy fuel oil and petroleum for operation of municipal utility systems (only one heat generating facility is known to use natural gas fuel). Motor vehicles traffic is increasing in relation to cargo transportation to the construction sites of oil-and-gas industries and other infrastructure facilities in the north of Irkutsk Region and Yakutia. The traffic flows are routed through the city centre and along residential quarters, further exacerbating air and soil contamination in the housing areas and increasing the level of noise. Multiple transshipment and storage facilities operating in the city also contribute to the air pollution level.		Impact cumulation with the Project is possible. Included in the CIA scope.
Erosion of the Lena River banks within Ust-Kut city	Uncontrolled development of territories on the Lena River banks that was practiced during a long period until recently resulted in the banks erosion and ingress of ground and pollutants into the river. The city was included into the Federal Target Programme "Water Industry Development in the Russian Federation 2012-2020", and rehabilitation of the bank stabilisation structures on the Lena River has been initiated (the damage prevented by the activities so far is estimated at 230.99 million roubles). Demarcation of water protection zones and shore protective belts on the Lena and Kuta rivers within the boundaries of Ust-Kut and Podymakhino was completed in 2017.		The Project facilities located immediately near the river (technical water pipeline, treated wastewater pipeline, berth facilities) will be designed to comply with the applicable regulations for water protection zones (WPZ) and shore protective belts (SPB). The design provides for erosion-preventive, soil and river bank protection areas within the water protection zone and elsewhere, as required.

Description	Characteristics	Parties/sources assessing the impact or issue significance	Comment by Ramboll (Project residual impact, potential overlapping with the Project impact)
Degradation (reduction and fragmentation) of protective (spawning protection) forests	Clearcutting and capital construction is prohibited in spawning protection forests (with few exceptions). However, the spawning protection forests are still exposed to selective and clear felling under a pretext of pest and diseases control, and the affected areas are increasing all the time. Therefore, in 2017 in response to request from WWF Russia, the RF President issued an instruction for complete prohibition of industrial forest logging and leasing of forest areas for harvesting within spawning protection belts and certain other forest land categories. Federal Law f 27.12.2018 No.538-FZ "On introduction of changes to the Forest Code of the Russian Federation and certain legal acts of the Russian Federation in terms of improvement of legal regulation concerning forest conservation on designated forest land and other land categories" that was adopted for implementation of the above instruction will take effect on the 1st of July 2019. However, instead of restricting forest logging in spawning protection belts, it rather provides legal schemes and prerequisites for a significant reduction (by 10 times) of the total size of such areas. According to WWF, the key problem in this law are the new criteria for categorization of areas as spawning protection forest belts. When the new criteria are applied, the protective forest belt is reduced from 1 km on each bank to 50-200 m, i.e. to the standard width of water protection zone. WWF experts believe that the reduced belt width is not sufficient to protect spawning grounds of valuable fish from the effects of industrial felling and other activities in the forest areas. Irkutsk Region is mentioned among the RF regions where forests outside spawning protection belts are most affected by wasteful felling. Felling and other disturbing activities in spawning protection forests cause irreparable damage to forest ecosystems, and also impair water quality, degrade populations of valuable and rare aquatic species, and affect angling conditions.	The World Wildlife Fund (WWF)	The Company selected a site for the plant process area outside the spawning protection forest belt, therefore, disturbance caused the Project will be reduced to unavoidable minimum level. However, impact cumulation with the Project is possible. Included in the CIA scope.
Inefficient solid waste management resulting in degradation of	The main issue in the sphere of solid waste management in Ust-Kut District is the lack of disposal and recycling facilities. The existing landfill capacities are almost used up, and the disposal sites are not equipped for sorting, neutralization or recycling of certain categories of waste. The remote location of landfills in relation to certain settlements results in illegal dumping of wastes in the natural	Municipal Administrations (Ust-Kut Municipality Socio-economic Development Strategy for the period till 2030 -	Due to the lack of capacity at the existing MSW landfill (90% full), the Project waste at the construction and operation phase will be disposed at own landfills of INK. Therefore, no

Description	Characteristics	Parties/sources assessing the impact or issue significance	Comment by Ramboll (Project residual impact, potential overlapping with the Project impact)
natural environment	environment including designated forest land. To reduce the impact of municipal solid waste, five sites will be constructed in the district territory for temporary storage of waste (11 months, maximum) before disposal at the existing landfill operated by SpetsAvto LLC (commissioned in 1995), or incineration (in the future). The Ust-Kut Municipality Socio-economic Development Strategy provides for construction of a waste sorting facility and a new MSW landfill. Also, construction of an industrial waste landfill is a matter of vital importance - such landfill never existed in the district but there is pressing need for one. According to the information received from the District Administration during the Consultant's site visit in April 2019, the landfill capacity will be used up by year 2025, if the waste flows remain at their current level.	Appendix 1 of the Ust-Kut Municipal Duma Resolution of 20.12.2018 No. 181. Ust-Kut City Sanitation Master Plan. – Chelyabinsk: NPF "Ecosistema", 2012)	cumulative impact on the existing waste disposal facilities in Ust-Kut city is expected.
High extent of wear, inadequate quality and deficiency of road infrastructure	At present, load on the environment is particularly increasing due to the growing intensity of vehicle traffic in relation to cargo transportation to the construction sites of oil-and-gas industries and other infrastructure facilities in the north of Irkutsk Region and Yakutia. The traffic flows are routed through the city centre and along residential quarters, further exacerbating air and soil contamination in the housing areas and increasing the level of noise. Multiple transshipment and storage facilities operating in the city also contribute to the air pollution level. More intensive cargo vehicles traffic increases the load on road infrastructure causing its early wear, poor quality of the roads in the city and district, and higher failure rate of vehicles (this parameter includes road accidents, as well as early wear of elements of vehicle chassis, body and engines).		Impact cumulation with the Project is possible. Included in the CIA scope.
Deficiency of the state environmental monitoring system	Scarcity of the existing observation stations for conditions/quality monitoring of atmospheric air, surface water, subsoil (including ground water), vegetation, terrestrial vertebrates, and freshwater hydrobionts	Territorial bodies/divisions of the Rosvodresursy, Roshydromet, Rospotrebnadzor, Rosprirodnadzor, Rosrybolovstvo, Rosnedra authorities	INK conducts operational environmental monitoring and control (OEMC) in the course of construction and operation of hydrocarbons production and transportation facilities in Ust-Kut District. On the Consultant's opinion, the existing OEMC

Description	Characteristics	Parties/sources assessing the impact or issue significance	Comment by Ramboll (Project residual impact, potential overlapping with the Project impact)
			programme should be enhanced to account for the construction of the LPG/SGC facilities, the GFU and the gas transportation system, and the designed Polymer Plant. Therefore, the Project monitoring activities will make a positive contribution to the data collection in the subject area.
Spread of endemic diseases	Ust-Kut district is not listed as tick-borne encephalitis endemic area, as of start of year 2019[293]. On the other hand, according to scientific landscape-epidemiological studies[294], the Project area belongs to Orlingo-Lensky epidemiological area where specific preventive measures are required to address the risk of tick-borne encephalitis. In addition, field surveys of 1990-2007 repeatedly detected high concentrations and high tick infection rates of ixodic ticks in Ust-Kut district in terms of encephalitis and Lyme disease, with an overall trend toward worsening of the situation.	Scientific research organizations. Territorial bodies of the Rospotrebnadzor	The local impacts are unlikely to produce any significant cumulative effect. However, mitigation activities including preventive measures shall be taken at the Company level to reduce the potential impact.
Loss of heritage	Extension of the areas affected by development and other economic activities results in inevitable loss or damage of heritage sites within the developed area. The manager of the local history and culture museum mentioned multiple archaeological finds encountered during construction activities in the territory of Ust-Kut city that indicate presence of fragmentary occupation layer and/or objects of cultural and historical value. The chance finds were attributed to ancient history and to activities of the indigenous small-numbered peoples.	Ust-Kut City History and Culture Museum. Scientific research organizations	The impacts are of the local scale, therefore, they should be considered at the project-specific level rather than cumulatively.

[293] Rospotrebnadzor letter of 28.01.2019 No. 01/1180-2019-27

[294] Bogomazova et al. Current epidemiological situation and ixodic ticks infection prevention in the northern areas of Irkutsk Region // Epidemiologia i Vartsynoprofilaktika ("Epidemiology and Preventive Vaccination"). 2009. No.3 (46). pp. 23-26.

Description	Characteristics	Parties/sources assessing the impact or issue significance	Comment by Ramboll (Project residual impact, potential overlapping with the Project impact)
Adverse radio-environmental conditions	Due to the crustal structure geology in Irkutsk Region, high levels of radon are reported in air in residential and public buildings in Ust-Kut District, with isotope 222Rn activity above 200 Bq/m3. Hight content of radon is also found in ground water, including sources of drinking water supply.	Rospotrebnadzor (State Report "On sanitary and epidemiological welfare of the population in Irkutsk Region, 2018". - Irkutsk: Rospotrebnadzor Department for Irkutsk Region, 2019)	The Project is not expected to cause any impact on the radio-environmental conditions.
High community morbidity rates in Ust-Kut district	According to the Hygiene and Epidemiology Center in the Irkutsk Region and Ust-Kut District Hospital consulted in 2017, the highest concerns were related to respiratory diseases incidence in Ust-Kut municipality, especially bronchitis of various origin. Other frequently diagnosed diseases are hepatitis B/C, tuberculosis, oncology diseases, congenital defects, HIV/AIDS, hypertony (HBP) and diabetes. The rates of alcoholism and narcomania in Ust-Kut District are also higher than the Region's average levels.		Impact cumulation with the Project is possible. Included in the CIA scope.
Depletion of forest habitat resources (hunting, recreational, food potential, etc.)	The local hunting and angling associations in Ust-Kut District are most concerned about the following issues: • Wasteful and illegal use of forests; • Decreasing populations of game species e.g. hare, capercaillie and hazel grouse most commonly hunted by rotation shift personnel; • Fragmentation of game species' habitats due to construction of the line facilities; • Improved access to habitats of game species as new roads, clearing and logging territories, and other open spaces appear; • Reduction of sable population due to land acquisition, fragmentation of habitats, and disruption of migration routes; • Increased frequency of human contacts with brown bear, due to development of the road network, disturbance of the species habitats, and inadequate management of municipal solid wastes; • Clearcutting of forests; • Illegal hunting and fishery activities further enhanced by improved equipment of the poachers and engagement of local communities.	Public hunting and angling associations in Ust-Kut District	Impact cumulation with the Project is possible. Included in the CIA scope.

- **Spatial boundaries**. The cumulative impacts are assessed within the area of influence identified in Sections 9.11 and 10.1.
- Temporal boundaries.
- In accordance with IFC PS1, the assessment covers the existing, planned, and/or reasonably predictable future projects and developments that are not directly associated with the Project. According to the EC guidance[295], consideration is normally given to the projects expected to be initiated within a period of 5 years from the date of scoping. The 5-year period is adopted as a reasonable starting point for the Project CIA.

13.3 Scoping Phase II Results– Other Activities and Environmental Drivers

This section identifies the former, current operations, as well as clearly described future projects near the Project area. Potential temporal and/or spatial interaction of the Project and the above activities may result in cumulative impacts.

13.3.1 Former and current activities in the Project area

Project area

The Project is located in Ust-Kut District being one of the key industrial areas of Irkutsk Region and an important transport logistics hub. As mentioned in Chapter 8, the main drivers of the District development include mineral extraction, wood processing, river and road transport, and heat energy generation.

Ust-Kut city area is stretched along the Lena and Kuta rivers to a length of 34 km. The maximum width of developed land strip is 3 km with river on the one side and steep hummocks on the other side. Housing areas alternate with industrial sites (including port facilities), so that neighbour residential quarters may be located 2-3 km apart.

The eastern part of the city comprises the following residential areas: YGU area; Biriusinka area (limited by the bypass road in the north, railroad in the south, and Neftebaza area in the west); Svetly area (private housing area located to the north of the bypass road adjoining the Biriusinka area); Neftebaza area associated with the Ust-Kut oil tank farm; Mostootryad area associated with the Bridge Construction Unit No.5 (located in the eastern end of the city, between the BAM railway line and the Lena River); Yakurim area (former workers' settlement in the area between the Yakurim Creek and the Mostootryad area, with a subordinated settlement of Mingan. Nowadays, the name of Yakurim is used to refer to a small private housing area adjoining the Mostootryad area on the northern side of the railway line).

Ust-Kut city was established in 1954 through a merger of workers' settlements Ust-Kuta and Osetrovo. Initially, the two parts of the city existed as independent residential areas with dominating private housing, as the territory between them remained undeveloped.

By the end of 1950-s, the main part of the city was the old housing area at the mouth of the Kuta River. The former Osetrovo settlement occupied a small area on the right bank, 5 km downstream the Lena River. The next downstream settlement Balakhnya was not a part of the city. Further downstream were the oil tank farm workers' settlement at the mouth of the Yakurim Kreek (subordinated to the city) and the Yakurim station, and after next 5 km was the eponymous settlement that did not belong to the city. In 1960-s the city development was boosted by construction of the Osetrovo river port. In 1970-1980-s the city's growth was related to construction of the BAM railroad, further development the port, and the geological exploration activities. Bridge Construction Units No.5 and No.102 were established in 1974. The old Yakurim village was completely redeveloped for Mostootryad settlement (as a part of Yakurim worker's settlement). The natural growth of the city stopped in early 1990s when housing and industrial construction activities came to a standstill.

<u>Industry</u> is the most important sector of Ust-Kut District economy. Extraction of minerals which has come to the fore of industrial activities includes inter alia the major project for exploration and development of

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[295] Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions, European Commission (EC), 1999

oil and gas condensate deposits, and extraction of oil and gas condensate which is developed by INK in Ust-Kut District. Ust-Kut District also has non-metal deposits.

Timber industry is another important sector of the District economy (sawn and unprocessed timber). In 2006-2017 Trans-Siberian Wood Company, LLC (TSLK, now IND Timber, LLC) implemented a major investment project for development of a sawmill and woodworking complex in Ust-Kut City which was listed among priority projects at the national level. By present the complex produced 320,000 m^3 of finished products. To address the issue of wood processing waste disposal, the TSLK partner company "Siberian Fuel Pellets" ("Sibirskiye Toplivnyje Granuly" LLC) constructed a fuel pellets plant.

The District territory includes forest concession areas of 19 businesses that lease forest areas for logging with estimated total logging area of 3,560,000 m^3.

Processing industry in the district is mainly represented by machinery fabrication including maintenance and repair of river vessels (Verkhne-Lenskaya and Osetrovo Fleet REB (ship maintenance yards), Osetrovo ship-building and repair yard), and Vektor LLC. Other producing companies in Ust-Kut city are Vita LLC (dairy), Yakurim Concrete Products Plant MS-9, and several smaller industries.

Agriculture plays a minor role in the District's economy. It is represented by two agricultural cooperatives (SPK Prilenye and SPK Lena-2), SHP-Turuka LLC, four individual entrepreneurs (A.A. Kuguk, M.V. Antipina, A.P. Markov, T.N. Kasatkina). Local communities practice subsidiary farming. The main agricultural products are meat and dairy, as well as grain.

Transport sector. Regular navigation of the Lena river is conducted from the port of Osetrovo to the Lena river delta. Historically river transport has played an important role in economy of the city and district. Dry cargoes account for two thirds of the total freight transport volume, and one third is oil and petroleum products. The following companies are active in the transport market: Osetrovo River Port JSC, Verkhnelensky River Shipping Company LLC, Verkhnelenskaya Sudokhodnaya Kompania LLC, Alrosa-Terminal JSC, Irkutsk-Terminal LLC, Bunker Base–Terminal North LLC, Osetrovsky LDK LLC, Terminal Lenarechtrans LLC, Lensky Transit LLC. The above companies mainly provide cargo storage, transportation and handling services, as well as other services for inland water transportation. They deliver cargoes to the northern areas of Irkutsk Region, the Republic of Sakha (Yakutia), and to the coastal Arctic areas from Khatanga to Kolyma.

The existing vessels fleet in the Lena River catchment area consists of 300 passenger, cargo and towing vessels. The small boats fleet is extensively used and consists of more than 30 units. The major enterprise in the sector - Osetrovo River Port (ORP) processed (i.e. received and dispatched) 1.307 million tons of cargoes in 2017 including about 170,000 tons of cargoes for construction of the Power of Siberia gas main and Chayandinsky OGCF. Historically, the key clients of ORP are Stroytransneftegas (supply of pipes and construction materials for the projects managed by the Yakutia Gas Production Centre, Surgutneftegas, Rosneft, Yakutcement, Verkhnelensky River Shipping Company, Irkutsk Oil Company. In 2015 the client base extended to include contractors engaged by Gazprom for the Power of Siberia Project.

Most cargoes are first delivered by railway to the Lena station in Ust-Kut, and then transferred to the river transport at the Osetrovo port for transportation to the final destination. The ORP operations are conducted in the Lena River section of 1980 km between Ust-Kut and Yakutsk. Average duration of navigation season is 120-150 days.

Existing infrastructure of Osetrovo river port consists of 1844 m berth space, a developed network of intra-port railway lines connected to the Lena station of the East-Siberian Railway (ESR). The port has well-developed storage facilities: 11 sheltered warehouses with the total area of 70,000 m^2, and 391,000 m^2 of outdoor storage sites. This is partially due to the lack of heavy cargo storage facilities at the Lena station of ESR in Ust-Kut.

Railway transport: the BAM railroad is routed across the area. Motor roads: the road network includes the Vilyui road of federal significance (Tulun - Bratsk - Ust-Kut - Mirny) and a regional-level road Ust-Kut - Yoyan. Most public roads owned by Ust-Kut district and settlement municipalities are old and need rehabilitation after a long period of outscoring wear and insufficient repair and development.

Heating system in Ust-Kut District consists of 23 heating boiler stations that use coal, furnace oil, wood chips, electric power and natural gas for heat generation. Most boiler houses are in municipal property. Few of them are privately owned (by Ust-Kut Sanatorium LLC, Kholbos LLC, Irkutsk-terminal LLC), and one belongs to correctional facility OIK-5. Total installed heat capacity of the facilities is 379.9 GCal/h of which 172.6 GCal/h is generated from coal, 135.0 GCal/h from fuel oil, 61.9 GCal/h from wood chips, 0.43 GCal/h from electric power, 10.0 GCal/h from LNG. Systematic efforts are being taken in Ust-Kut District since 2013 to eliminate inefficient heating sources operating on electric power, furnace oil, and petroleum.

Past and current activities within the Project's area of influence

The future Polymer Plant site is located in the designated forest land, 2-3 km to the north of the developed area in the east of Ust-Kut city. Forests in the Project area including the construction site are secondary forests disturbed by economic activities (historical felling at different times, fires, clearing areas, linear transport facilities, and mining of construction materials.

- An important source of negative impacts in the Project's AoI is the wood processing waste disposal site of TSLK (0.5 km to the west of PPF Area 1) with uncontrolled burning of wastes since 2014. Due to the wind rose conditions, this problem badly affects air quality in Mostootryad area giving raise to public concerns and complaints. In summer the situation is further aggravated by dust emissions from unpaved roads.

The existing activities near the Project site are mainly associated with implementation of the INK's Gas Programme (refer to Chapter 5 for detail), industrial operations including wood processing, operational maintenance and storage, berths on the Lena River, and infrastructure communications. The list of major existing and future facilities that may cause impacts within the Project's AoI is provided below.

Gas Programme of Irkutsk Oil Company

The Phase I facilities are completed and operational (since 2018), construction of Phase II facilities is in progress.

- Phase I:
  - Existing gas transportation system including a 200 km gas main with diameter 325 mm between the oil-gas condensate fields of INK (Yaraktinsky and Markovsky) and the gas processing and transportation facilities in Ust-Kut industrial area. Associated facilities of the gas transport system are: service driveway along the pipeline route, two-line overhead power transmission system, on-site facilities along the route;
  - LPG RS&O (sharing the site with the Project facilities (Area 2), less than 1 km from the designed PPF offloading terminals);
- Phase II:
  - Ust-Kut GPP (UKGFU);
  - Phase II - LPG/SGC RS&O (extension) (2.5 km to the south of the Project operational Area 1, adjoining the designed PPF offloading terminals (Area 2)).

Among other INK facilities located within the Project area, the following sites are related to the current construction activities:

- INK Utility Vehicles Depot;
- Construction Unit for access roads (motor and railway) to the GFU, LPG/SGC RS&O and temporary construction facilities;
- Limestone quarry mining;
- Operation of earth roads between the service driveway and the Vilyui A-331 road, and to the quarry.

Third parties:

- Berth of Alrosa-Terminal (4 km to the south-east of Area 1 and 2 km to the north-east of Area 2) (SPZ 50 m);
- Industrial support base of Alrosa logistics service including storage of explosives (3.5 km to the east of Area 1 and about 6 km to the north-east of Area 2) (SPZ 1000 m);

- IND Timber wood processing facilities with berths and access railway spur (about 3 km to the south of Area 1 and immediately near the south-western part of the designed PPF offloading terminal - across the railway line and motor road) (SPZ 300 m);
- Operational, storage and utility sites of Mikura LLC and Bridge Construction Unit No.5, and other facilities (3-5 km to the south and south-west of Area 1 and 1-6 km to the west of Area 2) (SPZ 300 m);
- Motor roads and railway lines (the Vilyui road, 25H26 road, subsidiary roads, BAM and access railway spurs);
- Power supply facilities (substation PS 220 kV "Yakurim" (existing); PS 500/220 kV "Ust-Kut" (under construction"); existing OHTL 220 kV and 110 kV; OHTL 500 kV under construction)
- (existing PS 500/220 kV "Ust-Kut" is located 4.5 km to the west of Area 1);
- MSW landfill of Ust-Kut city (on the opposite bank of the Lena River, 4 km to the south of Area 1 and 2 km to the south-west of Area 2) (SPZ 500 m);
- Irkutsknefteprodukt oil tank farm (7.5 km to the south-west of Area 1 and 6.5 km to the west of Area 2) (SPZ 500 m);
- TSLK wood processing waste dump (0.5 km to the west of Area 1; 5 km to the south-east of Area 2).

Land use:

The most significant potential uses of the forest land around the Project site include picking berries and mushroom, and hunting. The nearest farming land areas used as hayland are located within the outlines of the Podymakhino rural settlement in Ust-Kut District around the village of Polovinnaya at a distance of approximately 3 km from the design boundaries of the operational Area 1.

13.3.2 Proposed operations

The Draft Irkutsk Region Socio-Economic Development Strategy for the period until 2030 and the Irkutsk Region Territorial Planning Scheme for the north-western areas (Ust-Kut, Kirensk, Kazachinsko-Lensky Districts) provide for creation of Ust-Kut-Lena development base area (DBA). The prospective key specialization sectors of the territory are oil production, gas processing, gas energy, wood processing and wood chemistry.

The main prerequisites for development of this area include expansion of BAM railroad capacity, construction of the Power of Siberia gas main, capacity expansion of the Eastern Siberia – Pacific Ocean oil pipeline, the Lena transport hub, and construction of a gas-fired CHP in Ust-Kut.

Extensive exploration and development of oil and gas condensate fields is being conducted within the framework of development of the oil and gas chemical cluster in Ust-Kut District of Irkutsk Region. The main attraction center in the territory is Ust-Kut city, being an important transport and logistics hub and a centre of wood processing and wood chemical operations. The DBA is expected to create about 15 thousand new jobs.

Vast majority of the investment projects planned in Ust-Kut District are related to industrial development of the area. The enhanced gas processing project of INK is expected to create over 450 jobs. The main projects planned for implementation in Ust-Kut District in the near future are listed in Table 13.2 below.

Table 13.2: Planned projects in Ust-Kut Municipality

No.	Investment project name and brief description	Tentative terms of implementation, potential new jobs
Industry		
Gas Programme of Irkutsk Oil Company		
1	LPG RS&O (extension) and SGC RS&O (under construction)	Construction in 2019-2020, commissioning in 2020
2	Ust-Kut GPP (UKGFU) (under construction)	Construction in 2019-2020, commissioning in 2020

No.	Investment project name and brief description	Tentative terms of implementation, potential new jobs
3	Gas pipeline Yaraktinsky OGCF - Markovsky OGCF to Ust-Kut city (DSG transportation) The gas pipeline will have its terminal point at the GDS providing the gas supply base, including consumers within the city	Construction in 2019-2020, commissioning in 2023
4	MEG Plant	Construction in 2020-2023, commissioning in 2024
5	INK Gas Programme Phase V - Future gas processing and gas chemical projects (proteins and polyformaldehyde production)	No information available
6	Construction of fuel gas pipelines to Ust-Kut and Ust-Ilimsk. Gas supply to Ust-Kut via the GDS. The gas distribution scheme provides for 100% coverage of the existing and future private housing areas[296].	By present, the project implementation timeframes have not been defined. Neither Irkutsk Region State Programme "Housing and municipal services development and energy efficiency improvement" for the period 2019-2024 nor Ust-Kut City Municipal Infrastructure Integrated Development Programme 2017-2028 provide for any specific gas supply measures in Ust-Kut city.
7	Construction of APG pipelines from the Ichedinsky and Bolshetirsky fields to the gas transport system connecting the Yaraktinsky and Markovsky OGCFs with the Ust-Kut industrial area of INK	The possible construction terms have not been identified at this stage. Most probably after 2030.
8	INK – Yaraktinsky OGCF development	The field is being exploited, increase of production volumes is planned. Forecast for 2019-2023: oil and gas condensate production - 31.5 million tons, NGL production - 6.7 million tons Creation of jobs - 6.7 thousand
9	INK – Markovsky OGCF development	The field is being exploited, increase of production volumes is planned. Forecast for 2019-2023: oil and gas condensate production - 63 thousand tons, NGL production - 2059 thousand tons Creation of jobs - 0.4 thousand
10	Pacific Ocean Terminal (Tikhookeansky Terminal, LLC) - Development of the Ayansky West license area	Forecast for 2019-2023: oil and gas condensate production - 63 thousand tons, NGL production - 2059 thousand tons Creation of jobs - 0.4 thousand.
11	INK-Zapad CJSC - Ichedinsky oil field development (Zapadno-Yaraktinsky LA)	Test operation since 2015. Extension of the facilities is planned to increase the feed rate from 540,500 tons to 1,395,000 tons per year. Forecast for 2019-2023: oil and GC production - 11.6 million tons. Creation of jobs - 1.4 thousand.

[296] "Feasibility studies for centralized natural gas supply to residential customers in Ust-Kut city for the period until 2025. Gas supply and distribution master plan of Ust-Kut City, Irkutsk Region, for the period until 2024", Instroy LLC

No.	Investment project name and brief description	Tentative terms of implementation, potential new jobs
12	INK-Zapad CJSC - Bolshetirsky oil field development (Bolshetirsky LA)	Prospecting and evaluation, exploration and test operation activities are in progress. Targets for the period 2019-2023: oil and gas condensate production - 2.2 million tons. Creation of jobs - 0.2 thousand
13	INK - Helium recovery at the Yaraktinsky OGCF	Forecast for 2019-2023: helium recovery - 7549 M l. Creation of jobs - 35.
Other investment projects in Irkutsk Region		
14	Construction of Lenskaya CHP of Irkutskenergo in Ust-Kut, capacity 1.2 GW. The tentatively approved land plot for construction is situated between Rechniki and Biriusinka areas in Ust-Kut city. The site area is 26 ha. Gas for the Lenskaya CHP will be supplied from the gas fields in the north of Irkutsk Region (Markovskoye and Yaraktinskoye).	The project implementation is scheduled for completion by 2030. In accordance with the Irkutsk Region State Programme "Housing and municipal services development and energy efficiency improvement" for the period 2019-2024, the project feasibility depends on availability of major consumers, and on verification of the need for construction of new generation capacity within the unified energy system of Siberia.
15	Construction of the Power of Siberia GM, Kovykta - Chayanda section, 803 km. Pipeline diameter 1420 mm, operating pressure 9.81 MPa. Planned annual gas transportation by the gas main - 15-18 billion m^3. The gas main will be constructed as a single pipeline. Construction of a compressor station KS 2K 48 MW, service roads, and overhead power transmission lines 10 kV and 48 kV along the gas main route is included in the project scope. The gas main route and infrastructure sites will be located in the designated forest land.	Construction period 2021-2023.
Agriculture		
16	SPK Lena-2 - production base reconstruction in Podymakhino. Increase of output volumes (cultivated land area - 200 ha).	Implementation term - 2020.
17	Individual entrepreneur (IP) A.P. Markov - purchase of breeding cattle in Ruchei. Increase of output volumes (50 heads of cattle).	Implementation term - 2021.
18	SPK Lena-2 - production base creation in Niya	Implementation term - 2021.
Infrastructure (including construction/renovation of roads, utilities and housing infrastructure)		
19	Investment project of FGC UES for construction of 500 kV substation in Ust-Kut with feeders 500 kV and 220 kV. The project will enable collection of new substations at the Eastern Siberia - Pacific Ocean (ESPO) oil pipeline to the national unified power grid, and enhance power supply for the traction substations of the Baikal-Amur Railroad. In the future, substation 500 kV Ust-Kut will develop to become the feed centre for the new 220 kV transit Ust-Kut - Peledui - Mamakan (Taksimo), therefore, maximum allowed power flow will increase: in the Irkutsk - Buryatia section from 187 MW to 250 MW, to Taksimo - from 77 MW to 160 MW. FGC UES will invest almost 5 billion roubles into the substation construction. The new substation will provide reception and distribution of 500 kV power from Ust-Ilimsk HPP to the 220 kV power grid.	Implementation term 2016-2020. To be commissioned by 2020
20	Ust-Kut City Municipality - Reconstruction of the street road network section from the crossing of Khalturin and Nekrasov streets to crossing of Tchkalov street and Krasnaya Zvezda.	Implementation term – 2017-2019.

No.	Investment project name and brief description	Tentative terms of implementation, potential new jobs
21	UK Vodokanal-Servis - Design and reconstruction of water supply and wastewater disposal facilities, replacement of old equipment under the investment programme of the municipal service operator in Ust-Kut City Municipality.	Implementation term – 2019-2021.
22	Ust-Kutskiye Teplovye Seti i Kotelnye LLC (Ust-Kut heating networks and boiler houses) - Reconstruction of heat supply facilities, replacement of old equipment under the investment programme of the municipal service operator in Ust-Kut City Municipality including: • Lenskaya Teplovaya Kompaniya LLC (heat supply company) - conversion of heat boiler 12 MW for use of biofuel (wood chips, sawdust) in REB area (of 12 MW capacity); • Energoneftegas-Irkutsk LLC - improvement of heat supply reliability, transition from oil to biofuel (wood chips); • Lenateploinvest LLC - Construction of new municipal boiler house "Biriusinka"; • Reconstruction of the Tsentralnaya ("Central") boiler house including conversion to fuel gas combustion, 2024-2025.	Implementation term – 2019-2022.
23	Irkutsk Region Ministry of Construction and Roads, Ust-Kut Municipal Administration, Irkutsk Oil Company Design and construction of twelve 14-storey apartment blocks in Ust-Kut	Implementation term – 2019-2022.
24	Ust-Kut City Administration - Construction of 32 GCal/h boiler house in Ust-Kut	Implementation term – 2019-2022.
25	Ust-Kut City Administration - Design and construction of water main between the water intake facilities and the new residential area in Ust-Kut.	Implementation term – 2019-2020. 100% availability - by 2020.
26	Ust-Kut City Administration - Design and construction of water sewer network of PE pipes in Ust-Kut.	Implementation term – 2019-2021.
27	Ust-Kut City Administration - Design, construction, reconstruction of electric networks and substations for residential area in Ust-Kut.	Implementation term – 2019-2021.
28	Design, construction and renovation of motor roads in Ust-Kut for the new residential area	Implementation term – 2019-2022.
29	Ust-Kut Municipal Administration - Rehabilitation of road bridge across the Kuta River in Ust-Kut city	Implementation term – 2019-2021.
30	Ust-Kut City Municipality, Russian Timber Group - Construction of 100 MW boiler house fired by wood processing waste	Implementation term – 2022-2023.
Transport sector		
31	Ministry of Transport of the RF - Reconstruction of Ust-Kut airport	Implementation term - 2023.
32	Reconstruction of the Vilyui A-331 road section km 15+000 - km 149+000 (Ust-Kut - Verkhnemarkovo), 134 km, category III	By 2025
33	Renovation of the Vilyui A-331 road section km 0+000 - km 23+725 (Ust-Kut city bypass road), 23.72 km	2018 – 2019
34	Development of inland water transport - Development of a multimodal and multipurpose terminal facility on the basis of the Osetrovo River Port, Ust-Kut city	By 2035
35	Development of the Osetrovo port including construction of transshipment facilities	By 2035
36	Development of transport communications - Construction of railway line Ust-Kut (Lena station) - Zhygalovo - Irkutsk, length 690 km (Zhygalovsky, Kachugsky, Bayandayevsky, Ekhirit Balagatsky, Irkutsky Districts, Ust-Kut City, and Ust-Kut District).	By 2035

No.	Investment project name and brief description	Tentative terms of implementation, potential new jobs
Ecology		
37	Ust-Kut Municipal Administration, Ust-Kut City Municipality - Design and construction of MSW landfill (Ust-Kut city) and access road. The new MSW landfill with the total area of 30 ha will be established in the Yakurim River valley, along the Mingan road. By present time, the land plot has not been allocated for the purpose, however, its suitability for construction and operation of MSW has been confirmed by results of engineering survey.	Implementation term – 2019-2021.
38	Ust-Kut Municipal Administration, Ust-Kut City Municipality - Design and construction of waste treatment plant in Ust-Kut	Implementation term – 2019-2021.

13.3.3 Other anthropogenic impacts

Other anthropogenic impacts include degradation of habitats as a result of massive forest felling, littering of territories, forest fires and poaching; change of the wind rose – the change of wind pattern from northern to north-western is reportedly caused by massive forest felling and appearance of the large water plane at Boguchanskaya HPP; outbreak of bark beetle and ermel (as a result of disregard of forest use rules). 246 fires that destroyed 104,871.2 ha of forests in Ust-Kut District occurred over past five years.

The external anthropogenic factors which might affect the whole area of Irkutsk Region are climate changes including changes of geographic ranges of migrating animals and birds, shallowing of the Lena River, and increased frequencies of adverse events, e.g. fires, floods, etc. Two catastrophic spring floods were reported on the Lena River over past twenty years (in 1999 and 2001). In terms of level rise, size of flooded area, and damage caused, these events overpassed all major floods that were observed on the river during 20th century. In Ust-Kut, the floods affected streets near the banks and destroyed multiple buildings in the private housing areas. High water on the Kuta River also resulted in short-term flooding of the R419 road and partial erosion of the railway embankment. There is a major uncertainty about magnitude and nature of such externally induced changes throughout the Project life cycle. Thus, the CIA provides only a high level qualitative assessment of the climate change effects.

13.3.4 Discussion

Assessment of potential contribution of the Project to the cumulative impacts is enabled by the preceding review of existing activities and future projects (construction scope, distance to the Project area, area size). Table 13.3 provides results of the analysis and details of the future projects which were included to or excluded from CIA (it is considered that construction projects excluded from the assessment will not produce any significant cumulative impacts with the Project), as well as projects with high uncertainty factor, or projects which are not clearly described and thus may not be adequately assessed for their potential cumulative impacts.

Based on the analysis in Table 13.3, the following projects/activities have been included in CIA:

- LPG pipeline from the Yaraktinsky OGCF, Markovsky OGCF to Ust-Kut city (existing pipeline);
- LPG/SGC RS&O (existing facilities and extension);
- UKGFU;
- MEG Plant;
- Gas pipeline Yaraktinsky OGCF - Markovsky OGCF to Ust-Kut city (DSG transportation) and GDS;
- Limestone quarry mining by INK;
- IND Timber wood processing facilities with berths and wood processing waste dump;
- Other existing industries in Ust-Kut city;
- Existing motor roads and railway lines;
- Investment project of FGC UES for construction of 500 kV substation in Ust-Kut with feeders 500 kV and 220 kV;
- Development of oil and gas fields in the north of Ust-Kut District;

- Construction of the Power of Siberia GM;
- Road, utilities and housing construction / reconstruction in Ust-Kut city;
- Supply of LPG, DSG, MEG and PE products to customers by railway, motor road and water transport.

Other projects have been excluded from CIA for the following reasons:

- their temporal and/or spatial interaction with the Project will not cause any significant negative cumulative impact;
- the proposed construction projects are only at the conceptual development stage, or have been suspended; and
- lack of information for adequate assessment.

Table 13.3: Analysis of operations/projects which may cause potential cumulative impacts in combination with the Project

Operations / Potential development	Interaction with the Project	Included / Not included in CIA
Existing gas transportation system of INK from the Yaraktinsky OGCF and Markovsky OGCF to Ust-Kut city	Will have spatial and temporal interaction with the planned activities.	Included
LPG/SGC RS&O (existing facilities and extension)	Will have spatial and temporal interaction with the planned activities.	Included
UKGFU	Will have spatial and temporal interaction with the planned activities.	Included
MEG Plant	Will have spatial and temporal interaction with the planned activities.	Included
Gas pipeline Yaraktinsky OGCF - Markovsky OGCF to Ust-Kut city (DSG transportation) and GDS	Cumulative impact is possible if the same VECs are affected.	Included
Future gas processing and gas chemical projects (proteins and polyformaldehyde production)	No information available	Not included
Construction of fuel gas pipelines from GDS to Ust-Kut and Ust-Ilimsk	Temporal frames of this development have not been identified. If implemented, cumulative impact is possible if the same VECs are affected.	Not included
Supply of LPG, DSG, MEG and PE products to customers by railway, motor road and water transport	Will have spatial and temporal interaction with the planned activities.	Included
Limestone quarry mining by INK	Cumulative impact is possible if the same VECs are affected.	Included
IND Timber wood processing facilities with berths and wood processing waste dump	Will have spatial and temporal interaction with the planned activities.	Included[297]
Other existing industries in Ust-Kut city, particularly those located in the direct vicinity of the Project area (within the radius of 5 km): berths and industrial facilities of Alrosa including explosives store; operational, storage and utility sites of Mikura LLC and Bridge Construction Unit No.5; MSW landfill; Irkutsknefteprodukt oil tank farm, and other storage, utility and industrial facilities on the Lena River upstream of the Project area that may have impacts within the Project's AoI.	Cumulative impact is possible if the same VECs are affected.	Included[6]
Investment project of FGC UES for construction of 500 kV substation in Ust-Kut with feeders 500 kV and 220 kV.	Under construction. Cumulative impact is possible if the same VECs are affected.	Included
Development of oil and gas fields in the north of Ust-Kut District (enhancing production at the Yaraktinsky OGCF and Markovsky OGCF including construction of DSG transport and reinjection compressor stations; helium recovery at the Yaraktinsky OGCF;	The sites are located at a significant distance from the Project area. However, considering that Osetrovo is the only port on the Lena River that also handles cargoes transported by railway, including transshipment of 80% goods for further transportation by water to	Included

[297] The main impacts of these have been considered by the baseline analysis within the ESIA process. Included in the CIA scope due to the potential secondary pollution (through contamination of soil, ground, ground water and bottom sediments in the surface water bodies).

Operations / Potential development	Interaction with the Project	Included / Not included in CIA
development of the Ayansky West LA, Bolshetirsky, Ichedinsky and Verkhnetirsky Oil Fields)	Yakutia and northern areas of Irkutsk Region, development of oil-and-gas fields and other infrastructure in the north of Irkutsk Region and in Yakutia will likely result in an increase of vehicles traffic in Ust-Kut city. The traffic flows are routed through the city centre and along residential quarters, further exacerbating the problem of air contamination and noise and posing risks to community health and safety. Cumulative impact is possible if the same VECs are affected.	
Motor roads and railway lines (the Vilyui road, 25H26 road, subsidiary roads, BAM and access railway spurs)	Will have spatial and temporal interaction with the planned activities.	Included
Construction of Lenskaya CHP of Irkutskenergo in Ust-Kut, capacity 1.2 GW	The project is indefinitely postponed due to lack of power consumers. If implemented, cumulative impact is possible if the same VECs are affected.	Not included
Construction of the Power of Siberia gas main	The site is located at a significant distance from the Project area. However, considering that cargoes for construction of the Power of Siberia gas main are transported via the Osetrovo Port, cumulative impact is possible if the same VECs are affected.	Included
Planned agricultural activities (SPK Lena-2 - production base reconstruction in Podymakhino; individual entrepreneur A.P. Markov - purchase of breeding cattle in Ruchei; SPK Lena-2 - production base creation in Niya)	The facilities are located away from the site of the planned activities. May have spatial and temporal interaction the planned activities. The potential temporal interaction will unlikely result in significant negative cumulative effect.	Not included
Road, utilities and housing construction / reconstruction in Ust-Kut city (including under the investment programme of the municipal service operator in Ust-Kut City Municipality: • Reconstruction of the street road network section from the crossing of Khalturin and Nekrasov streets to crossing of Tchkalov street and Krasnaya Zvezda; • Renovation of the Vilyui A-331 road section km 0+000 - km 23+725 (Ust-Kut city bypass road), 23.72 km; • Reconstruction of the Vilyui A-331 road section km 15+000 - km 149+000 (Ust-Kut - Verkhnemarkovo), 134 km, category III); • Reconstruction of water and wastewater facilities, replacement of old equipment; • Reconstruction of heat supply facilities, replacement of old equipment, construction of new municipal boiler houses including a 100 MW boiler house fired by wood processing wastes; • Development of utility infrastructure for the new housing area in Ust-Kut; • Rehabilitation of the railroad bridge across the Kuta River.	Cumulative impact is possible if the same VECs are affected, particularly in terms of transport communications within the Ust-Kut city.	Included

Operations / Potential development	Interaction with the Project	Included / Not included in CIA
Reconstruction of Ust-Kut airport	The site is located at a significant distance from the Project area. Temporal interaction with the Project will not cause any negative cumulative impact.	Not included
Development of the Osetrovo port including construction of transshipment facilities, Ust-Kut city	No specific plans have been identified for development of the Osetrovo port.	Not included
Development of transport communications - Construction of railway line Ust-Kut (Lena station) - Zhygalovo - Irkutsk, length 690 km (Zhygalovsky, Kachugsky, Bayandayevsky, Ekhirit Balagatsky, Irkutsky Districts, Ust-Kut City, and Ust-Kut District).	The project implementation period is beyond the temporal scope of the CIA.	Not included
Construction of MSW landfill (Ust-Kut city) and access road	Details of the project location are not available. The project is not included into the Ust-Kut City Municipal Infrastructure Integrated Development Programme 2017-2028	Not included
Construction of waste treatment plant in Ust-Kut	Details of the project location are not available. The project is not included into the Ust-Kut City Municipal Infrastructure Integrated Development Programme 2017-2028	Not included

13.4 Assessment, Significance and Management of Cumulative Impacts

This section provides a review of potential cumulative impacts on important social and environmental components. Table 13.4 provides a summary of the analysis and indication of the future project activities that have been considered by CIA for VEC.

Table 13.4: Activities / projects included in VEC-specific CIA

Activities / development plans	VEC					
	Atmospheric air	Surface water	Forest resource and natural habitats	Aquatic habitats and aquatic life	Community health and safety	Local infrastructure;
LPG pipeline from the Yaraktinsky OGCF, Markovsky OGCF to Ust-Kut city (existing pipeline)		V	V			
LPG/SGC RS&O (existing facilities and extension)	V	V	V	V	V	V
UKGFU	V	V	V	V	V	V
MEG Plant	V	V	V	V	V	V
Gas pipeline Yaraktinsky OGCF - Markovsky OGCF to Ust-Kut city (DSG transportation), GDS	V	V	V	V	V	V
Limestone quarry mining by INK	V	V	V	V		V
IND Timber wood processing facilities with berths and wood processing waste dump	V	V	V	V	V	V
Other existing industries in Ust-Kut city	V	V	V	V	V	V
Existing motor roads and railway lines	V		V		V	
Investment project of FGC UES for construction of 500 kV substation in Ust-Kut with feeders 500 kV and 220 kV	V	V	V		V	V
Development of oil and gas fields in the north of Ust-Kut District	V		V		V	V
• Construction of the Power of Siberia GM	V		V		V	V
• Road, utilities and housing construction / reconstruction in Ust-Kut	V	V			V	V
• Supply of LPG, DSG, MEG and PE products to customers by railway, motor road and water transport	V	V		V	V	V

V - activities/projects included in the assessment

13.4.1 Atmospheric air

Residual impact of the Project construction and operation on atmospheric air (Section 9.1) will be low. The background air quality assessment within the Project's AoI (Section 7.1) considered the wood processing waste landfill located 500 m to the west of the "upper" Project area (Area 1). The waste has been burning for multiple years and, in combination with frequent adverse weather conditions which do not support atmospheric dispersion, produce a smoke blanket containing large quantities of suspended solids and other combustion products that covers large territories in the eastern areas of Ust-Kut city, with the worst effect on Mostootryad and Yakurim areas.

Assessment of the Project operation impacts (Section 9.1) also considered the impacts of the planned MEG Plant adjoining the Polymer Plant Site, including the general site utilities (flare system, boiler house, tank farms, wastewater treatment facility with a waste incinerator, etc.) that will be shared by the two plants.

Preparatory activities have already been initiated in the Area 1 sites; actual construction will start at the end of 2019 at the PPF site and in the middle of year 2020 at the MEG Plant site, and the main construction activities of the both facilities within Area 1 will overlap in time (PPF till the end of 2002, MEG Plant till the middle of 2023). The DSG pipelines from the Yaraktinsky OGCF and Markovsky OGCF to Ust-Kut city, as well as the GDS located 500 m to the south-east of the Area 1 sites (PPF, MEG Plant, and utilities area) will be constructed during the same period, whereas the main construction activities for the INK Gas Programme Phase II (LPG/SGC RS&O (extension) and GFU) in Area 2, the main associated facilities of the Project (interfacility road, Vilyui A-331 road section, large equipment unloading berth, water supply and wastewater disposal systems) and the power supply facilities (PS 500/220 kV "Ust-Kut") will be completed by the middle or end of year 2020. Therefore, a short-term period of coincidence of multiple construction activities is expected in the Ust-Kut industrial area of INK. The main sources of pollution emissions during construction are operating vehicles, machinery and equipment, welding and painting activities, dust emissions from transportation and handling of loose materials.

The main construction activities for the Project facilities in Area 2 will only coincide with construction of the MEG Plant offloading terminals, and will significantly differ from the construction activities in Area 1, in terms of their scope and scale. The construction activities will be focused on finished products storage facilities, and the main types of works with impact on air quality will be painting of the storage buildings. Considering that UKGFU, LPG/SGC RS&O, the large equipment unloading berth, and the Vilyui A-331 road section within Area 2 will have been commissioned by the time of construction of the PPF and MEG Plant offloading terminals, activities within Area 2 are not expected to cause any emissions with composition similar to emissions from painting works, therefore, no significant cumulative impact is expected.

Given the significant distance to the nearest receptors (Kedr-2 Gardening Association, Mostootryad and Yakurim areas), cumulative impact on the air quality at the Project construction phase is possible only in relation to increased intensity of traffic on public roads.

During the operation phase, the most significant impact of PPF on atmospheric air quality will be related to emissions of nitrogen dioxide, carbon oxide, as well as summation groups where these substances are present. No spatial overlapping of Area 1 and Area 2 SPZs of the Ust-Kut industrial zone (Section 9.11, Figure 9.11.4) is expected. However, SPZ of the operational Area 2 overlaps with SPZ of existing third-party operations in the east of the Ust-Kut industrial zone (IND Timber wood processing facilities with berths, operational, storage and utility sites of Mikura LLC and Bridge Construction Unit No.5, MSW landfill, etc.).

In addition, pollution emissions from the road transport may increase in the medium term, in relation to increased cargo transit for development of oil-and-gas deposits and other infrastructure in the north of Irkutsk Region and Yakutia (on winter roads during the cold season, and by river in summer). As a result of partial reclamation of the TSLK wood processing waste dump in 2018, intensity of smoke pollution lessened to a significant extent. It is assumed that the issue of burning wood waste will be solved in the near future by implementing a range of measures including reduction of the waste volumes, particularly by construction of a new biofuel-fired boiler house in Ust-Kut. In 2019 IND-Timber launched two fuel briquette lines which have reached their full capacity for recycling of timber waste. Also, the planned measures for improvement of environmental situation in the city by converting the municipal coal-fired boiler houses for operation on a more environmentally friendly fuel (natural gas, wood waste), as well as planned upgrading/re-equipment of the existing boiler houses should be taken into account.

Considering that the identified tentative area of influence of the Polymer Plant is wider than the SPZ belt of 5 km[298] (see Section 9.11 for details), the above sources may have a cumulation potential for pollution of air (especially in relation to nitrogen dioxide and carbon oxide). Depending on the weather conditions and direction of wind, this area of influence might include the Kedr-2 GA and Mostootryad area. In view of the high receptor sensitivity, potential cumulative impact on air is assessed as **moderate. Project contribution** to the cumulative impact is expected to be of **medium** scale.

13.4.2 Surface water

The main impacts of construction and operation of the Polymer Production Facility and associated facilities (primarily the oversize cargo berth) include warming, turbulence, reduction of water flow, agitation of bottom sediments, transformation of ice conditions etc. The residual impact of the Project construction and operation (Section 9.5) is assessed as negligible and low/moderate, due to the potential leaks risk that can be minimised by adopting appropriate prevention measures.

Construction and operation of various facilities within the Ust-Kut industrial area of INK may affect the same catchment area of the Lena River. The impact will be present in the form of wastewater discharges (LPG/SGC RS&O), abstraction of ground water from the upper horizons, and surface runoff from the industrial sites and surrounding areas (mainly during the construction phase). The cumulative impacts are most probable in relation to the Area 2 facilities which are likely to affect the WPZ and SPB of the Lena River. The main construction activities within Area 1 will coincide only with construction of the MEG Plant, as all other major construction activities of the previous stages of the INK Gas Programme (LPG/SGC RS&O, GFU) and associated facilities will have been completed by that time.

The main existing sources of the Lena River pollution are untreated (inadequately treated) wastewater, storm water from industrial and residential areas, and melt waters from roads, contaminated with oil and petroleum products from oil tank farms, shipyards.

Although the Polymer Plant construction and operation will not produce any significant contribution to the total impact (provided that the proposed mitigation measures are implemented), the cumulative impact on the Lena River is still assessed as **long-term high scale**, given the decline of water quality and level in the river (excessive concentrations of certain pollutants, contamination with oil products). The Project **contribution to the above impacts** can be assessed as **negligible**.

13.4.3 Forest resource and natural habitats

The main Project impact on the forest resource and natural habitats is related to the long-term physical losses caused by land acquisition for the Project facilities and infrastructure, destruction of forest and other vegetation (irreversible by nature), complete loss and fragmentation of habitats within the land allocation, and the loss of ecosystem protective functions of the landscape. The residual impact of the Project (Section 9.6) is assessed as low / moderate (depending on the scope of compensation measures).

The second alternative which has been selected as the preferred option provides for construction of the PPF process area at an elevated site within the merchantable forest, therefore, disturbance (destruction and fragmentation) of spawning protection forest will be minimised. The impact on protective forests cannot be completely avoided due to the need for the technical communications corridors between the PPF process area and the offloading terminal, the GFU and the existing transport corridors. Therefore, a part of the spawning protection forest will be acquired for construction of the linear facilities.

On the other hand, facilities within operation Area 2, as well as existing and planned facilities within the scope of the INK Gas Programme, existing wood processing and other industrial facilities are located within the former area of spawning protection forests, resulting in transformation and fragmentation of natural areas.

Another source of serious threat to the natural ecosystems is forest fires. The risk of fires will increase, as the gas chemical and gas processing complex, and in particular the Polymer Plant will use fire- and explosion-hazard processes and materials, and other industrial facilities in the Project area also represent

[298] Concentrations of most emitted components will decrease to the threshold level of 0.05*MPC within this area.

fire hazard in case of emergency (wood processing, burning timber wastes landfill, explosives stores, fuel stores, etc.). In addition, the inflow of migrant workforce for construction and operation of all development projects in Ust-Kut District will increase the risk of resident-caused fires manyfold.

Taking into account small size of the forest land area acquired for the Project (on the district scale), sensitivity and environmental significance of the affected ecosystems, and overall duration of the man-caused impacts, the cumulative impact on the forest resource and natural habitats is assessed as **moderate**. The Project contribution is assessed as **medium**.

13.4.4 Aquatic habitats and aquatic life

The greatest Project impact on the aquatic organisms providing the basic food resource for fish will be directly related to the impact on their habitat, particularly during the dredging operations, construction of the berth, water abstraction and discharge facilities in the river and the floodplain. Considering the local extent and short duration of impact (most impacts will be present only during the period of construction), the residual impact is assessed as low (Section 9.5).

A more significant impact with a long-term cumulative effect on aquatic ecosystems is related to acquisition and transformation of designated spawning protection forest land for construction of the INK's Gas Programme facilities in the "lower" process area (LPG/SGC RS&O, GFU, offloading facilities of the PPF and MEG Plant). The disposition selected for the Project provides for the main construction site location outside the spawning protection forest belt, therefore, the Project impact on spawning protection areas will be limited to the strips needed for construction of linear communications between the process sites and offloading areas.

At the background of decline of water level and quality in the Lena River (excessive concentrations of certain pollutants, contamination with oil products), and poaching, the existing and future development activities in the Project area may increase the load on fresh-water ecosystems of the Lena River.

The impacts will hardly coincide in time to produce a significant cumulative effect. Thus, the cumulative impact is assessed as **low**.

13.4.5 Community health and safety

The main Project impacts with cumulation potential of negative effects on community health and safety in combination with other existing and planned development projects include the following:

- Community health risks (residual impact of the project is assessed as moderate);
- Community safety risks related to influx of migrant workforce from other regions (residual impact of the Project is assessed as low);
- Community safety risks related to heavy machinery and passenger vehicles traffic on the public roads - increased traffic intensity may affect road safety and increase the risks of traffic accidents (residual impact of the Project is assessed as moderate at the construction phase and low during operation).

Potential cumulative impact on air from the current and future operations which has been considered above (refer to the thematic section on atmospheric air) may induce an increase of respiratory diseases morbidity rate.

In general, the greatest influx of migrant workforce in relation to the planned activities is expected during construction of the INK's Gas Programme facilities which will be implemented in several phases. Construction of the PPF and the MEG Plant is planned for the period after completion of the previous phases of the INK Gas Programme. Nevertheless, over 10,000 workers may reside in the temporary accommodation compound (TAC) during the peak period of the MEG Plant and PPF construction. After the proposed mitigations and considering the remote position of the TAC in relation to residential areas in Ust-Kut city, no significant cumulative impact is expected in relation to the migrant labour influx.

Cumulation of the impacts caused by increased traffic intensity (heavy machinery movement) in the public roads is possible, especially during the Project construction. This impact will particularly affect Mostootryad and Yakurim areas due to their location along the road. In addition, road transport intensity may increase in the medium term, in relation to increased cargo transit through the Osetrovo port for development of oil-and-gas deposits and other infrastructure in the north of Irkutsk Region and Yakutia (on winter roads during the cold season, and by river in summer).

In general, cumulative impact on community health and safety produced by all major projects being implemented or planned in the region can be assessed as **moderate**.

13.4.6 Local infrastructure

The migrant workforce flows associated with various projects in the region may increase the load on the existing infrastructure facilities and services, primarily the transport system (roads quality).

Construction activities under all planned projects will increase intensity of heavy machinery traffic on the public roads in Ust-Kut district and city. Such traffic may deteriorate quality of local roads, and hence more funding from the local public budgets will be required to maintain the road network. This will also influence traffic intensity related to trips of local residents using private cars or public transport. In view of the generally poor state and low capacity of the road network, and in absence of adequate mitigation measures within the scope of specific projects, overall cumulative impact on local infrastructure can assessed as **moderate**.

13.5 Management of Cumulative Impacts and Main Conclusions

Mitigation of cumulative impacts should be provided on a project specific basis, with responsibility vested in the project operator, and in terms of VEC management - at the regional level.

The main mechanism of regional management of VEC shall be based on strategic assessment of the regional development and planning, which is normally the function of competent government authorities. Operator of specific project has no tools to oblige other parties to adopt mitigation measures, as long as it has no power or authority to directly control them, and is not responsible for their activities.

The Company has adopted an active approach to management of such impacts through rigorous implementation of Project specific mitigation measures, continuous community engagement and consultation activities (refer to Chapters 4 and 10).

In accordance with guidance note to the IFC Performance Standards, operator of the planned activities will use commercially reasonable efforts to engage relevant government authorities, other industries, affected communities, and, where appropriate, with other relevant stakeholders, in the design and implementation of coordinated mitigation measures to manage the potential cumulative impacts.

The CIA did not identify any potentially significant cumulative impacts on natural and social environment which would require specific mitigation and management measures in addition to those identified for the Project (refer to Chapters 9 and 10). However, the assessment provides certain recommendations for mitigation of the identified impacts which are listed below.

- Pollution dispersion modelling for all phases of INK Gas Programme in Ust-Kut and development of general impact mitigations as appropriate.
- Given the expected coincidence of construction of facilities under the INK Gas Programme Phases II-IV (also including construction of associated facilities and third-party activities), coordinated traffic management plans should be developed for the construction and operation.
- Development of a unified environmental monitoring and action programme for all phases of the INK Gas Programme in Ust-Kut, including consideration of establishing a common SPZ for the Ust-Kut industrial area of INK.
- A study is needed to assess all traffic flows which will be generated by all phases of the INK Gas Programme and other projects planned for implementation in Ust-Kut city and district.
- Disclosure activities and communication with local residents in order to address community concerns about the projects.
- It is advisable that the Company is engaged in community consultation activities in case of any new projects which may be developed near the Project site and its area of influence in the future.

14. ENVIRONMENTAL AND SOCIAL MANAGEMENT

14.1 Structure of Environmental and Health and Safety Management at INK

Irkutsk Oil Company has a corporate-level integrated management system (IMS) comprising Environmental Management System (EMS) and Occupational Health and Safety Management System (OHSMS) which take into account the requirements of ISO 14001:2015 and ISO 45001:2018. The IMS is an integral part of the corporate governance system.

Since the European Bank for Reconstruction and Development holds a share in INK, the Company is committed to apply specific efforts to make sure that its operations meet the EBRD's requirements. The respective commitments are reflected in the corporate Environmental and Social Action Plan which implementation progress is annually disclosed via the Company's official website.

Persons responsible for environmental management, occupational health and safety, social management in INK are directly subordinated to the General Director of the Company, thus prompt response and management efficiency is ensured.

Environmental and stakeholder engagement activities are supervised by the Deputy General Director on Legal and Environmental Issues and Regional Policy E.Y. Milov who is also top management representative for IMS. A. A. Dyakov, Director of the Environment and Land Use Department which is subordinated to the above Deputy General Director, is responsible for the Environmental Management System (EMS). Another Department supervised by the Deputy General Director is the Department for Regional Policy and Authorities Liaison which is in charge of public relations, preparation and approval of permitting documents, representation of the Company interests in the Republic of Sakha (Yakutia).

Activities in the sphere of occupational health and safety are supervised by the Deputy General Director for occupational health and industrial safety. Departments under this Deputy General Director are OHS Department and Fire Safety and Emergency Response Department. Director of the Occupational Health and Industrial Safety Department A.I. Bogdanov is in charge of the OHSMS.

Roles, responsibility and powers of personnel within IMS are defined in specific job descriptions, division regulations, Procedures and other internal IMS documents, as well as various organizational documents and instructions of the Company.

Environmental, social, occupational health and safety management structure of INK is shown in Figure 14.1.

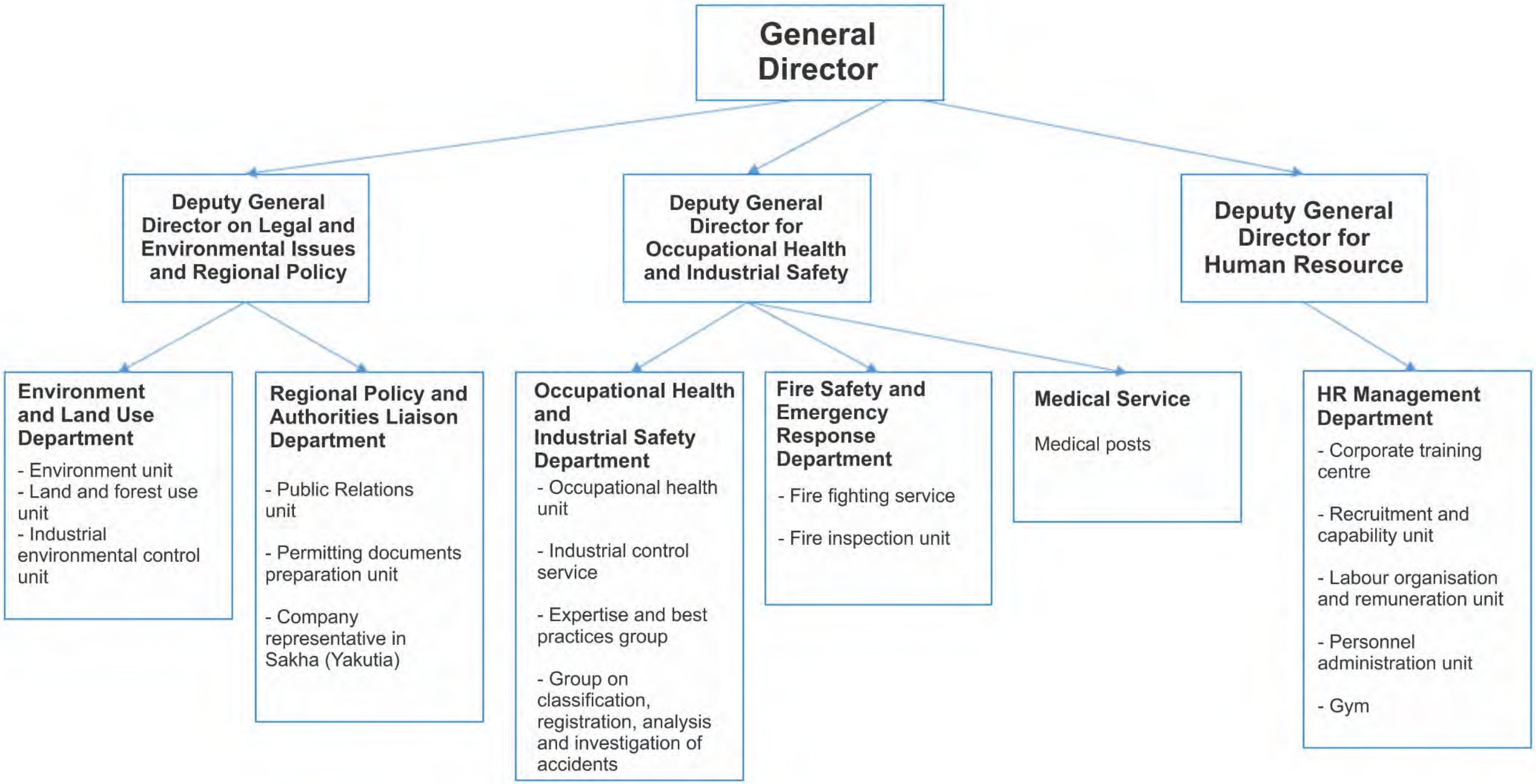

Figure 14.1: Environmental, social, occupational health and safety management structure of INK

14.2 Integrated Management System of INK

Integrated Management System of INK Group is built on the following key principles:

- Environmental leadership and occupational health and safety (OHS) leadership of the top management. The top management is committed to provide adequate resource for continuous improvement of IMS;
- Involvement of personnel at all levels in the process of environmental management, control of OHS risks, continuous improvement of IMS;
- Personal accountability of each employee for compliance with IMS;
- Personnel motivation for identification of potential improvements of IMS;
- Risk oriented approach;
- Priority is given to proactive as opposed to reactive measures;
- Continuous improvement of IMS.

The original Environmental, Health and Safety Policy was approved in 2009, and its updated version was approved by the Order of INK LLC of 17.06.2018 No.0582/00-п. The Policy is disclosed to general public via the Company's corporate website.

The Environmental, Health and Safety Policy defines strategic direction for development of the Company operations, declares the Company's commitments in the sphere of environmental protection, health and safety of personnel and local communities. The Policy provides the basis for planning and implementation of any activities, is taken into account at identification of the respective targets and objectives, and covers all divisions and subsidiaries of the Company. Its key principles are listed below:

- Preventing environmental pollution, injury, and illness of employees and the general public;
- Minimizing the negative impact of operations and other activities on the environment;
- Reducing operational risks;
- Rationally using natural resources, introducing modern waste management technologies;
- Improving the integrated management system, which complies with ISO 14001:2015 and ISO 45001:2018;
- Ensuring the contractors also comply with INK's Health, Safety, and Environment Policy;
- Improving the INK employees' skills, knowledge, and awareness in the field of health, safety, and the environment;
- Holding a direct dialogue with stakeholders through public discussions to assess the impact of proposed activities on the environment and by publishing information in the media and on the Company's website;
- Supporting the local population and indigenous peoples who live in places of INK's operations.

With respect to the above principles, priority focus areas of INK efforts over recent years included introduction and certification of integrated management system comprising Environmental Management System and Occupational Health and Safety Management System which is compliant with the international standards ISO 14001:2015 and ISO 45001:2018.

The INK's IMS covers the following operations: exploration, drilling, development of oil and gas fields, production, processing and transportation of oil, gas, and gas condensate.

The document which describes the key principles, sphere of application and interfaces between IMS components is the IMS Manual (document CT 01.11 rev. 4). Other key IMS documents are listed in the table below.

Table 14.1: Key documents of the INK IMS

Document ID	Description
CT.01.01	Documented information management
CT.01.32	Integrated risk management system
CT.02.10	Environmental, occupational health and safety leadership

Document ID	Description
СТ.02.11	IMS planning and management review
СТ.03.10	Personal protective equipment. Main provision and handling requirements.
СТ.03.11	IMS internal audits
СТ.03.32	Business processes modelling
СТ.04.10	Client's environmental, health and safety requirements
СТ.05.10	Management and interaction with contractors on occupational health and safety issues
РГ.01.10	Management of occupational health and safety risks
РГ.01.11	Environmental management
РГ.02.10	Preventive actions management within the scope of the occupational health and safety management system
РГ 02.11	Management of environmental, health and safety obligations. Conformity assessment
РГ.03.11	IMS monitoring and measurements
РГ.04.10	OHS incidents investigation and reporting
РГ.04.11	Corrective actions management within IMS
РГ.05.11	Internal and external communication within IMS
РГ.06.14	Industrial process risk management
П.01.10	On organising and conducting operational monitoring of compliance with industrial safety requirements at operation of hazardous facilities of INK»
П.01.11	On operational environmental monitoring procedure at INK Group facilities
П.02.10	Procedure of technical investigation of the causes of incidents at hazardous facilities of INK
П.02.11	On IMS Development Committee

INK Group sets IMS targets and objectives which are documented in the Environmental Management Programme and OHS Management Programme. Procedures to be followed for determination of environmental targets and objectives, OHS targets and objectives, implementation action planning procedures, as well as procedures for preparation and conducting the management review of IMS are defined by the Standard document СТ.02.11 - IMS planning and management review.

The Integrated Management System of the INK Group comprising Environmental Management System and Occupational Health and Safety Management System passed re-certification audit in August 2018. Therefore, certificate of the OHS Management System of INK Group compliance with the management system standard BS OHSAS 18001:2007 was confirmed, and compliance of the Environmental Management System with the new version of international standard ISO 14001:2015 was certified. Both certificates cover the Company’s operations in Krasnoyarsk Krai and the Republic of Sakha (Yakutia).

14.2.1 OHSE requirements to contractors

INK adopted Standard document СТ.04.10 - Client's environmental, health and safety requirements. This Standard sets general requirements relating to the access, admission, presence and safe working of contractors in the Company’s premises in terms of compliance with the applicable access control, occupational health, industrial, fire and environmental safety regulations. The Standard covers all contract agreements pertaining presence of contractor's personnel at the sites of INK and/or its subsidiaries. The Standard further identifies the list of violations and respective fines to be charged by the Company in case of contractor's failure to comply with the OHSE requirements.

The Standard is integral part of each contract. When and where needed the Company defines specific requirements to contractors engaged for certain types of works (operations). Contractor is fully responsible for making sure that his subcontractors respect the Standard requirements.

The Company has also implemented Standard document CT 5.10 - Management and interaction with contractors on occupational health and safety, and environmental issues - which sets out general requirements for management and interaction on OHS issues with contractors working on the Company's sites and assignments. The Standard regulates the following processes in the context of occupational health and safety: qualification assessment of Contractor, selection of Contractor to perform the works, making the contract agreement, Contractor's access to the Company's facilities and to the works, monitoring of Contractor's OHS performance during the works, allocation of Final Score based on the contract performance.

The Company provides desk review of documentation of potential Contractor and (if necessary) arranges further on-site audit at the stage of competitive bidding. If any comments are made, potential Contractor must define and implement adequate corrective actions prior to starting his works in the Company's premises.

Within 15 working days from obtaining access to the site, the Contractor must perform a documented risk assessment of the planned works including:

- Description of all potential hazards, including emergency situations;
- Potential injuries of personnel;
- Potential damages to equipment, buildings, structures, utilities;
- Potential emergency situations (fire outbreak, burning, etc.);
- Potential environmental contamination (oil spills, etc.);
- Identification of effective risk mitigation measures, including appointment of responsible persons and definition of specific and agreed deadlines.

Based on the results of risk assessment, the Contractor must within 3 days develop a Safety Plan and get it approved. The Safety Plan must describe specific measures, persons in charge, and terms of implementation.

The Safety Plan is subject to approval by the Supervisor - the Company's representative for supervision of on-site construction and other works (services). The Supervisor also assigns specific responsibility areas for each contractor (layout of accommodation and domestic facilities, laydown areas, waste accumulation sites, temporary parking lots for vehicles and machinery, etc.). The Supervisor makes the necessary arrangements to facilitate access permits for the Contractor to perform the works (services), and monitors Contractor's works for compliance with OHSE requirements.

Contractor's personnel engaged for the Project must always comply with the Company's OHSE policy and procedures developed and controlled in accordance with IMS documentation, keep record of the efforts to ensure safe operation of the plant and mandatory use of personal protection equipment (PPE) as applicable to the type of works.

Contractor working in the Company's premises is obliged to:

- Provide OHSE management as applicable to his organizations and Project works;
- Arrange regular inspection of HSE compliance during the works, and if any gaps are identified develop corrective and preventive measures, with specific deadlines and persons in charge of implementation;
- Comply with instructions and recommendations received from the Company's OHSE service;
- Provide timely training (pre-appraisal training, appraisal, knowledge testing) on occupational health, industrial and fire safety of own personnel, and make sure that the involved subcontractor's personnel are adequately skilled, trained and certified;

- Provide toolbox training for own and subcontractor's personnel on health and safety provisions, compliance with legal and other regulatory requirements, Company's corporate regulations applicable to the works, in order to prevent potential injury, damage to the Company, life and health of personnel and other parties, with record in the toolbox training log certified by signature of trainee;
- Respect all rules of sustainable use, conduct in the Company's premises, conservation of vegetation and soil, and follow instructions of the Company's representatives concerning compliance with the above;
- Manage OHSE practices of subcontractors and make sure that subcontractors comply with OHSE requirements;
- Be responsible to the Company for the practices and functioning of subcontractors' OHSE services;
- Arrange for collection of statistical and other reporting information within his own organization and by subcontractors, and prepare OHSE reports in compliance with the applicable procedures of the Company.

Contractors' managers of all levels must:

- Set personal example to other demonstrating good practice of establishing and maintaining safe working environment;
- Take part in OHSE meetings arranged by the Company (upon agreement);
- Participate investigations of accidents, incidents, emergencies;
- Regularly walk over the work sites of Contractor's personnel and review HSE status;
- Arrange inspections and audits;
- Demonstrate high safety culture at all levels of operation;
- Stop any works which are in breach of safety requirements.

The Company representatives monitor OHSE compliance in the course of Contractor's works on the Company sites at all stages of the contract. Monitoring is provided in the form of regular inspections and checks by the Company representatives, e.g. Operation Control Service, Health and Safety Unit, etc.

Contractors are required to submit their monthly reports by the 5th day of the month following the reporting period. Contractors' reports are used for monitoring of their performance: progress reviews at regular meetings, rewarding of personnel for particularly good performance, and evaluation of Contractor's performance upon completion of contract works. The above assessment is taken into account during subsequent pre-qualification and tendering procedures.

14.2.2 Operational control and monitoring

INK Group annually develops and implements an operational environmental monitoring program for observation of status of natural environment at the field operation sites and in the license areas. E.g. in 2018 environmental monitoring activities were conducted in 24 field sites and license areas. Results of chemical analysis of various components of the environment (air, water, soil) indicate that environmental quality in the field sites and license areas of the Company in general corresponds to the background parameters measured in the reference areas, and the normal values observed in the north of Eastern Siberia. The operational environmental monitoring procedure is documented in the corporate regulations: П.01.10 - On organising and conducting operational monitoring of compliance with industrial safety requirements at hazardous facilities of INK, П.01.11 - On operational environmental monitoring procedure at INK Group facilities, and РГ 03.11 - IMS monitoring and measurements.

Description of the monitoring and control of Contractors' practices is provided in subsection 14.2.1.

14.3 Social Management System

HR management in INK is supervised by the Deputy General Director for Human Resource who has the following departments under control: HR Management Department being in charge of recruitment and adaptation of new employees, labour organization and remuneration, HR administration, preparation and training of personnel.

Provision of safe working environment for personnel and contractors at the construction sites is the duty of the services reporting to the Deputy General Director for OHS, and the Client Service.

Deputy General Director for Legal and Environmental Issues and Regional Policy is in charge of communication with external stakeholders. The Deputy General Director supervises the Department for Regional Policy and Authorities Liaison which is in charge of public relations, preparation and approval of permitting documents, representation of the Company interests in the Republic of Sakha (Yakutia).

HR management and interaction with contractors is provided in compliance with the Labour Law of the Russian Federation and other obligations assumed by the Company.

The key provisions of the HR-related social policy are set forth in the following main documents:

- Internal rules of conduct (employment, transfer and dismissal procedures, key rights, duties and responsibility of employee and employer, working hours, rest time, applicable incentives and penalties, etc.);
- Employment contract (definition of job post and functions of employee, remuneration, working conditions);
- Regulation on guarantees and compensations for INK personnel (leave entitlement, material support, medical and accident insurance, etc.).

Personnel training and skills enhancement is provided via the Corporate Training Centre of INK. In particular 95 specialists have been trained under the training programme "Environmental safety of hazardous waste management operations". П.01.10 - On organising and conducting operational monitoring of compliance with industrial safety requirements at hazardous facilities of INK.

14.3.1 Stakeholder Engagement Approach

The Company's community engagement activities (including engagement of communities affected by the Project) are implemented in accordance with the Stakeholder Engagement Plan which describes the main principles of engagement and related measures. For processing and analysis of stakeholder grievances, the Company has developed and maintains the guideline document "On the public grievance procedure of Irkutsk Oil Company LLC" approved by INK Order of 31.06.2008 No.137/00-п.

In 2015 INK launched the Socio-Economic Cooperation and Charity (Sponsor) Policy (approved by INK Order of 26.10.2015 No.605-00-п). The Policy defines the procedure and conditions for provision of charity (sponsor) support for development of human capital and provision of fair social climate in the regions of the Company's presence. The Policy is developed in compliance with the Civil Code and other regulations of the Russian Federation, INK Charter, the existing Socio-Economic Partnership Agreements between the Company and the Government of Irkutsk Region, other public and/or local authorities and non-governmental organizations.

The Socio-Economic Cooperation and Charity (Sponsor) Policy describes:

- General principles of charity (sponsor) support;
- Procedure for consideration of individual requests for charity (sponsor) support;
- Procedure for implementation of decisions about provision of charity (sponsor) support and reporting on the use of finance;
- Funding procedure.

INK uses the following methods of interaction with external stakeholders:

- Liaison with public authorities and non-governmental organizations in the areas of the Company's operations;
- Interaction with communities of indigenous minorities of the North at the field operation sites;
- Provision of information on socio-economic cooperation and environmental activities;
- Public hearings, provision of feedback to written requests and public grievances.

INK participates in socio-economic development of Irkutsk Region by providing financial support for social activities, e.g. the Company spent 150 million roubles for social and charity programmes in 2018.

INK interacts with stakeholders in an open and efficient manner. In 2016 the Company held 12 public hearings on the Environmental Impact Assessments for the proposed construction projects, as well as 4 unscheduled discussions of planned activities with Administrations of Mirny District and Ust-Kut Municipality, and with the Public Environmental Board at the Republic of Sakha (Yakutia) Ministry of Nature Protection.

14.4 Environmental, Social and OHS Management at the Project Level

Existing procedures at the corporate level of INK ensure adequate control of environmental, social, health and safety impacts and risks. However, project specific management and monitoring procedures should take into account both special features of the area identified by the ESIA, and the current construction and business practices at the Project sites.

The Irkutsk Polymer Plant will be implemented by special purpose subsidiary of INK – Irkutsk Polymer Plant LLC. This means that the approach and procedures adopted for environmental, occupational health and safety, and social management will not conflict with the respective procedures and documents of INK, however they may be amended and refined to better correspond to specific operations of the Irkutsk Polymer Plant, the applicable requirements and commitments, and the Project features.

In general, the following key stakeholders have been identified for the Irkutsk Polymer Plant Project:

- Project Operator (Irkutsk Polymer Plant, LLC (IZP)) - the Borrower and party responsible for the Project compliance with the applicable requirements;

- Project Coordinator (Irkutsk Oil Company, LLC) - shareholder of IZP - participation in strategic decision making for the Project, progress monitoring through regular meetings, audits, inspections;

- General Designer (NEFTECHIMPROJECT, CJSC) – responsibility for Project design development in compliance with the applicable national and international requirements[299], for selection of contractors with adequate skills for the design and works acceptance phases;

- Key construction contractors (not appointed by the time of ESIA process) - responsible for implementation of the Project construction works in strict compliance with the applicable national and international regulations, provisions of the Project general and detailed design, and for quality of subcontractors' works.

IZP will coordinate and monitor all stages of the Project construction and operation – from design to decommissioning. Specific tools will be used at each stage to prevent, minimize, mitigate potential negative impacts, as well as measures to enhance potential benefits, including:

- assessment of environmental and social impacts in compliance with international requirements, including incorporation of stakeholders' opinions identified as a result of public discussions;
- selection of qualified contractors who are capable of performing the Project requirements, and monitoring contractors' performance according to the requirements throughout the contracts;
- procurement of modern equipment and materials that comply with the up-to-date environmental and safety standards;
- current management and control of the site construction activities, performance of the works using modern technologies;
- arrangement of environmental, social, OHS training for the Company's and contractors' personnel;
- current and long-term management of impacts and risks for the environment, occupational safety, health and safety of personnel and public, within the scope of the Company's IMS.

INK does not intend to include IZP and the PPF into the certified Integrated Management System, however the System procedures for environmental protection, health and safety (EHS) and social

[299] Description of the applicable requirements of international lenders and national regulations is provided in the ESIA Chapter 2 and in the Project Standards Document.

management, monitoring and control will be applied to IZP and hence to all parties involved in the Project implementation.

In order to ensure performance of the applicable requirements and duties assumed by the Project parties during the course of its implementation, IZP will develop and implement specific documents with measures and actions aiming to improve environmental and social performance and reduce potential environmental and social risks and impacts identified by the ESIA process. The documents will be integrated into the Company's management system and will include procedures, rules and plans intended to provide systematic and comprehensive management of all environmental and social aspects of the Project. The above program documents shall be applied to all activities performed by IZP and by (sub)contractors under IZP supervision, considering the nature of the activities.

In particular IZP will develop the documents which will become the main management and monitoring documents at the construction stage:

- Environmental and Social Management Plan (subsection 14.4.1);
- Environmental and Social Action Plan (subsection 14.4.2).

At the construction phase OHSE issues will be managed via the Client Service, including application of the requirements to contractors that are mentioned in section 14.2.1, and under management supervision on the part of IZP and INK.

It is anticipated that at the operation phase IZP will have its own environmental and OHS services: Chief Ecologist's Service, and Deputy Chief Engineer's Service. It is further anticipated that personnel preparation and training processes will be introduced. The above services will be subordinated to the Technical Director – Chief Engineer.

Recommended approaches to the Project management and monitoring at the construction and operation stages, structure and content of ESMP are covered in Chapters 9 and 10 herein.

14.4.1 Environmental and Social Management Plan (ESMP)

ESMP is a framework document that describes the environmental and social management and monitoring procedures. The document is supplemented as required by a set of environmental and social management plans and procedures for specific activities which are of importance for the Project and require special attention. ESMP will establish environmental and social requirements to the Project, and the methods and ways to ensure compliance with the requirements at the Project development and implementation. In particular, ESMP will describe the following:

- Environmental and social management organization approach, including definition and allocation of functions and responsibility;
- Applicable environmental and social standards;
- Specific activities to be performed in the sphere of management, mitigation and monitoring of environmental and social impacts.

In view of the dynamic nature of the Project development, the environmental and social management plan(s) will provide for operative response to the changing situation, unforeseen events, and results of monitoring and analysis of the Project activities.

In view of the natural, technical and socio-economic baseline of the project area which is described in sections above, the potential environmental and social impacts, as well as proposed prevention and mitigation measures, the following management plans and procedures must be developed for the Project (without limitation):

- Project specific Stakeholder Engagement Plan (for details please refer to Chapter 4) including comprehensive measures for provision of adequate information for local communities and stakeholders about INK projects in Ust-Kut District, a programme of various consultations, provision of personnel and public grievance mechanism;
- Updated Stakeholder Engagement Plan at the corporate level (as required);
- Environmental and Social Management and Monitoring Plan for the construction phase (for the main construction contractors, providing "umbrella" coverage for subcontractors);

- Waste Management Plan for the construction and operation phases;
- Land Mass Management Plan (including dust control and bank protection);
- Transport Traffic Management Plan;
- Workforce Temporary Accommodation Management Plan for the construction phase;
- Workforce and Working Conditions Management Plan;
- Personnel Code of Conduct for the construction sites (also applicable to contractors);
- Workplace Discrimination Counteraction Policy (or incorporation of anti-discrimination principle into internal regulations of the Company);
- Chance Finds Procedure.

14.4.2 Environmental and Social Action Plan

Pursuant to the Project management approach developed within the scope of the ESIA and described in this Chapter, and aiming to ensure compliance with the applicable requirements of the international financial institutions at all stages of the Project life cycle, the Company will prepare an Environmental and Social Action Plan (ESAP) and get it approved by the Lenders. ESAP development is intended to identify the key target actions and respective performance criteria, and to designate responsibility for successful management of the most sensitive environmental and social aspects of the Project. The Plan is an integral part of the Loan Agreement.

Based on the above impact assessment and the Company's initiatives, the Consultant compiled the following tentative list of the key activities to be included in the Plan:

1. Refining the corporate land acquisition procedures in relation to capital projects, by providing thorough consideration of the natural and anthropogenic environment conditions in the planned sites.

2. At the end of construction, reclamation of leased land that will not be further used, and transfer to the land owners.

3. Complete scope of compensatory reforestation, with priority given to substitution of areas representing a high value.

4. Monitoring and keeping records of the actual and future terrestrial habitats, to prevent or minimise fragmentation. In special situations - provision of ecological corridors (animal crossing facilities, etc.).

5. Establishing a common SPZ for the facilities located within the Ust-Kut industrial area - LPG/SGC RS&O, the gas fractioning unit, and IPP - based on the data collected through operational environmental monitoring and control[1].

6. Provision of operational environmental monitoring and control of the Ust-Kut industrial area, including a system of measures to control and monitor construction and operation of the IPP.

7. Hierarchy of the environmental management system should be improved, and environmental commitments should be translated to contractors and subcontractors involved for construction of the IPP.

8. Implementation of carbon capturing processes for the products, subsoil resources and restored ecosystems (CCU – carbon capture and utilization and CCS - carbon capture and storage).

9. To reduce water consumption for the plant operation processes - consideration should be given to exporting excess heat from the cooling units at the Polymer Plant to third parties.

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[1] Two different options are available for designing the IPP sanitary protection zone: 1) as a part of common SPZ of the industrial area which, besides the IPP, includes LPG/SGC RS&O, GFU, and other facilities within the Ust-Kut industrial area of INK; and 2) separately from the approved SPZ of the industrial area of INK.

10. Active participation in improving urban environment of Ust-Kut city, including provision of open public spaces in the Mostootryad and Yakurim areas, and arranging competitions for grant support for projects of social importance in Ust-Kut District.

15. CONCLUSIONS AND RECOMMENDATIONS

The assessment of environmental and social impacts (ESIA) of construction and operation of the proposed Polymer Production Facility provided herein is intended to update and refine the PreESIA studies of 2017 considering the new solutions under the Gas Programme of the Irkutsk Oil Company (INK), adopted general engineering decisions for the Project, the land allocation documents for the Project sites, and other materials available by present time. Some of the ESIA conclusions are preliminary and may be revised in more detail considering the results of the environmental survey and the design documentation which is currently being developed.

The main results of ESIA have been grouped by objects (receptors) and type of impacts, and tentative assessment of scale, significance and risk of the negative consequences has been prepared (refer to the table below).

According to the available materials, Irkutsk Oil Company has selected the site located about 4 km to the north of the Ust-Kut site as the basic site location for the Polymer Production Facility and associated facilities. Disadvantages of this scenario include the remote location of the site in relation to the associated facilities (LPG facilities, GFU) and the Lena River (source of technical water supply and recipient of effluents), as well as the technical and environmental risks related to vicinity of a major source of air pollution – the wood processing waste dump that have been burning for multiple years. However, the key advantage of the selected option is its location in merchantable forest land. Therefore, the sensitive ecosystems of spawning protection forests are no more considered for construction of the Project production facilities and impact on them will be minimised.

The long-term history of unreasonable use of land other natural resource in the proposed Project area has resulted in significant reduction of the woodland areas being the main renewable resource in the region, due to felling and fires, and consequential decline in population numbers of commercial terrestrial vertebrate species and aquatic fauna, littering of vast territories. The above circumstances contribute to the social strain and make many members of local communities resist to any industrial development initiatives.

The Project is a part of the INK Gas Programme which is focused to gradually enhance utilization of gaseous components of the produced hydrocarbon mixtures using the existing or new gas processing and transport facilities of INK - the gas transportation system, LPG reception, storage and offloading terminal, gas processing plant. The Polymer Production Facility will utilize the benefits offered by the unique fraction composition of the produced gas (including associated petroleum gas) for production of marketable products. The wasteful and environmentally unfriendly practice of flaring will completely cease, therefore, the negative environmental impacts will be reduced. At this background cancellation of the PPF Project will not yield any environmental or social benefits for the district, as the main causes of the existing problems are beyond the scope of activities of the Irkutsk Oil Company.

The main negative environmental effect of the Project is condemnation of a part of modified forest land habitats (merchantable forests), along with fragmentation of the natural habitats in the designated spawning protection forests by communication corridors. Estimated total area allocated for the PPF facilities is **584 ha** (100%) including **134.0 ha** (23 %) for the process areas, **358 ha** (61%) for the linear facilities, and **92 ha** (16 %) for temporary facilities at the construction phase.

Significance of other anticipated impacts on the environment, e.g. pollution emissions to air, water abstraction from the Lena River and discharge of treated wastewater to the same river, as well as disposal of wastes, will be incomparably lower. Such impacts will not result in development of any pronounced deterioration trends in the quality of air, water, biological and subsoil resources.

Social Impacts

The Project implementation in the region that badly needs socio-economic development will produce a range of economic and social benefits. The Project will yield significant and permanent benefits for local communities in terms of new employment opportunities for young people and other local groups, attraction of new workforce, sales opportunities for local businesses through the Project procurement system, as well as guarantees within the scope of corporate social responsibility.

The main social risks are related to the construction phase when up to 7000 workers will be engaged for the Project. The main negative effects include:

- Increased load on the road infrastructure in the city and district due to the Project vehicles traffic (deterioration of road pavement, traffic restrictions on public roads, etc.), and respective risks of traffic accidents;
- Potential conflicts between the Project labour migrants and local communities. A set of measures has been identified to minimize this impact of moderate significance.

The impacts' significance is assessed as high for the construction and moderate for the Project operation phase. Mitigation measures have been proposed to minimise it.

Potential negative impacts may also be caused by violations in the sphere of labour relations and working conditions for the Project personnel. Those include disregard of labour rights and occupational health and safety regulations, provision of temporary accommodation that fails to meet the applicable Russian and international requirements. Such impacts and risks are most attributable to the engaged contractors and subcontractors. Significance of the potential impact is assessed as moderate, however, mitigation measures have been proposed to further reduce it.

The Project will affect local land users - hunters using the Project area and nearby territories. Two hunters produce fur animals in the area, and another 20-50 hunters produce upland game and water fowl. The impact is assessed as moderate in significance. Mitigation measures have been proposed by the ESIA to minimise it.

On the Consultant's opinion, the Project can be implemented on the conditions of prevention, minimization and compensation of any negative environmental and social impacts.

On the basis of the obtained results Ramboll prepared the recommendations (see below) to be followed by INK for further environmental follow-up of the Project, including environmental engineering studies, detailed assessment of the impacts of construction and operation of the Polymer Plant based on the finally selected location and processes and in combination with associated facilities, designing environmental measures, provision of operational environmental monitoring and control.

15.1 Consultant's Recommendations for the Project Environmental Support and Development of Stakeholder Engagement

The ESIA Report with assessment of environmental and social impacts of construction and operation of the Polymer Production Facility has been prepared without reference to results of the environmental surveys that the Company planned to conduct during 2019. Recommendations for arrangement of the environmental survey activities, enhancement of the operational environmental monitoring and development of environmental sections of the design documentation are listed below.

15.1.1 Recommendations for programme (assignment) development and preparation of environmental survey materials for the Polymer Production Facility construction and operation project

1. Results of previous engineering surveys and special studies (particularly archaeological) in the area allocated for the future LPG/SGC RS&O and GFU, as well as materials of this ESIA, and results of operational environmental monitoring and control (OEMC) at the construction sites of LPG Facilities and the gas transportation system, should be taken into account at development of environmental survey programme for the Polymer Production Facility Construction Project.
2. Prepare a geophysical base map for the survey area using sub-meter resolution satellite images with the optimum timeframes, seasons and other characteristics for the landscape decryption (p. 8.1.4 of SP 47.13330.2016). Such a base will facilitate planning and implementation of field studies, georeferencing of observation results and associated spatial data, subsequent processing of the mapping materials and visualization of results of the studies.

3. The survey area should include all land plots allocated for the proposed Polymer Production Facility, the whole sanitary protection zone required by the applicable regulations, and - for specific operations – the territory of the influence zone within the 0.05MPC isoline for nitrogen dioxide being the pollutant with the greatest area of propagation (according to the preliminary estimation herein, the zone will cover all regulated territories within Ust-Kut Municipality located near the design battery limits).
4. The works scope and volumes should be planned on the basis of requirements of the applicable regulations, national standards, guidance documents and methodologies. The reporting documents on the results of the studies should be prepared in line with requirements of SP 47.13330.2012/2016 (with separate identification of the mandatory and intermediate provisions).
5. Recommendations for planning of specific environmental survey activities:
    a. for air quality survey: arrange at least 5 route site stations within the standard SPZ of the Polymer Production Facility (preferably in its part nearest to the SPZ of LPG/SGC RS&O and GFU), at the boundary of the nearest regulated areas (SOT Kedr-2 and Mostootryad area in Ust-Kut), and at the northern boundary of SPZ (preferably at the crossing of the land allocation boundary and the gas pipeline easement belt); the list of monitored parameters should include weather parameters (atmospheric pressure, air temperature and humidity, wind speed and direction), concentrations of substances for which reference information is available from the Irkutsk Department of Meteorological Service (oxides of nitrogen, sulphur and carbon, suspended solids, as well as hydrocarbon gases (total or separately for each substance), ammonia, hydrogen sulphide, benz(a)pyrene, carbon soot; where possible, assess the level of the wood processing waste combustion products in air within the PPF site from the neighbour site of IND Timber;
    b. for surface water bodies survey: arrange at least three monitoring sections on the Lena River (background monitoring station can be combined with the station used for background monitoring for wastewater disposal system of LPG/SGC RS&O facilities, and a monitoring section located 500 m downstream of the designed discharge point of wastewater from the PPF, and an additional monitoring section 500 m downstream of the Polovinnaya River mouth), and one monitoring section at the mouths of the Sukhoy and Gremyachy creeks and the Polovinnaya River[300]; the list of parameters to be controlled should be defined on the basis of background surface water quality reported by Irkutsk Weather Service (suspended solids, mineral content, chemical and biological oxygen demand, total petroleum products) and the approved discharge limits for the LPG RS&O Facilities, with addition (if necessary) of any specific components of waste water from the Polymer Production Facility, as well as hydrological parameters (depth, flow velocity, water flows and levels, etc.);
    c. for survey of water bodies drainage areas: arrange a more detailed survey (compared to other areas) of the water protection zones with registration of all existing and historical sources of surface runoff contamination (spills of oil and other process liquids, decommissioned buildings and structures, solid waste dumps or signs of wastes burial) and signs of dangerous exogenous processes (erosion and accumulation, landslide and sloughing processes, subsurface water outlets and waterlogging, surface water flooding, karst-suffosion processes,technogenic frozen areas, etc.);
    d. for ground water survey: arrange for registration and testing of all subsurface water outlets (springs) identified in the area, artesian wells at LPG Facilities, and where possible ground water intake at the berth facilities of Alrosa-Terminal LLC which may be exposed to impacts of the proposed construction; the list of tested ground water parameters should include the same characteristics as those measured in the wells of LPG Facilities (alongside with the total alpha activity, it is also advisable to measure radon activity); the

[300] At this stage, the monitoring programme shall be adapted for the configuration of PPF wastewater drainage systems selected by the Company.

survey should cover the section on the left bank of the Polovinnaya River that adjoins the ground water intake facilities, comprising the future protective sanitary zone and the water pipeline corridor between the abstraction site and the PPF process area;

e. for assessment of current levels of harmful physical impacts: measure electrical and magnetic fields associated with the existing power transmission lines with various voltage levels which are routed along the boundaries of the future land allocation area (for estimation of the respective zones of influence); measure levels of the acoustic impacts in a series of monitoring points (including the reference points proposed in ESIA) with identification of natural and anthropogenic sources of noise and estimation of their contribution to the total background noise level in the survey area, in order to enable subsequent monitoring and regulation of noise impacts related to construction and operation of the Polymer Plant;

f. for soil cover survey: arrange for soil mapping of the area of the future facilities of the Polymer Production Facility, including estimation of thickness and agrochemical properties of fertile soil with sufficient level of detail for subsequent development of disturbed land reclamation projects and other soil-protection activities; the list of characteristics for soil testing should include the parameters from the standard list provided in p.6.4 of SanPiN 2.1.7.1287-03;

g. for studies of vegetation cover: record species composition and age characteristics of arborescent stratum in natural landmark forests (particularly those planned for felling and located within the designed SPZ), and all signs of trees stress states related to pyrogenesis, adverse edaphic conditions, technogenic disturbances;

h. for fauna studies: alongside with general assessment of species composition and numbers of terrestrial vertebrates, identify their migration routes and time patterns, other lifecycle phases characteristic for the surveyed area, in sufficient detail for subsequent designing of fauna protection activities; when determining the population numbers of species being subjects of recreational and commercial hunting in the surveyed area (hazel grouse, capercaillie, chipmunk, squirrel, hare, sable, ungulates, brown bear, etc.), consider their living conditions in the neighbour sections of the habitat; survey of freshwater ecosystems of River Lena should include definition of populations and species composition of aquatic fauna, state of food reserves for fish (benthos species composition, population and reserves) in the section between mouths of the Sukhoy Creek and the Polovinnaya River, and at the background sections of the Lena River outside the Project area (both up- and downstream).

i. for assessment of socio-economic conditions of the Project implementation: a survey of transport infrastructure in Ust-Kut city and district is required, including inter alia survey of local road traffic and assessment of the road surface quality to inform identification of mitigation measures in relation to the Project transport impact (the recommendation is particularly relevant in case of construction of the Company's residential quarters near the Staraya REB and Novaya REB areas); further analysis of activities of Ust-Kut city and district administrations in the sphere of socio-economic development, for a more accurate definition of community needs and updating the list of the Company's activities in the sphere of corporate social responsibility (this activity can be conducted in relation to development of the Social Investment Plan).

15.1.2 Recommendations for enhancement of the existing operational environmental monitoring of INK

Irkutsk Oil Company conducts operational environmental monitoring and control (OEMC) activities at construction and operation of hydrocarbon production and transportation facilities in Ust-Kut district. In view of construction of LPG/SGC Facilities and the gas transportation system, and design development for the Polymer Production Facility, it is advisable to enhance the existing OEMC programme as follows.

1. Arrangement of route sites for regular monitoring of atmospheric air quality and levels of hazardous physical impacts (noise) within the designed sanitary protection zone LPG/SGC RS&O

and GFU and standard sanitary protection zone of PPF, and also at the boundaries of the nearest regulated territories – SOT Kedr-2, Mostootryad and Yakurim areas in Ust-Kut city (also see item 5a in subsection 16.1), taking into account the anticipated significant impact of external sources (waste disposal facilities of IND Timber; wood waste and coal fired boiler houses, etc.).

2. Arrangement of regular monitoring stations for hydrological parameters and water quality in River Lena and mouths of the Sukhoy and Gremyachy Creeks and the Polovinnaya River (refer to item 5.b in subsection 16.1), taking into account the anticipated significant impact of external sources (discharge of contaminated ground water in the area of petroleum tank farm of Irkutsknefteprodukt JSC; discharges from the upstream wastewater treatment plants; storm water runoff from contaminated surfaces at the berths and wood processing facilities; flows of right-hand tributaries draining the area of waste disposal landfill, etc.).
3. Arrangement of stations for regular monitoring of ground water aquifers exploited by the LPG Facilities (INK), and where possible at the berth facilities of Alrosa-Terminal (refer to item 5d in subsection 16.1).
4. Arrangement of regular soil cover monitoring in sample areas to be selected depending on positions of the emission sources which are being constructed or designed, conditions of ground level pollution dispersion, configuration of sanitary protection zones of facilities within the Ust-Kut industrial area of INK being constructed or designed, positions of the nearest regulated territories (particularly the Kedr-2 GA, private subsidiary farms of residents of Mostootryad and Yakurim areas of Ust-Kut, agricultural land in Polovinka village). Alongside with soil testing in the areas, it is advisable to test snow samples taken at the time of maximum accumulation (i.e. before snow-melting period), with separate quantitative chemical analysis of suspended matter (solids) and melt water.
5. Arrangement of regular monitoring of status/recovery of soil and vegetation cover, development of dangerous exogenous processes and hydrological phenomena in the areas after technical and biological reclamation, and in the water protection zones of the Lena River and its tributaries affected by INK operations.

15.1.3 Recommendations for development of environmental sections of design documentation

Due to the preliminary nature of the assessment of environmental and social impacts of the proposed operations conducted by the Consultant, its conclusions are subject to review and where necessary amendment and adjustment at the subsequent stages of design development, in the context of the adopted options for location of the Polymer Plant facilities, processes and other solutions. The following recommendations for development of environmental sections of the design documentations are tentative and based on the current understanding of the future environmental impacts of the proposed operations.

1. The impacts of the Polymer Production Facility construction and operation on the natural and social environment should be considered with reference to the impacts of other gas transportation and processing facilities located in neighbourhood (GFU, gas transportation system, LPG/SGC RS&O, Utility Vehicles Depot, temporary accommodation facilities, access roads). Some elements of environmental support system may be shared by several facilities listed above or, ideally, by the whole Ust-Kut industrial area of INK (e.g. sanitary protection zone and OEMC programme).
2. Considering the unavoidable fragmentation of the spawning protection forests areas in relation to construction of the Project’s linear facilities, the respective land plots planning and subsequent construction activities shall be conducted to make sure that the existing forest vegetation areas are preserved as far as possible, their fragmentation by the linear structures is minimized, and respective measures should be designed to ensure recovery, restoration (as appropriate) and protection of the remaining forest against fires and other adverse impacts.
3. Design of water supply and sewerage systems should take into account the known adverse characteristics of surface (contamination with oil products, excessive concentrations of oxidizable organic compounds, etc.) and ground water (high levels of iron and carbonates, high mineral

content, high radon activity, etc.), as well as the trend toward decline of water content in the Lena River and variable aquifer conditions characteristic of the planned Project area.

4. Construction management (particularly preparatory works, excavations and construction of foundations) should take into account the uncertainties related to potential response of soil cover and geological environment to technogenic impacts:
   - the thin of organogenous and humic-accumulating soil horizons in the steep-sloped surface areas mean that soil is vulnerable to physical and mechanical impacts and the risk of erosion-accumulation and other slope processes is high, and deep freezing of soil may be expected in winter in the areas where organogenous layers are removed or disturbed (including development of technogenic frozen areas);
   - sporadic presence of phreatic aquifer in combination with macrofragmental quaternary deposits and fissured bedrock in the interfluve areas and valley slopes of River Lena make the phreatic aquifers vulnerable to chemical contamination and complicate prediction of further transportation of pollutants with ground water;
   - largely carbonaceous composition of bedrock means its exposure to erosion in erosive conditions (e.g. in the areas with lumped infiltration of surface runoff along at the boundaries of structures and paved surfaces);
   - potential presence of hydrological links between phreatic aquifer in some areas of the floodplain and terraces of the Lena River valley and surface waters of the river.
5. Design for soil protection and land reclamation activities should take into account that the applicable national standards require that fertile soil layer (FSL) in certain areas of the Polymer Plant facilities is cut and preserved. On the other hand, the FSL layer is thin and the quantity of excess material may be too small to satisfy the needs of reclamation of the land leased for short term, and landscaping of the Project territories. Thus it is advisable to consider using peat-and-sand mix or other artificial FSL for the purpose.
6. Design of ground water protection measures should take into account potential arrangement of protective sanitary zones for the water supply sources in the neighbour sites of LPG Facilities (INK LLC) and berth facilities (Alrosa-Terminal LLC): according to the conclusion issued by the competent authority of the Federal Agency on Mineral Resources, the ground water resource is potentially exposed to impacts of the proposed operations.
7. Design of heating and ventilation systems and atmospheric air protection measures should take into account the most significant source of air pollution which is located close by the Project area: the wood processing wastes landfill of IND Timber has been burning for multiple years and, in combination with frequent adverse weather conditions which do not support atmospheric dispersion, generates a smoke blanket that covers large territories, which results in high concentrations of suspended solids and other combustion products in near-ground air.
8. Design of solid waste management system should take into account the problems which are common for the location area of the future Polymer Production Facility, namely:
   - prevention of engagement of the wastes generated by the Company and its construction contractors into the illegal disposal schemes which currently exist in Ust-Kut district;
   - if illegal dumping is identified within the project area, provide for extraction, pre-sorting and disposal (utilization) of the wastes in accordance with the project solutions;
   - as the volume of forest clearing in the Project area is expected to be large, special attention should be paid to collection, sorting, temporary storage and transportation of timber and felling residues at the stage of clearing; failure to comply with the rules of handling of such wastes would dramatically increase the risk of fire;

- along with monitoring of INK and construction contractors' waste accumulation sites, the OEMC programme should include specific measures for prevention of illegal dumping of wastes by third parties in the areas leased by INK.

15.1.4 Recommendations for development of Project-related public engagement activities

The Consultant confirms presence of implemented and functional procedures and standards for social management and interaction between INK and stakeholders, both external (e.g. the Instruction of INK on community grievance procedure) and internal (e.g. PR ISM 4.4.3-01-2016 Organization of internal and external communication within the scope of integrated management system).

The Company has developed a Stakeholder Engagement Plan which defines the general principles and approaches of INK to interaction with stakeholders and covers all types of the Company's operations. The SEP developed by Rambol and tailored for the specific Project needs (SEP 2019) should be implemented to close the following information gaps in SEP 2013:

- The need to account for the changes that happened in local communities, social and cultural practices of potential stakeholders, community attitudes to the Company, administrative changes in Ust-Kut city and district, and in the list of potential stakeholders;
- Lack of alignment with the changes in INK organization relating to allocation of resource and responsibilities for interaction with stakeholders (including creation of new posts and structural units);
- Need to update information on activities of the Stakeholder Engagement Commission, its membership, meetings, issues discussed and decisions made;
- Addressing specific needs of vulnerable communities;
- Planning of future stakeholder engagement and information disclosure activities.

Ramboll recommends Irkutsk Oil Company to ensure annual review and updating of the SEP, and further develop an Accommodation Management Plan for personnel of construction contractors which will regulate interaction between the Company and its contractors on all matters relating to immigration, accommodation and transportation of personnel.

APPENDICES

APPENDIX 1
REFERENCE LIST

1. MATERIALS OF ENGINEERING SURVEYS AND SPECIAL RESEARCHES

1.1 Irkutsk Polymer Plant

Газохимический Комплекс (ГХК) в Усть-Кутском районе Иркутской области. Результаты инженерных изысканий. Технический отчет по выполненным инженерно-геологическим изысканиям. Шифр 1/-1373-ИГИ. Том 1. – Иркутск: ООО «ИНГЕО», 2013.

1.2 Ust-Kut Gas-Fractioning Unit

Усть-Кутская газофракционирующая установка. Этап №1. Технический отчёт по результатам инженерно-геологических изысканий. Шифр: 2826-1426-1783/2-ИГИ-Т. Тома 2.1, 2.2.1. Текстовая и графическая части. – Иркутск: ООО «ИНГЕО», 2018.

Усть-Кутская газофракционирующая установка. Этап №1. Технический отчёт по результатам инженерно-гидрометеорологических изысканий. Шифр: 2826-1426-1783/2-ИГМИ. Том 3. – Иркутск: ООО «ИНГЕО», 2018. 89 с.

Усть-Кутская газофракционирующая установка. Этап №1. Технический отчёт по результатам инженерно-экологических изысканий. Шифр: 2826-1426-1783/2-ИЭИ. Том 4. – Иркутск: ООО «ИНГЕО», 2018. 326 с.

1.3 Liquefied Hydrocarbon Gases Reception, Storage and Shipment Terminal

Геологическое заключение по результатам бурения гидрогеологической скважины № СУГ-1Г на площадке Комплекса примера, хранения, и отгрузки СУГ в г. Усть-Кут. – Иркутск: ООО ГГК «Раздолье», 2014.

Геологическое заключение по результатам бурения гидрогеологической скважины № СУГ-2Г. – Иркутск: ООО «Акваресурс», 2016.

Отчет о НИР: Выполнение мероприятий по сохранению части территории, обладающей признаками наличия объекта археологического наследия, расположенного в границах земельного участка, испрашиваемого для строительства Комплекса приема, хранения и отгрузки СУГ, подъезда к площадке Комплекса приема, хранения и отгрузки СУГ, ВЛ 10кВ от ПС «Якурим» до площадки Комплекса приема, хранения и отгрузки СУГ, нефтегазового комплекса с ж.-д. путями в Усть-Кутском районе Иркутской области. – Иркутск: ООО «Раритет», 2014.

Паспорт буровой скважины № СУГ-2Г Комплекса СУГ г. Усть-Кут. Паспорт. – с. Худяково: ООО «Акваресурс», 2016. 4 с.

Паспорт гидрогеологической скважины № СУГ-1Г. Паспорт. – с. Мальта: ООО ГГК «Раздолье», 2014. 4 с.

Комплекс приема, хранения и отгрузки сжиженных углеводородных газов. Результаты инженерных изысканий. Технический отчет по выполненным инженерно-геодезическим изысканиям. Шифр 2108/1-1182-13146/1–ИГ. Том 1. – Иркутск: ООО «ИНГЕО», 2014.

Комплекс приема, хранения и отгрузки сжиженных углеводородных газов. Результаты инженерных изысканий. Технический отчет по выполненным инженерно-геологическим изысканиям. Шифр 2108/1-1182-13146/1–ИГИ 1.1. Том 2.1.1. Раздел 1. Текстовая часть. Часть 1. Текстовая часть. Приложения. – Иркутск: ООО «ИНГЕО», 2014.

Комплекс приема, хранения и отгрузки сжиженных углеводородных газов. Результаты инженерных изысканий. Технический отчет по выполненным инженерно-геологическим изысканиям. Шифр 2108/1-1182-13146/1–ИГИ 1.2. Том 2.1.2. Раздел 1. Текстовая часть. Часть 2. Приложения (паспорта испытаний грунтов). – Иркутск: ООО «ИНГЕО», 2014.

Комплекс приема, хранения и отгрузки сжиженных углеводородных газов. Результаты инженерных изысканий. Технический отчет по выполненным инженерно-геологическим изысканиям. Шифр

2108/1-1182-13146/1–ИГИ 2.2. Том 2.2.2. Раздел 2. Графическая часть. Часть 2. Геологические колонки выработок. – Иркутск: ООО «ИНГЕО», 2014.

Комплекс приема, хранения и отгрузки сжиженных углеводородных газов. Результаты инженерных изысканий. Технический отчет по выполненным инженерно-гидрометеорологическим изысканиям. Шифр 2108/1-1182-13146/1–ИГМ. Том 3. – Иркутск: ООО «ИНГЕО», 2014.

Комплекс приема, хранения и отгрузки сжиженных углеводородных газов. Результаты инженерных изысканий. Технический отчет по выполненным инженерно-экологическим изысканиям. Шифр 2108/1-1182-13146/1–ИГЭ. Том 4. – Иркутск: ООО «ИНГЕО», 2014.

1.4 Berth Facilities on the river Lena and renovation of Federal Highway A-331 “Vilyuy”

Программа комплексных инженерных изысканий по объекту: Причал для разгрузки крупногабаритного оборудования на р. Лена – ЗАО «Сибречпроект», 2018. 42 с.

Строительство участка автомобильной дороги А-331 «Вилюй» Тулун – Братск – Усть-Кут – Мирный Якутск на участке км 19+300 – км 20+500 для обеспечения провоза крупногабаритного и тяжеловесного оборудования на перспективную площадку строительства Иркутского завода полимеров в г. Усть-Кут. Рабочая документация. Автомобильная дорога. Пояснительная записка. Чертежи, ведомости. Сводная ведомость объёмов работ. Материалы инженерных изысканий. Шифр 039.2-2018-АД1. Том 1. – Иркутск: ООО «СибПроектНИИ», 2018. 77 с.

2. PRE-PROJECT AND PROJECT DOCUMENTATION

2.1 Irkutsk Polymer Plant

2.1.1 Basic Technical Solutions and Situational Plans

Инфраструктурные объекты для обеспечения ИЗП питьевой водой и водоотведение. Основные технические решения. Том 1.1. Шифр: ИНК-210-54-09-19-ОТР. Инв. №55043 – Иркутск, АО «Сибгипробум», 2019. 142 с.

Иркутский газохимический комплекс ООО «ИНК». Технические решения. Книга 1. Общая пояснительная записка. Шифр: 1921-ТР2-ПЗ. – РУП «БЕЛНИПИЭНЕРГОПРОМ», 2018. 221 с.

Иркутский газохимический комплекс ООО «ИНК». Технические решения. Книга 2. Графические материалы. Шифр: 1921-ТР2-ПЗ. – РУП «БЕЛНИПИЭНЕРГОПРОМ», 2018. 12 с.

Иркутский газохимический комплекс. Проектная документация. Раздел 1. Пояснительная записка. Шифр: 70605-П-000-ПЗ. – ЗАО «НЕФТЕХИМПРОЕКТ», 2018. 86 с.

Обзорная карта-схема. Иркутский завод полимеров. Масштаб 1:50 000. – Иркутск: ООО «ИНК». 1 с.

Усть-Кутский завод полимеров. Схема генерального плана. – Иркутск: ООО «ИНК», 2017.

Иркутский газохимический комплекс. Обзорная схема Усть-Кутского промышленного узла. – Иркутск: ЗАО «НЕФТЕХИМПРОЕКТ».

Строительство объектов общезаводского хозяйства Иркутского завода полимеров, строительного городка и рационализации коммуникационных связей между предприятиями Усть-Кутского промышленного района ООО «ИНК». Основные технические решения. Книги 1-10. Пояснительная записка. Текстовая часть (начало). Шифр 70591-ОТР-ПЗ1...310. – ЗАО «НЕФТЕХИМПРОЕКТ», 2017.

2.1.2 Engineering Support Networks

Иркутский газохимический комплекс ООО «Иркутская нефтяная компания». Проектная документация. Раздел 5. Сведения об инженерном оборудовании, о сетях инженерно-технического обеспечения, перечень инженерно-технических мероприятий, содержание технологических решений. Подраздел 1. Система электроснабжения завода. Шифр 70605-П-000-ИОС1. Тома 5.1.1-5.1.7. – ЗАО «НЕФТЕХИМПРОЕКТ», 2018.

Иркутский газохимический комплекс ООО «Иркутская нефтяная компания». Проектная документация. Раздел 5. Сведения об инженерном оборудовании, о сетях инженерно-технического обеспечения, перечень инженерно-технических мероприятий, содержание технологических решений. Подраздел 2. Системы водоснабжения. Шифр 70605-П-000-ИОС2. Книга 1. Том 5.2. – ЗАО «НЕФТЕХИМПРОЕКТ», 2018. 70 с.

Иркутский газохимический комплекс ООО «Иркутская нефтяная компания». Проектная документация. Раздел 5. Сведения об инженерном оборудовании, о сетях инженерно-технического обеспечения, перечень инженерно-технических мероприятий, содержание технологических решений. Подраздел 3. Системы водоотведения. Шифр 70605-П-000-ИОС3. Книга 1. Том 5.3. – ЗАО «НЕФТЕХИМПРОЕКТ», 2018. 36 с.

Иркутский газохимический комплекс ООО «Иркутская нефтяная компания». Проектная документация. Раздел 5. Сведения об инженерном оборудовании, о сетях инженерно-технического обеспечения, перечень инженерно-технических мероприятий, содержание технологических решений. Подраздел 4. Отопление, вентиляция и кондиционирование воздуха, тепловые сети. Шифр 70605-П-300-ИОС4.1. Часть 1. Отопление, вентиляция и кондиционирование воздуха. Книга 1. Общезаводское хозяйство. – ЗАО «НЕФТЕХИМПРОЕКТ», 2017. 22 с.

Иркутский газохимический комплекс ООО «Иркутская нефтяная компания». Проектная документация. Раздел 5. Сведения об инженерном оборудовании, о сетях инженерно-технического обеспечения, перечень инженерно-технических мероприятий, содержание технологических решений. Подраздел 4. Отопление, вентиляция и кондиционирование воздуха, тепловые сети. Шифр 70605-П-160, 170, 220/230, 240, 250-ИОС4.1. Часть 1. Отопление, вентиляция и кондиционирование воздуха. Книга 1. Установка производства Метанола. Установка воздухоразделения. Комбинированная установка конверсии, очистки газа и разделения H2/CO. Комбинированная установка DMO. Комбинированная установка ЭГ. – ЗАО «НЕФТЕХИМПРОЕКТ», 2017. 24 с.

Иркутский газохимический комплекс ООО «Иркутская нефтяная компания». Проектная документация. Раздел 5. Сведения об инженерном оборудовании, о сетях инженерно-технического обеспечения, перечень инженерно-технических мероприятий, содержание технологических решений. Подраздел 5. Сети связи. Текстовая и графическая части. Шифр 70605-П-000-ИОС5. – ЗАО «НЕФТЕХИМПРОЕКТ», 2017. 77 с.

Иркутский газохимический комплекс ООО «Иркутская нефтяная компания». Проектная документация. Раздел 5. Сведения об инженерном оборудовании, о сетях инженерно-технического обеспечения, перечень инженерно-технических мероприятий, содержание технологических решений. Подраздел 6. Система газоснабжения. Текстовая и графическая части. Шифр 70605-П-000-ИОС6. – ЗАО «НЕФТЕХИМПРОЕКТ», 2017. 21 с.

Иркутский газохимический комплекс ООО «Иркутская нефтяная компания». Проектная документация. Раздел 5. Сведения об инженерном оборудовании, о сетях инженерно-технического обеспечения, перечень инженерно-технических мероприятий, содержание технологических решений. Подраздел 7. Технологические решения. Шифр 70605-П-160-ИОС7.1. Часть 1. Текстовая часть. – ЗАО «НЕФТЕХИМПРОЕКТ», 2017. 98 с.

Иркутский газохимический комплекс ООО «Иркутская нефтяная компания». Проектная документация. Раздел 5. Сведения об инженерном оборудовании, о сетях инженерно-технического обеспечения, перечень инженерно-технических мероприятий, содержание технологических решений. Подраздел 7. Технологические решения. Шифр 70605-П-170-ИОС7.1. Часть 1. Текстовая часть. – ЗАО «НЕФТЕХИМПРОЕКТ», 2017. 80 с.

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Иркутский газохимический комплекс ООО «Иркутская нефтяная компания». Проектная документация. Раздел 5. Сведения об инженерном оборудовании, о сетях инженерно-технического обеспечения, перечень инженерно-технических мероприятий, содержание технологических решений. Подраздел 7. Технологические решения. Шифр 70605-П-250-ИОС7.1. Часть 1. Текстовая часть. – ЗАО «НЕФТЕХИМПРОЕКТ», 2017. 114 с.

Иркутский газохимический комплекс ООО «Иркутская нефтяная компания». Проектная документация. Раздел 5. Сведения об инженерном оборудовании, о сетях инженерно-технического обеспечения, перечень инженерно-технических мероприятий, содержание технологических решений. Подраздел 7. Технологические решения. Шифр 70605-П-300-ИОС7.1. Часть 1. Текстовая часть. – ЗАО «НЕФТЕХИМПРОЕКТ», 2017. 116 с.

Иркутский газохимический комплекс ООО «Иркутская нефтяная компания». Проектная документация. Раздел 5. Сведения об инженерном оборудовании, о сетях инженерно-технического обеспечения, перечень инженерно-технических мероприятий, содержание технологических решений. Подраздел 7. Технологические решения. Шифр 70605-П-300-ИОС7.2. Часть 2. Графическая часть. – ЗАО «НЕФТЕХИМПРОЕКТ», 2017. 54 с.

Энергообеспечение Иркутского завода полимеров ООО «Иркутская нефтяная компания». Технические решения. Книга 1. Общая пояснительная записка. Книга 2. Графические материалы. Шифр: 1921-ТР1-ПЗ. – РУП «БЕЛНИПИЭНЕРГОПРОМ», 2017.

Энергообеспечение Иркутского завода полимеров ООО «Иркутская нефтяная компания». Ответы на замечания (1921-ТР1-ПЗ, книга 1). – РУП «БЕЛНИПИЭНЕРГОПРОМ», 2019. 3 с.

2.1.3 Design and Planning Solutions

Иркутский газохимический комплекс. Проектная документация. Раздел 3. Архитектурные решения. Часть 6. Общезаводское хозяйство. Шифр: 70605-П-300-АР1. Том 3.6. – ЗАО «НЕФТЕХИМПРОЕКТ», 2018. 32 с.

Иркутский газохимический комплекс. Проектная документация. Раздел 2. Схема планировочной организации земельного участка. Шифр: 70605-П-000-ПЗУ. – ЗАО «НЕФТЕХИМПРОЕКТ», 2018. 30 с.

Иркутский газохимический комплекс. Проектная документация. Раздел 4. Конструктивные и объёмно-планировочные решения. Часть 1. Текстовая часть. Книга 1. Шифр: 70605-П-300-КР1.1. Том 4.1. – ЗАО «НЕФТЕХИМПРОЕКТ», 2018. 132 с.

Иркутский газохимический комплекс. Проектная документация. Раздел 4. Конструктивные и объёмно-планировочные решения. Часть 2. Графическая часть. Книга 1. Шифр: 70605-П-300-КР2.1. Том 4.2.1. – ЗАО «НЕФТЕХИМПРОЕКТ», 2018. 44 с.

Иркутский газохимический комплекс. Проектная документация. Раздел 4. Конструктивные и объёмно-планировочные решения. Часть 2. Графическая часть. Книга 1. Шифр: 70605-П-300-КР2.1. Том 4.2.1. – ЗАО «НЕФТЕХИМПРОЕКТ», 2018. 11 с.

2.1.4 Water Supply and Sanitation Facilities

Система водоснабжения Усть-Кутского завода полимеров. Предпроектная документация. Шифр: 889-ПЗ. – Красноярск: Институт «КРАСНОЯРСКГИДРОПРОЕКТ», 2015.

Строительство объектов водоснабжения и водоотведения Иркутского газохимического комплекса ООО «Иркутская нефтяная компания». Основные технические решения. Часть 1. Блоки оборотного водоснабжения. Шифр ПР-1803-ОТР1. – ООО «ИСТЭКОЙЛ», 2018. 45 с.

Строительство объектов водоснабжения и водоотведения Иркутского газохимического комплекса ООО «Иркутская нефтяная компания». Частичная проектная документация. Часть 1. Очистные сооружения. Шифр ПР-1803-ОТР2. – ООО «ИСТЭКОЙЛ», 2018. 100 с.

Строительство объектов водоснабжения и водоотведения Иркутского завода полимеров, строительного городка и жилого посёлка ООО «Иркутская нефтяная компания». Основные технические решения. Часть 1. Водозабор, водоподъём, водовыпуск. Шифр: 1006-ПР17-ОТР1. – ООО «Истэкойл», 2017. 93 с.

Строительство объектов водоснабжения и водоотведения Иркутского завода полимеров, строительного городка и жилого посёлка ООО «Иркутская нефтяная компания». Основные технические решения. Часть 1. Блок оборотного водоснабжения. Шифр: 1006-ПР17-ОТР2. – ООО «Истэкойл», 2017. 49 с.

Строительство объектов водоснабжения и водоотведения Иркутского завода полимеров, строительного городка и жилого посёлка ООО «Иркутская нефтяная компания». Основные технические решения. Часть 4. Очистные сооружения. Шифр: 1006-ПР17-ОТР4. – ООО «Истэкойл», 2017. 105 с.

2.1.5 Documentation of the Choice of Main Production Technologies (analytical notes, technical proposals of licensors, etc.)

600 KTA EG. Technical Appendix. Annex 01, General Process Information. – HeNanPingmeiShenma Far East Chemical Co. Ltd. & Irkutsk Oil Company, LLC, Natural Gas Project. 151 p. [in Chinese]

Pjchem Syngas to MEG Process. Preliminary Technical Proposal. Rev 0. – Pujing Chemical Industry Co. Ltd, 2018. [in English and Chinese]

Выбор технологии: Highchem или Pujing? Аналитическая записка по итогам посещения заводов МЭГ в Китае от 29.01.2019 г. Документ без выходных данных. Предоставлен ООО «ИНК». 13 с.

Газохимический комплекс ИНК. Установка по производству бутена-1. Техническое предложение. Документ без выходных данных. Предоставлен ООО «ИНК».

Иркутский Завод Полимеров (ИЗП). Техническое предложение для Установки производства полиэтилена, 650 тыс. т/г, одна технологическая нитка, 31 июля 2018 г. Документ без выходных данных. Предоставлен ООО «ИНК»

Иркутский Завод Полимеров (ИЗП). Установка по производству этилена (650 тыс. т./г). Техническое предложение (апрель 2018). Документ без выходных данных. Предоставлен ООО «ИНК».

Иркутский завод полимеров. Установка по производству полиэтилена. Часть 1. Объём работ. Приложение 2. Интерфейсы и границы установки. Редакция А. – Иркутск, 2018. 33 с.

Шанхай Пуцзин – Технология этиленгликоля, синтетического газа и промышленное производство. Презентация. – Pujing Chemical Industry Co. Ltd., 2018. 49 с.

2.1.6 Environmental Protection and Fire Safety Measures

Иркутский газохимический комплекс. Проектная документация. Раздел 7. Пожарная безопасность. Текстовая и графическая части. Шифр: 70605-П-000-ПБ. – ЗАО «НЕФТЕХИМПРОЕКТ», 2017. 101 с.

Разработка мероприятий по обеспечению пожарной безопасности (Основные технические решения). Презентация. – Иркутск: ЗАО «НЕФТЕХИМПРОЕКТ», ООО «Пожинжиниринг», 2017. 32 с.

Иркутский газохимический комплекс. Проектная документация. Раздел 8. Перечень мероприятий по охране окружающей среды. Часть 1. Текстовая часть. Шифр: 70605-П-ООС8.1. – ЗАО «НЕФТЕХИМПРОЕКТ», 2018. 69 с.

2.2 Ust-Kut Gas Fractioning Unit

Усть-Кутская газофракционирующая установка. Этап №2. Проектная документация. Раздел 8. Перечень мероприятий по охране окружающей среды. Часть 1. Мероприятия по охране окружающей среды. Шифр: 17.013.6-ООС1. Том 8.1. – ООО Институт ЮЖНИИГИПРОГАЗ», 2018. 138 с.

Усть-Кутская газофракционирующая установка. Этап №2. Проектная документация. Раздел 8. Перечень мероприятий по охране окружающей среды. Часть 2. Оценка воздействия на атмосферный воздух. Книги 1-4. Период эксплуатации. Текстовая часть. Шифр: 17.013.6-ООС2.1. Тома 8.2.1-8.2.4. – ООО Институт ЮЖНИИГИПРОГАЗ», 2018.

Усть-Кутская газофракционирующая установка. Этап №2. Проектная документация. Раздел 8. Перечень мероприятий по охране окружающей среды. Часть 3. Оценка воздействия на геологическую среду, почвы и земельные ресурсы, водную среду, растительность, животный мир и социальную среду. Шифр: 17.013.6-ООС3. Том 8.3. – ООО Институт ЮЖНИИГИПРОГАЗ», 2018. 107 с.

Усть-Кутская газофракционирующая установка. Этап №2. Проектная документация. Раздел 8. Перечень мероприятий по охране окружающей среды. Часть 4. Оценка воздействия окружающую среду при обращении с отходами. Книга 1. Период строительства. Книга 2. Период эксплуатации. Шифр: 17.013.6-ООС4.1-4.2. Тома 8.4.1, 8.4.2. – ООО Институт ЮЖНИИГИПРОГАЗ», 2018.

2.3 Liquefied Hydrocarbon Gases Reception, Storage and Shipment Terminal

Комплекс приема, хранения и отгрузки сжиженных углеводородных газов. Ситуационный план. Масштаб 1:10000. Шифр 11504-П-004.000.000-ГП-Ч-001. – ПАО «УКРНГИ», 2016.

Комплекс приёма, хранения и отгрузки сжиженных углеводородных газов. Проектная документация. Раздел 8. Перечень мероприятий по охране окружающей среды». Часть 1. Текстовая часть. Шифр: 9311-ИНК-СУГ-ООС1. – Иркутск: АО «ИркутскНИИхиммаш», 2016. 131 с.

Комплекс приёма, хранения и отгрузки сжиженных углеводородных газов. Проектная документация. Раздел 8. Перечень мероприятий по охране окружающей среды». Часть 2. Приложения. Графическая часть. Шифр: 9311-ИНК-СУГ-ООС2. – Иркутск: АО «ИркутскНИИхиммаш», 2016. 278 с. Комплекс приема, хранения и отгрузки сжиженных углеводородных газов. Ситуационный план. Масштаб 1:10000. Шифр 11504-П-004.000.000-ГП-Ч-001. – ПАО «УКРНГИ», 2016.

2.4 Reconstruction of A-331 “Vilyui” Federal Highway section

Строительство участка автомобильной дороги А-331 «Вилюй» Тулун – Братск – Усть-Кут – Мирный Якутск на участке км 19+300 – км 20+500 для обеспечения провоза крупногабаритного и тяжеловесного оборудования на перспективную площадку строительства Иркутского завода полимеров в г. Усть-Кут. Рабочая документация. Автомобильная дорога. Поперечные профили земляного полотна. Шифр 039.2-2018-АД2. Том 2.– Иркутск: ООО «СибПроектНИИ», 2018. 43 с.

Строительство участка автомобильной дороги А-331 «Вилюй» Тулун – Братск – Усть-Кут – Мирный Якутск на участке км 19+300 – км 20+500 для обеспечения провоза крупногабаритного и тяжеловесного оборудования на перспективную площадку строительства Иркутского завода полимеров в г. Усть-Кут. Рабочая документация. Проект организации строительства. Шифр 039.2-2018-ПОС. Том 4. – Иркутск: ООО «СибПроектНИИ», 2018. 61 с.

2.5 Berth Facilities on the River Lena

Причал для разгрузки крупногабаритного оборудования на р. Лена. Основные технические решения. Шифр 022-2018-00-ОТР. – ЗАО «Сибречпроект», 2018. 80 с.

2.6 Power Supply Facilities

ПС 220 кВ ИЗП. ВЛ 220 кВ Усть-Кут – ИЗП №1; ВЛ 200 кВ Усть-Кут – ИЗП №2. Основные технические решения по ПС. Электротехнические решения. Шифр: 14/2018-ПС220-ИЗП-ОТР-06. – Новосибирскстройкомплекс, 2018. 49 с.

2.6.1 Specifications of third parties

Об увеличении объёмов перевозок – Письмо от 16.06.2016 г. исх. № 5381/ВСЖД Филиала ОАО «РЖД» Восточно-Сибирская железная дорога от 16.06.2016 г. исх. № 5381/ВСЖД. «Об увеличении объемов перевозок».

Производственная программа ООО «СПЕЦАВТО» по обеспечению производства в сфере захоронения (размещения) твердых бытовых отходов на период действия с 01.01.2017 г. по 31.12.2019 г. Утв. Генеральным директором ООО «СПЕЦАВТО» В.И. Бабиковым. Согласовано Главой администрации Усть-Кутского МО (городского поселения) В.Г. Кривоносенко

Актуализированные технические условия на примыкание ж/д пути необщего пользования ООО «ИНК» к станции Лена-Восточная – Письмо от 16.06.2016 г. исх. № 5381/ВСЖД Филиала ОАО «РЖД» Восточно-Сибирская железная дорога от 16.06.2016 г. исх. № 5381/ВСЖД. «Актуализированные технические условия на примыкание ж.д. пути необщего пользования ООО «ИНК» к станции Лена-Восточная».

2.7 DSG Pipeline

Газопровод Ярактинское НГКМ – Марковское НГКМ до г. Усть-Кут. Основные проектные решения. Шифр: 1117-ПП-001.000.000-ПЗ. Том 1. Часть 1. Пояснительная записка. – ПАО «Украинский нефтегазовый институт», 2018. 289 с.

Газопровод Ярактинское НГКМ – Марковское НГКМ до г. Усть-Кут. Основные проектные решения. Шифр: 1117-ПП-001.000.000-ПЗ. Том 2. Часть 2. Графическая часть. – ПАО «Украинский нефтегазовый институт», 2018. 57 с.

3. SANITARY PROTECTION ZONE OF THE GFU AND LPG/LGC TERMINAL

Проект единой санитарно-защитной зоны для объектов УКГФУ, КПХиО СУГ (расширение), КПХиО СГК (проектный комплекс 1150.4). Книга 1. Том 1. Пояснительная записка. – Иркутск, ООО «ИНК», ООО «Байкал ЭкоАудит», 2018. 189 с.

Санитарно-эпидемиологическое заключение о соответствии Проекта обоснования единой санитарно-защитной зоны для объектов УКГФУ, КПХиО СУГ (расширение), КПХиО СГК (проектный комплекс 1150.4) ООО «ИНК» государственным санитарно-эпидемиологическим требованиям №38.ИЦ.06.000.Т. от 17.01.2019 г.

Текстовое и графическое описание местоположения границ. Санитарно-защитная зона для УКГФУ, КПХиО СУГ (Расширение), КПХиО СЕГ (проектный комплекс 1150.4). – Иркутск: ООО «ИНК», 2018. 72 с.

4. MATERIALS OF PUBLIC DISCUSSIONS AND OTHER FORMS OF INTERACTION BETWEEN THE COMPANY AND STAKEHOLDERS

Перечень социальных мероприятий на 2019 год, выполняемых за счёт средств общества с ограниченной ответственностью «Иркутская нефтяная компания» для социально-экономического развития Иркутской области. Приложение 2 к Соглашению о социально-экономическом сотрудничестве между Правительством Иркутской области и ООО «Иркутская нефтяная компания».

Инструкция «О порядке рассмотрения жалоб и обращения общественности в ООО «Иркутская нефтяная компания». Утв. Приказом от 31.06.2008 г. №137/00-п.

Перечень социальных мероприятий на 2017 год, выполняемых за счет средств общества с ограниченной ответственностью «Иркутская нефтяная компания» для социально-экономического развития Иркутской области. – Приложение 2 к Соглашению о социально-экономическом сотрудничестве между Правительством Иркутской области и ООО «Иркутская нефтяная компания» от 31.12.2010 №05-72-80-10.

План взаимодействия с заинтересованными сторонами ООО «Иркутская нефтяная компания». – Отдел по связям с общественностью ООО «ИНК», Кафедра Археологии, этнологии, истории древнего мира ИГУ. 2013. 49 с.

Политика социально-экономического сотрудничества и благотворительной (спонсорской) деятельности ООО «ИНК». – Приложение к приказу ООО «ИНК» от 26.10.2015 г. №605-00-п.

Правила поведения работников ИНК в районах традиционного хозяйствования коренного малочисленного населения и приравненных к нему этнографических групп севера Средней Сибири. Утв. Приказом ООО «Иркутская нефтяная компания» от 14.08.2009 г. №103/00-П (дополнены в 2013).

Протокол заседания Инвестиционного Совета при Правительстве Иркутской области от 26.08.2014 г. Утв. Губернатором Иркутской области, Председателем Инвестиционного Совета при Правительстве Иркутской области Ерощенко С.В. – Иркутск, 2014. 3 с.

Протокол общественных обсуждений (публичных слушаний) по материалам оценки воздействия на окружающую природную и социальную среду намечаемой деятельности при реализации проектных решений по объектам развития газовой программы ООО «Иркутская нефтяная компания» на Яракстинском НГКМ, Марковском НГКМ. Яракстинское НГКМ, УКПГ-2. Марковское НГКМ, УКПГ. - Усть-Кут, 2017. 6 с.

Протокол общественных слушаний по проекту бюджета Усть-Кутского муниципального образования (городского поселения) на 2017 и плановый период 2018-2019 годов. – Усть-Кут. 2016. 8 с.

Письмо Администрации Усть-Кутского муниципального образования от 16.05.2017 г. Исх. №1-0-1401 от 16.05.2017 г. в адрес Генерального директора ООО «Иркутская нефтяная компания» Седых М.В. «Предоставление информации Усть-Кутского муниципального образования для ОВОС» (с Приложениями).

Письмо Департамента Лесного Хозяйства по Сибирскому Федеральному округу Федерального агентства лесного хозяйства (Рослесхоз) от 03.04.2017 г. Исх. №1441/06-40 в адрес Представителя Усть-Кутского городского отделения Иркутской областной общественной организации охотников и рыболовов.

Письмо Областного государственного бюджетного учреждения здравоохранения «Усть-Кутская районная больница» от 29.05.2017 г. Исх. № 1197 в адрес Генерального директора ООО «Рэмболл Энвайрон Си-Ай-Эс» Сенченя И.Н. «О предоставлении информации в сфере здравоохранения».

Письмо Усть-Кутского городского отделения Иркутской областной общественной организации охотников и рыболовов от 04.05.2017 г. Исх. №35 в адрес Начальника ТО АЛХ Иркутской области по Усть-Кутскому району Коротаева Н.Г.

5. LAND RECLAMATION AND FORESTRY DEVELOPMENT, URBAN PLANNING DOCUMENTATION. TERRITORIAL PLANNING AND OTHER DOCUMENTATION OF MUNICIPALITIES

Акт выбора лесного участка №86 от 12.11.2018 г. Утв. Решением заместителя министра Лесного комплекса Иркутской области Ступина А.Ю. 19.11.2018 г.

Акт натурного технического обследования лесного участка от 21.11.2018 г. Утв. Решением зам. Министра Лесного комплекса Иркутской области Ступина А.Ю.

Актуализация схемы теплоснабжения МО «г. Усть-Кут» на период 2013-2017 и на перспективу до 2025 г. Обосновывающие материалы. Том 1. – Чебоксары: ООО «Экспертэнерго», 2016. 151 с.

Выписка от 27.12.2018 г. из Единого государственного реестра недвижимости об основных характеристиках и зарегистрированных правах на объект недвижимости на основании запроса 25.12.2018 г. Участок с кадастровым номером 38:18:000010:1438. – Иркутск: Госреестр, 2018. 4 стр.

Выписка от 27.12.2018 г. из Единого государственного реестра недвижимости об основных характеристиках и зарегистрированных правах на объект недвижимости на основании запроса 25.12.2018 г. Участок с кадастровым номером 38:18:000010:1624. – Иркутск: Госреестр, 2018. 4 стр.

Выписка от 27.12.2018 г. из Единого государственного реестра недвижимости об основных характеристиках и зарегистрированных правах на объект недвижимости на основании запроса 25.12.2018 г. Участок с кадастровым номером 38:18:000010:1628. – Иркутск: Госреестр, 2018. 4 стр.

Выполнение работ 3, 4, и 5 этапов по разработке схемы территориального планирования муниципального района Усть-Кутского муниципального образования. Проектная документация. Часть 1 Основная часть проекта, подлежащая утверждению. Положение о территориальном планировании. Книга 1. 125-2010-СТП-УЧКн1. Редакция 2. – Иркутск: ОАО «Иркутскгипродорнии», 2011. 11 с.

Выполнение работ 3, 4, и 5 этапов по разработке схемы территориального планирования муниципального района Усть-Кутского муниципального образования. Проектная документация. Часть 2 Материалы по обоснованию проекта. Книга 2. 125-2010-СТП-ОМКн.2. Редакция 2. – Иркутск: ОАО «Иркутскгипродорнии», 2011. 192 с.

Генеральная схема санитарной очистки территории города Усть-Кут. Том 1. Характеристика и состояние территории города Усть-Кут. – Челябинск: ООО НПФ «Экосистема», 2012. 44 с.

Территориальное планирование. Градостроительная комплексная оценка территории. Том 2. Схема территориального планирования Усть-Кутского муниципального образования. Отчёт. – Иркутск: ОАО «Иркутскгипродорнии», 2010.

Договор аренды лесного участка №91-163/17 от 26.06.2017 г. – Иркутск: Министерство лесного комплекса Иркутской области, 2017.

Договор аренды лесного участка №91-212/18 от 16.04.2018 г. – Иркутск: Министерство лесного комплекса Иркутской области, 2018.

Закон Иркутской области «О статусе и границах муниципальных образований Усть-Кутского района Иркутской области». Закон Иркутской области от 16.12.2004 г. № 93-оз.

Лесной план Иркутской области. - Приложение к указу Губернатора Иркутской области от 26.11.2013 г. № 445-уг [Электронный ресурс]. – Режим доступа: http://irkobl.ru/sites/alh/documents/lesplan/lesplan1.pdf, свободный.

Лесохозяйственный регламент Усть-Кутского лесничества. – Иркутск: ФГУП «Рослесинфорг», 2008.

О внесении изменений и дополнений в генеральный план г. Усть-Кута (утв. решением Думы УКМО (ГП) №218/39 от 24.06.10). Решение Думы Усть-Кутского муниципального образования (городского поселения) от 18.09.2014 г. №124/26.

О внесении изменений и дополнений в Правила землепользования и застройки Усть-Кутского муниципального образования, утвержденные решением Думы Усть-Кутского муниципального образования (городского поселения) от 24.05.2011 г. №270/50. Решение Думы Усть-Кутского муниципального образования (городского поселения) от 29.05.2014 г. №104/22.

Об утверждении акта выбора лесного участка №86 (арендатор ООО «ИНК») – Распоряжение Министерства лесного комплекса Иркутской области от 19.11.2018 г. №3924-мр

Об утверждении генерального плана городского поселения Усть-Кутского муниципального образования. Решение Думы Усть-Кутского муниципального образования (городского поселения) от 24.06.2010 г. № 218/39.

Отчет Главы муниципального образования «город Усть-Кут» В.Г. Кривоносенко «О социально-экономическом положении на территории муниципального образования «город Усть-Кут» в 2016 году. – Усть-Кут, 2016. 29 с.

Порядок разработки, корректировки, осуществления мониторинга и контроля реализации документов стратегического планирования Усть-Кутского муниципального образования. Утв. Постановлением Администрации Усть-Кутского муниципального образования от 21.03.2016 г. № 199-п.

Постановление № 795–п от 15.11.2016 г. «Об одобрении Прогноза социально-экономического развития Усть-Кутского муниципального образования на 2017 год и на плановый период 2018 и 2019 годов». – Иркутская область: Администрация Усть-Кутского муниципального образования, 2016. 14 с.

Проект генерального плана Усть-Кутского муниципального образования (городского поселения). Генеральный план Усть-Кутского муниципального образования (городского поселения). Сводная схема (основной чертеж) генерального плана. Масштаб 1:10000. / Проект генерального плана Усть-Кутского муниципального образования (городского поселения) Усть-Кутского района Иркутской области. Шифр: ГП 1171-09. – Омск: ООО Институт территориального планирования «Град», 2016.

Проект генерального плана Усть-Кутского муниципального образования (городского поселения). Положения о территориальном планировании. – Омск: ООО Институт территориального планирования «Град», 2015. 27 с.

Проект генерального плана Усть-Кутского муниципального образования (городского поселения). Генеральный план Усть-Кутского муниципального образования (городского поселения). Материалы по обоснованию. – Омск: ООО Институт территориального планирования «Град», 2009. 120 с.

Проект освоения лесов на лесном участке, предоставленном в аренду ООО «ИНК» для строительства, реконструкции, эксплуатации линейных объектов и заготовки древесины по договору аренды лесного участка от 16.04.2018 г. №91-212/18 на территории Усть-Кутского лесничества в муниципальном образовании «Усть-Кутский район» Иркутской области. – Иркутск: ООО «ИНК», 2018. 58 с.

Схема водоснабжения и водоотведения Усть-Кутского муниципального образования. – Санкт-Петербург, ООО «НэкстЭнерго», 2014. 127 с.

Схема территориального планирования Усть-Кутского муниципального образования. Том 2. Шифр 125-2010, Экземпляр № 1. – Иркутск: ОАО «Иркутскгипродорнии», 2010. 49 с.

Устав Усть-Кутского муниципального образования (городского поселения) Усть-Кутского района Иркутской области. Принят Решением Думы Усть-Кутского муниципального образования (городского поселения) от 20.12.2005 г. №4. В ред. от 25.08.2011 г.

6. DOCUMENTATION OF ENVIRONMENTAL MANAGEMENT

6.1 Documentation in the field of production and consumption waste management

Производственная программа ООО «СПЕЦАВТО» по обеспечению производства в сфере захоронения (размещения) твердых бытовых отходов на период действия с 01.01.2017 г. до 31.12.2019 г. – Усть-Кут: ООО «СПЕЦАВТО». 6 с.

Документ об утверждении нормативов образования отходов и лимитов на их размещение выдан ООО «Иркутская нефтяная компания» (Объекты в Усть-Кутском районе Иркутской области), №ООС -573 от 28.11.2013 г. – Усть-Кутский район Иркутской области: Федеральная служба по надзору в сфере природопользования, Управление Федеральной службы по надзору в сфере природопользования (Росприроднадзора) в Иркутской области (Управление Росприроднадзора по Иркутской области), 2013. 5 с.

Лицензия ООО «Иркутская нефтяная компания» № 038 00194 от 05.04.2016 г. на осуществление деятельности по сбору, транспортированию, обработке, утилизации, обезвреживанию, размещению отходов I – IV классов опасности. - Иркутская область: Федеральная служба по надзору в сфере природопользования, 2016. 55 с.

Лицензия ООО «ВССК ЛТД» №ЧЦЛ 023 от 21.06.2013 г. на осуществление деятельности по заготовке, хранению, переработке и реализации лома черных металлов, цветных металлов. – Иркутская область: Служба потребительского рынка и лицензирования, 2013. 2 с.

Лицензия ИП Митюгина А.В. №038 00141 от 28.12.2015 г. на осуществление деятельности по сбору, транспортированию, обработке, утилизации, обезвреживанию, размещению отходов I – IV классов опасности. – Иркутская область: Федеральная служба по надзору в сфере природопользования, 2015. 8 с.

Договор № 778/60-02/16 от 01.12.2016 г. между ООО «ВССК ЛТД» и ООО «ИНК» о покупке лома и отходов черных металлов в количестве и качестве, ориентировочно 350 (триста пятьдесят) тонн.

Договор на оказание услуг № 783/60-02/16 от 27.10.2016г. между ИП Митюгиным А.В. и ООО «ИНК» по обезвреживанию отходов (ртутьсодержащих ламп, аккумуляторов, автошин и оргтехники) в Усть-Кутском районе.

Лицензия ООО «СПЕЦАВТО» №038 00146 от 11.01.2016 г. на осуществление деятельности по сбору, транспортированию, обработке, утилизации, обезвреживанию, размещению отходов I – IV классов опасности. – Иркутская область: Федеральная служба по надзору в сфере природопользования, 2016, 14 с.

Договор на оказание услуг № 1038/60-02/16 от 23.12.2016 г. между ООО «ИНК» и ООО «СПЕЦАВТО» по сбору (приему) и размещение (захоронению) отходов IV-V класса опасности на полигоне ТБО в Усть-Кутском районе.

6.2 Documentation of the water bodies, subsoil and other natural resources use

Письмо ООО «ИНК» от 28.06.2019 г. №0445-00-ГХК-ИНК в адрес ГИП ЗАО «Нефтехимпроект» Луховского А.И.

Письмо Федерального агентства по рыболовству (Росрыболовство), Ангаро-Байкальского территориального управления от 24.07.2015 №ИС-1649. Заключение по объекту «Комплекс приема и хранения сниженных углеводородных газов. Очистные сооружения производственно-дождевых сточных вод в части строительства и эксплуатации выпуска очищенных сточных вод в р. Лена (район мыса Толстый г. Усть-Кут)».

Проект нормативов допустимого сброса (НДС) веществ и микроорганизмов, поступающих в реку Лена с производственно-дождевыми стоками Комплекса приема, хранения и отгрузки сжиженных углеводородных газов. Инв. №54029. 535-635-НДС. – Иркутск: АО «Сибгипробум» 2015. 65 с.

Протокол лабораторных исследований (испытаний) от 10.03.2016 г. №1410 – Иркутская область: Федеральная служба по надзору в сфере защиты прав потребителей и благополучия человека, филиал ФБУЗ «Центр гигиены и эпидемиологии по республике Бурятия» в Северобайкальском районе, 2016. 3 с.

Протокол лабораторных исследований (испытаний) от 16.03.2016 г. №1063 – Иркутск: Федеральная служба по надзору в сфере защиты прав потребителей и благополучия человека, Восточно-Сибирского Дорожного филиала ФБУЗ «Центр гигиены и эпидемиологии по железнодорожному транспорту», 2016. 3 с.

Гидрологическая и судоходная обстановка на реках Ленского бассейна и Северо-Востока Российской Федерации (по состоянию на 5 июня 2013 г). -// Якутск: ФБУ «Администрация Ленского бассейна внутренних водных путей» [Электронный ресурс]. – Режим доступа: http://www.lgbu.ru/topic.php?id=200, свободный.

Заключение Отдела геологии и лицензирования по Иркутской области (Иркутскнедра) Департамента по недропользованию по Центрально-Сибирскому округу (Центрсибнедра) от 06.12.2016 г. №25710/ЦС-10-25 «Об отсутствии (наличии) полезных ископаемых в недрах под участком предстоящей застройки» для проекта строительства полимеров.

О государственной регистрации – Письмо Министерства природных ресурсов и экологии Иркутской области от 21.09.2018 г. исх. №02-66-4264/18 в адрес ООО «Иркутская нефтяная компания»

О предоставлении информации – Письмо Министерства природных ресурсов и экологии Иркутской области от 27.11.2013 №66-37-7539/3. в адрес и.о. Директора института ЗАО «Сибирский ЭНТЦ» Красноярского филиала Поваренкинау В.А.

О предоставлении информации – Письмо Службы архитектуры Иркутской области от 25.11.2016 г. №02-82-1623/16 в адрес Представителя ООО Иркутская нефтяная компания по доверенности Галкину К.Б.

О предоставлении информации – Письмо Службы по охране и использованию животного мира Иркутской области от 26.08.2014 № 84-37-1276 в адрес Директора института «Красноярскгидропроект» Красноярского филиала ЗАО «Сибирский научно-исследовательский центр» Вайкум В.А.

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7. CULTURAL HERITAGE PROTECTION

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Анализ действий Усть-Кутского муниципального звена ТП РСЧС Иркутской области по безопасному прохождению весеннего паводка 2015 года. – Иркутская область: Администрация Усть-Кутского муниципального образования, 2015.

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9. FISHING CHARACTERISTICS OF WATER BODIES

Рыбохозяйственное значение р. Лена. – Письмо ФГБУ «Байкальское бассейновое управление по рыболовству и сохранению водных биологических ресурсов (Байкалрыбзавод)» от 22.08.2014 № 03-09/1423 в адрес Директора института «Красноярскгидропроект» Красноярского филиала ЗАО «Сибирский научно-исследовательский центр» Вайкум В.А.

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Об утверждении положительного заключения государственной экспертизы проекта освоения лесов (арендатор ООО «ИНК») – Распоряжение Министерства лесного комплекса Иркутской области от 06.09.2018 г. №3012-мр.

Положительное заключение государственной экспертизы № 021-17/КРЭ-2230/03 (№ в Реестре 00-1-1-3-03-45-17). Объект капитального строительства. Комплекс приема, хранения и отгрузки сжиженных углеводородных газов. – Красноярск: Министерство строительства и жилищно-коммунального хозяйства Российской Федерации (Минстрой России), Федеральное Автономное Учреждение «Главное управление государственной экспертизы» (ФАУ «Главгосэкспертиза России»), Красноярский филиал, 2017. 186 с.

11. ENVIRONMENTAL MONITORING AND CONTROL MATERIALS

Договор № 04/УК/17 от 16.01.2017 г. между ФГБУ «Центр лабораторного анализа и технических измерений по Сибирскому федеральному округу» и ООО «ИНК» по проведению испытаний и измерений объектов (включая отбор проб) на Марковском, Ярактинском и Даниловском НГКМ.

Договор на оказание услуг № 25 от 19.01.2017 г. между ФБУЗ «Центр гигиены и эпидемиологии в Иркутской области» и ООО «ИНК» на проведение исследований сточных вод на объектах Иркутской нефтяной компании в Усть-Кутском районе.

Договор на оказание услуг № 26 от 19.01.2017 г. между ФБУЗ «Центр гигиены и эпидемиологии в Иркутской области» и ООО «ИНК» на проведение исследований воды из наблюдательных скважин №№ 1,2, почв, воздуха, физических факторов и радиационного контроля полигона ТБО Марковского НГКМ.

Договор на оказание услуг № 27 от 19.01.2017 г. между ФБУЗ «Центр гигиены и эпидемиологии в Иркутской области» и ООО «ИНК» на проведение исследований атмосферного воздуха и физических факторов воздействия на объектах Иркутской нефтяной компании в г. Усть-Кут и Усть-Кутском районе.

Договор №03/УК/17 от 16.01.2017 г. между ФГБУ «Центр лабораторного анализа и технических измерений по Сибирскому федеральному округу» и ООО «ИНК» по проведению измерений (испытаний) сточных вод на очистных сооружениях биологической очистки вахтового поселка Яракта КСК-120 и КОУ-12 (УПН) Ярактинского НГКМ, ПСП «Марковское» (КОСВ.Б.20-05), Даниловского НГКМ (КСК-20), а также поверхностных вод р. Малая Тира, р. Лена (май-октябрь).

План-график проведения проверок производственного экологического контроля на объектах группы компании ООО «ИНК» на 2017 год. Утв. Директором департамента экологии и землепользования ООО «ИНК» Дьяковым А.А., 2016. 4 с.

План-график проведения производственного экологического контроля за качеством очистки сточных вод на выпусках с очистных сооружений КОСВ.Б.20-05 на ПСП «Марковское», КСК-120 и КОУ12 (УПН) Ярактинского, КСК-20 Даниловского месторождений на 2017 год. Утв. Генеральным директором ООО «ИНК» Седых М.В., 2017. 2 с.

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13.3 Procedure for interaction with contractors on environmental protection issues, occupational health and safety

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APPENDIX 2
PROJECT ENVIRONMENTAL AND SOCIAL STANDARDS

Intended for
Irkutsk Oil Company LLC

Date
August 2019

IRKUTSK POLYMER PLANT. POLYETHYLENE PRODUCTION

ENVIRONMENTAL AND SOCIAL PROJECT STANDARDS

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Date	
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Ref

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Annex A

List of the main applicable RF regulations

Annex B

Regulatory regime in the territory of the future Project facilities: use-restricted areas and references to the applicable requirements

Annex C

Overview of the applicable international conventions

1. INTRODUCTION

The purpose of this Project Environmental and Social Standards Document ("the Project Standards") is to summarise the national and international standards and guidelines that are applicable to the Irkutsk Polymer Plant (the Project or IPP), and to document the standards and guidelines adopted for the Project.

The Project Standards document is a Project Environmental and Social Management Control Document that forms part of the Project Environmental and Social Management System (ESMS) and is central to the preparation of the international Environmental and Social Impact Assessment (ESIA) documentation.

Project Standards are also used to inform and guide the continuing development of the Project particularly in respect of compliance with regulatory and Lender requirements. The Project Standards are therefore subject to amendment and updating as external requirements (and the requirements of the Project) continue to evolve.

2. DEVELOPMENT OF THE PROJECT STANDARDS

2.1 Strategy

The following approach will be taken to prevent and reduce environmental impact and threats to the aquatic and onshore environment.

- Compliance with the Russian environmental and social codes and standards.
- Compliance with Good International Industry Practice (GIIP) for pollution prevention and control.
- Utilisation of the best available technologies (BATs) in the context of Russian Federation (RF) regulatory requirements and EU BATs[1].

If Russian regulations differ from the international guidelines, the more stringent requirement shall be applied, and deviation may be accepted only against a full and detailed justification

For social impacts, such as resettlement, influx management, stakeholder engagement etc. numeric standards are generally not applicable. Nevertheless, the most appropriate good practice management techniques will be used, drawing upon Russian and international standards and practices as appropriate to ensure adverse effects are minimised and positive impacts are enhanced.

2.2 Source documents

The Source Documents for this Project Standards Document include:

- International treaties and conventions;
- IFIs' guidelines/standards that will be required by potential Lenders to the Project (see Section 2.4 and 2.5);
- RF legal and regulatory documents.

2.3 National legislation requirements

Summary of the key Russian legislation applicable to the Project is provided in Section 2 of the ESHIA Report. The quantitative standards applicable to the Project are listed in Chapter 3 of this document, and the list of the applicable legislation and regulations of the RF is provided in Annex A herein; summary information on the sources of requirements to the use-restricted areas is provided in Annex B herein.

The designed polymer facility meets the NEI criteria for operations category I, therefore, application of BAT is an essential prerequisite for the permit to put the facilities into operation.

The following Russian sector-specific BAT reference documents (ITS) are applicable to the Project:

- ITS 18-2016 Production of basic organic chemicals;
- ITS 31-2017 Production of fine organic synthesis products;
- ITS 32-2017 Production of polymers, including biodegradable

For the purpose of the Plant benchmarking in the context of BAT, it is advisable to refer to environmentally significant parameters of three reference technologies:

- Production of ethylene by pyrolysis of LPG and ethane fraction;
- Production of butene-1 (α-olefins);
- Production of polyethylene using gas phase technology.

Reference numeric values of parameters of the three technologies mentioned above are included in Tables 3-10 – 3-12. General BAT applicable to these technologies are listed in Table 3-13.

Besides the requirements listed in sector-specific ITS documents, certain requirements of cross-sectoral BAT reference documents are also applicable to the Project. These relate to emissions and discharges treatment, waste management processes, design and operation of waste neutralization and disposal facilities, process cooling systems, environmental management and energy management systems:

[1] Since 2019 the Russian environmental regulation will be based on the BAT principle. The national BAT Reference Documents were developed taking into account the EU BREFs over the period 2015-2017.

- ITS 8-2015 Wastewater treatment in manufacture of products (goods), performance of works and provision of services at large enterprises;
- ITS 47-2017 Waste water and waste gas treatment/management systems in the chemical sector;
- ITS 22-2016 Purification of harmful (polluting) emissions to air from manufacturing of products (goods), works and services at large enterprises;
- ITS 22.1-2016 General principles of industrial environmental monitoring and its metrological support;
- ITS 46−2019 Reduction of pollution emissions and discharges from storage of products (goods);
- ITS 9-2015 Thermal waste treatment (waste incineration);
- ITS 48-2017 Increase of energy efficiency.

Most cross-sectoral reference documents provide high-level guidance and duplicate the requirements of the RF environmental law which are already addressed in the Company's commitments, policies, corporate standards and other corporate regulations. However, certain specific BAT requirements shall be considered during selection of process technologies and subsequent design development for the Project.

2.4 Treaties and conventions

Summary of the international agreements and conventions that may be applied to the Project (commensurate with its nature and scope) is provided in Annex C herein.

2.5 IFI requirements

2.5.1 Equator Principles

The Equator Principles (EP) is a set of ten volunteer environmental and social standards to be adhered if the Project is to be financed by Equator Principles Financial Institutions (EPFIs).

The Equator Principles include:

- Principle 1: Review and categorization
- Principle 2: Environmental and Social Assessment
- Principle 3: Applicable Environmental and Social Standards
- Principle 4: Environmental and social management system and Action Plan
- Principle 5: Stakeholder engagement
- Principle 6: Grievance mechanism
- Principle 7: Independent Review
- Principle 8: Covenants
- Principle 9: Independent Monitoring and Reporting
- Principle 10: Reporting and Transparency

In identifying applicable standards under the EPs, reference is made to the provisions of Principle 3: "Applicable Social and Environmental Standards". Principle 3 sets out responsibility of an ESIA Report to establish the Project's overall compliance with (or justified deviation from) the relevant host country laws, respective IFC PS, and EHS Guidelines.

2.5.2 IFC Performance Standards

In January 2012, the International Financial Institution (IFC) has developed and published an updated Sustainability Framework, which includes a revised Policy on Environmental and Social Sustainability and revised Performance Standards (PSs).

PS 1: Assessment and management of environmental and social risks and impacts
PS 2: Labour and Working Conditions
PS 3: Resource efficiency and pollution prevention
PS 4: Community health, safety, and security
PS 5: Land acquisition and involuntary resettlement
PS 6: Biodiversity conservation and sustainable management of living natural resources
PS 7: Indigenous peoples
PS 8: Cultural heritage

The eight performance Standards are supported by IFC Environmental, Health and Safety (EHS) guidelines.

2.5.3 Applicable IFC EHS Guidelines

For the Project, the following IFC EHS guidelines are relevant:

- EHS Guidelines for Large Volume Petroleum-based Organic Chemicals Manufacturing (includes gaseous hydrocarbons as raw materials; April 2007);
- EHS Guidelines for Petroleum-based Polymers Manufacturing (partially applicable; April 2007);
- EHS Guidelines for Thermal Power Plants (December 2008);
- EHS Guidelines for Onshore Oil and Gas Development. (applicable to the Project auxiliary facilities, April 2007);
- EHS Guidelines for Natural Gas Processing (applicable to the Project auxiliary facilities). (April 2007);
- EHS guidelines for ports, harbours, and terminals (with regard to onshore facilities; February 2017).
- EHS Guidelines for Waste Management Facilities (December 2007);
- EHS Guidelines for Water and Sanitation (December 2007);

2.5.4 Japan Bank for International Cooperation (JBIC) Guidelines for Confirmation of Environmental and Social Considerations

In 2015, the JBIC reviewed its Guidelines for Confirmation of Environmental and Social Considerations, which were adopted on April 1, 2012.

The Guidelines' objective is to ensure consideration of the environmental and social aspects in all projects subject to lending or other financial operations by JBIC.

JBIC ascertains whether a project complies with environmental laws and standards of the host nation and local governments concerned, as well as whether it conforms to their environmental policies and plans.

JBIC also ascertains, whether the project meets the applicable EHS standards of the World Bank Safeguard Policies or IFC PSs. JBIC also refers to standards established by other IFI, other internationally recognized standards, and/or standards or good practices established by developed countries such as Japan as benchmarks.

2.5.5 OECD Common Approaches

Export Credit Agencies (ECAs) from member states of the Organisation for Economic Cooperation and Development (OECD) apply the "Recommendation of the Council on Common Approaches for Officially Supported Export Credits and Environmental and Social Due Diligence (The "Common Approaches"), which were most recently updated in 2016.

The Common Approaches provide guidance to ECAs for screening, classifying, environmental and social reviewing, evaluating, making a decision and monitoring projects under consideration by ECAs. Project should, in all cases, comply with host country standards. Members benchmark projects against the relevant aspects of the following international standards:

- All ten World Bank Safeguard Policies; or
- All eight International Financial Corporation (IFC) Performance Standards (see below);
- Relevant aspects of the standards of Regional Development Banks (such as European Bank for Reconstruction and Development (EBRD));
- Relevant internationally recognised standards such as those of the EU.
- In addition, Members may also benchmark projects against the relevant aspects of any internationally recognised sector specific or issue specific standards that are not addressed by the World Bank Group.

2.5.6 EBRD Environmental and Social Policy and Performance Requirements

In April 2019 EBRD adopted a new Environmental and Social Policy (ESP) which will be applied to projects initiated after 1 January 2020. The key changes in ESP are intended to clarify the performance standards and their applicability; specify the scope for preliminary screening of projects; reinforce the approach and requirements to the supply chain management; introduce more stringent requirements for identification of vulnerable communities, and evaluation and mitigation of disproportionate impact on them; reinforcement of gender focus at all stages of project cycle.

Under the effective Policy which was adopted in May 2014, projects are expected to be designed and operated in compliance with good international practices relating to sustainable development. The EBRD Performance Requirements (PRs) comprise:

PR 1: Assessment and Management of Environmental and Social Impacts and Issues;
PR 2: Labour and Working Conditions;
PR 3: Resource Efficiency and Pollution Prevention and Control;
PR 4: Health and Safety;
PR 5: Land Acquisition, Involuntary Resettlement and Economic Displacement;
PR 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources;
PR 7: Indigenous Peoples;
PR 8: Cultural Heritage;
PR 9: Financial Intermediaries;
PR 10: Information Disclosure and Stakeholder Engagement.

The EBRD, as a signatory to the European Principles for the Environment, is committed to promoting the adoption of EU environmental principles, practices and substantive standards. As stated in the ESP, substantive environmental standards of the European Union are contained in EU secondary legislation, for example, regulations, directives and decisions.

EU documents applicable to the project include:

- Directive on the assessment of the effects of certain public and private projects on the environment (2011/92/EU);
- Public Participation in Decision Making Directive (2003/35/EC);
- Directive on environmental liability with regard to the prevention and remedying of environmental damage (2004/35/CE);
- Ambient Air Quality Directive (2008/50/EC);
- Regulation on substances depleting the ozone layer (2037/2000);
- Directive on industrial emissions (integrated pollution prevention and control) (2010/75/EC);
- Directive relating to the assessment and management of environmental noise (2002/49/EEC);
- Water Framework Directive (2000/60/EC);
- Directive on environmental quality standards in the field of water policy (2008/105/EC);
- Groundwater Directive (2006/118/EC);
- Directive on the quality of fresh waters needing protection or improvement in order to support fish life (78/659/EEC);
- Waste Framework Directive (2008/98/EC);
- Habitats Directive (92/43/EEC);
- Birds Directive (2009/147/EC);
- Drinking Water Directive (98/83/EC).

Directive 2010/75/EU establishes fixed emission limit values and lays out recommended schemes for equipment design and use to ensure a high level of protection of the environment as a whole through the use of the best available techniques (BAT).

The following EU BREFs[2] can be applied to the Project:

- Production of Polymers, August 2007;
- Common Waste Water and Waste Gas Treatment/Management Systems in the Chemical Sector, 2016;
- Large Volume Organic Chemical Industry, February 2003;
- Large Combustion Plants, July 2006;
- Refining of Mineral Oil and Gas, 2015;
- Emissions from Storage, 2006;
- Waste Incineration, August 2006;
- Energy Efficiency, February 2009.

2.6 Applicability of standards

The applicability of each of the aforementioned standards is provided for the different project facilities/activities in the matrix below. The applicability of each convention/standard is provided in terms of its direct relevance and whether it is a primary or secondary standard for the Project.

[2] http://eippcb.jrc.ec.europa.eu/reference/

Table 2-1: Applicability of standards

	Ethylene production	Polyethylene production	Butene-1 production	Thermal power plant	Infrastructure[3]	Berth on the Lena River	Gas pipeline[4]	Workforce	Comments (see foot of table)
All national legislation	●	●	●	●	●	●AF	●AF	●	
Bonn Convention	○	○	○	○	○	○AF	○AF	-	Comment 1
Bern Convention									Comment 1
Biological diversity	●	●	●	●	●	●AF	●AF	●	
UN Convention on Climate Change, Kyoto Protocol	○	○	○	○	○	○AF	○AF	-	
Vienna Convention (Ozone), Montreal Protocol	○	○	○	○	○	○AF	○AF	-	
Basel Convention	-	-	-	-	○	-	-	-	
Convention Concerning the Protection of the World Cultural and Natural Heritage	●	●	●	●	●	●AF	●AF	●	
Convention on the Transboundary Effects of Industrial Accidents	●	●	●	●	●	●AF	●AF	-	
ILO Conventions	-			-	-	-	-	●	Comment 2
OECD Common Approaches	○	○	○	○	○	○AF	○AF	○	
Equator Principles	○	○	○	○	○	○AF	○AF	○	
JBIC Guidelines for Confirmation of Environmental and Social Considerations	○	○	○	○	○	○AF	○AF	○	
IFC Performance Standards	●	●	●	●	●	●AF	●AF	●	
IFC EHS Guidelines									

[3] Including water supply and drainage system, interfacility road and Vilyui A-331 road section, power supply
[4] Gas pipeline Yaraktinsky OGCF - Markovsky OGCF to Ust-Kut city

General EHS Guidelines	●	●	●	●	●	●AF	●AF	●	
Large Volume Petroleum-based Organic Chemicals Manufacturing	●	-	●	-	-	-	-	-	
EHS Guidelines for Onshore Oil and Gas Development	-	-	-	-	-	-	●AF	-	
Petroleum-based Polymers Manufacturing	-	●	-	-	-	-	-	-	
Thermal Power Plants	-	-	-	●	-	-	-	-	
EHS Guidelines for Ports, Harbours, and Terminals	-	-		-	-	●AF	-	-	
EHS Guidelines for Waste Management Facilities	-	-	-	-	●	-	-	-	
EHS Guidelines for Water and Sanitation	-	-	-	-	●	-	-	-	
EBRD standards and EU documents	●	●	●	●	●	●AF	●AF	●	

Key

●	of direct relevance and a primary standard for the project
○	secondary standard used to supplement primary standard or of partial relevance
-	expected to be of little or no relevance to the project
AF	Associated Facility (acknowledges limited control and influence over the facility)

Comments

1. The Conventions are applicable if the Project Area of Influence includes wildlife habitats / migration routes of species protected by the Conventions.
2. ILO conventions 87, 98, 100, 111, 169 and UN Convention on the Protection of the Rights of all Migrant Workers and Members of their Families are considered to be most relevant. Others concerning forced and child labour should be considered but are unlikely to be relevant

3. PROJECT NUMERIC STANDARDS

Numeric standards and guidelines applicable to the Project appear in a variety of materials, primarily the IFIs Requirements (in particular, the IFC EHS Guidelines) and the Source Documents. These numeric standards and guidelines have been tabulated to compare values for similar topics as they are applied under national jurisdiction and in the IFIs requirements.

These topics are presented in separate tables as follows:

Table 3-1: Environmental Standards for Emissions to the Atmosphere

Table 3-2: Environmental Standards for Ambient Air

Table 3-3: Environmental Standards for Water Quality & Discharges to Water Bodies

Table 3-4: Drinking Water Standards

Table 3-5: Water protection zones and protected shoreline belts

Table 3-6: Environmental Standards for waste

Table 3-7: Environmental noise standards

Table 3-8: Soil Quality Standards

Table 3-9: Social environment and working conditions

Table 3-10: BAT technological indicators for ethylene production

Table 3-11: BAT technological indicators for butene-1 production

Table 3-12: BAT technological indicators for polyethylene production

Table 3-13: General BAT applicable to ethylene, butene-1 and polyethylene production

The Project Numeric Standards tables present a side-by-side comparison of the various standards identified in the source documents for each of the topics. The tables also identify the adopted Project Numeric Standards (to apply across the Project) for each topic, and the rationale for selection thereof (the most stringent standard is selected unless otherwise stated and justified). Environmental standards for waste disposal (tables 3-6 - 3-7) contain not only numeric standards. Tables 3-10 - 3-12 present BAT technological indicators for production of ethylene, butene-1 and polyethylene.

Table 3-1: Environmental Standards for Emissions to the Atmosphere

Topic	National standards/ requirements	International Standards/ Guidelines		Adopted Project Standard	Rationale
	Russia	IFC EHS General Guidelines (or IFC PS)	Other (including IFC industry sector specific guidelines)		
Thermal power plant emissions (natural gas)	**GOST R 50831-95**[5], SOx (<200 MW) 1200 (if S content <0.045 %)/ 1400 (≥ 0.045%) NOx 125 CO 300	Emissions do not contribute more than 25 % of the applicable air quality standards to allow additional, future sustainable development in the same airshed.	**IFC EHS Guidelines for thermal power plant (mg/Nm3)** Natural gas (all turbines >50 MW) NOx 51 (25 ppm) Dry Gas Excess O2 Content 15%	The standards are set in mg/Nm3 $SO_2$1200 NOx 125 Dry Gas Excess O2 content 15% CO 300	Most stringent
Emissions from onshore thermal waste treatment facilities	**ITS 9-2015**[6] **and RF Ministry of Natural Resources Order No. 270 of 25.04.2019**[7]**, mg/m³** NO_x 200 SO_2 50 CO 50 saturated hydrocarbons C12-C19 10 carbon (soot) 10 SS 10	No relevant numeric standard	**IFC EHS Guidelines for Waste Management Facilities**, mg/m³: suspended solids: 10 (24 h) SO_2 50 (24 h) NO_x 200-400 (24 h) HCl 10 dioxins and furans 0.1 mg TEQ[8]/m³ (6 – average during 8 hours) cadmium 0.05-0.1 (0.5 - average during 8 hours) CO 50-150	NO_x 200 mg/m³ SO_2 50 mg/m³ CO 50 mg/m³ C12-C19 10 mg/m³ carbon (soot) 10 mg/m³ suspended solids 10 mg/m3 benzapyrene 0.001 ng/m³ HCl 10 mg/m³ HF 1 mg/m³ Dioxins 0.1 ng/m³	Most stringent

[5] GOST R 50831-95 Boiler plants. Heat-mechanical equipment. General technical requirements. The standard is applicable to heat machinery equipment within boiler-based power generation facilities within the range of 80 to 1200 MW.
[6] ITS 9-2015 Thermal waste treatment (waste incineration)
[7] RF Ministry of Natural Resources Order of 24.04.2019 No.270 "On approval of environmental regulation document "Process parameters of best available technologies for thermal waste treatment (waste incineration)""
[8] TEQ – toxicity equivalent

	benzapyrene 0.001 ng/m^3 HCl 10 HF 1 dioxins 0.1 ng/m^3 mercury and its compounds 0.05 Cd + Tl 0.05 total other heavy metals 0.5		total metals: 0.5-1 (0.5 - average during 8 hours) Hg 0.05-0.1 (0.5 - average during 8 hours) HF 1	mercury and its compounds 0.05 mg/m^3 Cd + Tl 0.05 mg/m^3 total other heavy metals 0.5 mg/m^3	
Emissions of Ozone Depleting Substances	No relevant numeric standard	No relevant numeric standard (Although 'no new systems or processes should be installed using CFCs, halons, 1,1,1-trichloroethane, carbon tetrachloride, methyl bromide or HBFCs')	No relevant numeric standard	Consistent with applicable international conventions apply the principle that the will be no utilisation of ozone depleting substances (halons, PCBs, CFCs, HCFCs)	Good practice
Greenhouse gas (GHG) emissions	No relevant numeric standard	IFC PS 3, 2012 supersedes 2007 EHS guidance. It requires that for projects that are expect to produce more than 25,000 tonnes CO_{2e} per annum emissions will be quantified in accordance with internationally recognised methodologies and good practice.	No relevant numeric standard	No relevant numeric standard. GHG will be quantified and reported annually if >25,000 tonnes CO_2 equivalent per year are expected	Most relevant

Table 3-2: Environmental Standards for Ambient Air

Topic	National Standards/ Requirements	International Standards/ Guidelines		Adopted Project Standard	Rationale
	Russia	IFC EHS General Guidelines (or IFC PS)	Other (including IFC industry sector specific guidelines)		
Air Quality - Human population protection (at receptors)	GN 2.1.6.3492-17[9] and GN ГН 2.1.6.2309-07[10] at border of sanitary protection zone (SPZ) (mg/m3): CO 3 (24 h) CO 5 (20 min) H_2S 0.008 (20 min) NO 0.06 (24 h) NO 0.4 (20 min) NO_2 0.04 (24 h) NO_2 0.2 (20 min) SO_2 0.05 (24 h) SO_2 0.5 (20 min) Alkanes (C_{12}-C_{19}) 1 (20 min) Benz(a)pyrene (3,4-benzpyrene) 0.000001 (24 h) Petrol (petroleum-based, low-sulphur) 1.5 (24 hours) Petrol (petroleum-based, low-sulphur) 5 (20 min)	Where set, national air quality standards apply. If no national standards are set then apply WHO standards. WHO guidelines, mg/m^3: $PM_{2.5}$ 0.01 (1 yr) $PM_{2.5}$ 0.025 (24 h) PM_{10} 0.02 (1 yr) PM_{10} 0.05 (24 h) NO_2 0.04 (1 yr) NO_2 0.2 (1 h) SO_2 0.02 (24 h) SO_2 0.5 (10 min)	**IFC EHS Guidelines for Onshore Oil and Gas Development** Emission concentrations as per General EHS Guidelines, and: H_2S: 5 mg/ m^3 **Directive 2008/50/EC**[11] CO 100 (15 min) CO 10 (8 h)	Russian standards supplemented by EU/WHO (mg/m^3): CO 3 (24 h) CO 5 (20 min) H_2S 0.008 (20 min) NO 0.06 (24 h) NO 0.4 (20 min) NO_2 0.04 (1 yr) NO_2 0.04 (24 h) NO_2 0.2 (20 min) SO_2 0.02 (24 h) SO_2 0.5 (10 minutes) Alkanes (C12-C19) 1 (20 min) Benz(a)pyrene (3,4-benzpyrene) 0.000001 Petrol (petroleum-based, low-sulphur) 1.5 (24 hours) Petrol (petroleum-based, low-sulphur) 5 (20 min) Benzene 0.3	Russian standards supplemented by EU/WHO where necessary to achieve most stringent suite[12]

[9] GN 2.1.6.3492-17. Maximum permissible concentrations (MPCs) of polluting substances in air atmospheric air in residential areas (appr. by the RF Chief State Sanitary Officer, Resolution No.165 of 22.12.2017)
[10] GN 2.1.6.2309-07. 2/1/6/. Atmospheric air and air of premises, sanitary air protection. Safe reference level of impact (SRLI) of pollutants in atmospheric air of residential areas. Hygienic standards
[11] Directive 2008/50/EC of 21 May 2008 on ambient air quality and cleaner air
[12] The IFC cites WHO ambient air quality guidelines typically apply only in jurisdictions where there are no national standards in place. National standards exist, but nevertheless WHO guidelines have been adopted where these are more stringent than national standards. EU Ambient Air Quality standards are a requirement of the EBRD

Topic	National Standards/ Requirements	International Standards/ Guidelines		Adopted Project Standard	Rationale
	Russia	IFC EHS General Guidelines (or IFC PS)	Other (including IFC industry sector specific guidelines)		
	Benzene 0.3 Butane 200.0 Hexane 60.0 (SRLI) Dioxins and furans 0.5 pg/m^3 Kerosene 1.2 Xylene 0.2 (24h) Methane 50.0 (SRLI) Pentane 100.0 Pentyl 1.5 (24h) Saturated hydrocarbons C1-C5 50.0 Mixed saturated hydrocarbons C6-C10 30.0 Titanium dioxide 0.5 Toluene 0.6 (24h) PM10 0.06 (24h) PM10 0.3 (20 min) PM10 0.04 (1 yr) PM2.5 0.035 (24 h) PM2.5 0.16 (20 min) PM2.5 0.025 (1 yr) Carbon (soot) 0.05 (24 h) Carbon (soot) 0.15 (20 min) Ethane 50.0 (SRLI)			Dioxins and furans 0.5 pg/m^3 Kerosene 1.2 Xylene 0.2 (24h) Methane 50.0 Pentyl 1.5 (24h) Saturated hydrocarbons C1-C5 50.0 Mixed saturated hydrocarbons C6-C10 30.0 Hydrochloric acid (HCl) 0.2 (24 h) Titanium dioxide 0.5 Toluene 0.6 (24h) PM10 0.02 (1 yr) PM10 0.3 (20 min) PM10 0.05 (24 h) PM2.5 0.025 (1 yr) PM2.5 0.035 (24 h) PM2.5 0.16 (20 min) Carbon (soot) 0.05 (24 h) Carbon (soot) 0.15 (20 min) Ethylbenzene 0.02 (24 h)	

Topic	National Standards/ Requirements	International Standards/ Guidelines		Adopted Project Standard	Rationale
	Russia	IFC EHS General Guidelines (or IFC PS)	Other (including IFC industry sector specific guidelines)		
	Ethylbenzene 0.02 (24 h)				
Air Quality – protection of vegetation (at sensitive receptors)	No relevant numeric standard	No relevant numeric standard	**Directive 2008/50/EC**[13]: SO2 10 µg/m3 (1 year, for lichen) SO2 20 µg/m3 (24 hours, for lichen) NOx 19.5 - 24 mg/m3 (1 yr)	SO2 10 µg/m3 (1 year, for lichen) SO2 20 µg/m3 (24 hours, for lichen) NOx 19.5 - 24 mg/m3 (1 yr)	Only relevant standards
Air quality - Workplace air	GN 2.2.5.3532-18[14] (mg/m^3): CO 20 (one-time) CO_2 27000 (one-time); 9000 (time-weighted workshift average) NO_2 2 (one-time) NOx (as NO2) 5 (one-time) SO_2 10 (one-time) H_2S 10 (one-time) Butane 900 (one-time), 300 (time-weighted workshift average)	Maintaining levels of contaminant dusts, vapors and gases in the work environment at concentrations below those recommended by the ACGIH[15] as TWA-TLV's (threshold limit value)—concentrations to which most workers can be exposed repeatedly (8 hours/day, 40 hrs/week, week-after week), without sustaining adverse health effects	No relevant numeric standard	CO 20 (one-time) CO_2 27000 (one-time); 9000 (time-weighted workshift average) NO_2 2 (one-time) NO_x (as NO_2) 5 (one-time) SO_2 10 (one-time) H_2S 10 (one-time) Methane 7000 (one-time) Mixed saturated hydrocarbons C1-C4 900 (one-time), 300 (time-weighted workshift average)	Most stringent

[13] EU Directive 2008/50/EC on ambient air quality and cleaner air

[14] GN 2.2.5.3532-18. Maximum permissible concentrations (MPC) of harmful substances in workplace ambient air. (appr. by the RF Chief State Sanitary Officer, Resolution No.25 of 13.02.2018)

[15] Threshold Limit Values for Chemical Substances and Biological Exposure Indices, 2005. ACGIH - American Conference of Governmental Industrial Hygienists

Topic	National Standards/ Requirements	International Standards/ Guidelines		Adopted Project Standard	Rationale
	Russia	**IFC EHS General Guidelines (or IFC PS)**	**Other (including IFC industry sector specific guidelines)**		
	Hexane 900 (one-time), 300 (time-weighted workshift average) Methane 7000 (one-time) Mixed saturated hydrocarbons C1-C4 900 (one-time), 300 (time-weighted workshift average) Pentane 900 (one-time), 300 (time-weighted workshift average) Benzene 15 (one-time), 5 (time-weighted workshift average) Toluene 150 (one-time), 50 (time-weighted workshift average) Xylene 150 (one-time), 50 (time-weighted workshift average) Hexane 900 (one-time), 300 (time-weighted workshift average) Mixed saturated hydrocarbons C6-C10 900 (one-time), 900	TWA-TLV, ppm: CO 25 (29.4 mg/m3) TWA[16] CO_2 5000 (9242.1 mg/m3) TWA; 30000 (55452.6 mg/m3) STEL[17] NO_2 3 (0.3864 mg/m3) TWA; 5 (9.6 mg/m3) STEL SO_2 2 (6 mg/m3) TWA; 5 (13.4 mg/m3) STEL H_2S 10 (15 mg/m3) TWA; 15 (21.5 mg/m3) STEL C1-C4 1000 (714 mg/m3) TWA Pentane 600 (1930 mg/m3) TWA Benzene 0.5 (1.7 mg/m3) TWA; 2.5 (8.2 mg/m3) STEL Toluene 50 (205 mg/m3) TWA Xylene 100 (220 mg/m3) TWA; 150 (661 mg/m3) STEL Hexane 50 (181 mg/m3) TWA		Pentane 900 (one-time), 300 (time-weighted workshift average) Benzene 0.5 (1.7 mg/m3) TWA; 2.5 (8.2 mg/m3) STEL Toluene 150 (one-time), 50 (time-weighted workshift average) Xylene 150 (one-time), 50 (time-weighted workshift average) Hexane 50 (181 mg/m3) TWA Hexane 300 (time-weighted workshift average) Mixed saturated hydrocarbons C6-C10 900 (one-time), 900 (time-weighted workshift average) Mercury 0.01 (one-time), 0,005 (time-weighted workshift average) Chlorine 1 (one-time) Chlorine 0.5 (1.5 mg/m3) TWA	

[16] TWA - 8-hour, time-weighted average
[17] STEL – Short-term exposure limit (during 15 minutes)

Topic	National Standards/ Requirements	International Standards/ Guidelines		Adopted Project Standard	Rationale
	Russia	IFC EHS General Guidelines (or IFC PS)	Other (including IFC industry sector specific guidelines)		
	(time-weighted workshift average) Mercury 0.01 (one-time), 0,005 (time-weighted workshift average) Chlorine 1 (one-time) Methanol 5 (time-weighted workshift average)	Chlorine 0.5 (1.5 mg/m3) TWA; 1 (3 mg/m3) STEL Methanol 200 (270 mg/m3) TWA; 250 (336 mg/m3) STEL		Methanol 5 (time-weighted workshift average)	

Table 3-3: Environmental Standards for Water Quality & Discharges to Water

Topic	National standards/ requirements	International Standards/ Guidelines		Adopted Project Standard	Rationale
	Russia	IFC EHS General Guidelines (or IFC PS)	Other (including IFC industry sector specific guidelines)		
Water quality	The list of MPCs of harmful substances in the waters of fishery water bodies[18] (mg/l): Suspended solids (to background) +0.25[19] Dissolved O_2 6.0 mg/l 5-day BOD5 (at t 20°C) 2.1 mg/l BODtot (at 20°C) 3 mg/l Background pH of water body Chlorides 300 Sulphates 100 Ammonium 0.5 Phosphate (as P) 0.05 for oligotrophic, 0.15 for mesotrophic, 0.2 for eutrophic water bodies Iron (Fe) 0.1 Copper (Cu) 0.001 Nitrate (NO_3) 40 Nitrite (NO_2) 0.08	No relevant numeric standard	No relevant numeric standard	Suspended solids (to background) +0.25 Water temperature shall not increase by more than 5 °C compared to natural temperature of the water body, with the total temperature increase: - to a maximum of 20 °C in summer and 5 °C in winter, for the water bodies providing habitats for cold water fish (salmonids and whitefishes); to a maximum of 28 °C in summer and 8 °C in winter in all other cases. The winter water temperature in the burbot spawning grounds shall not be raised more than by 2 °C. Dissolved O_2 6.0 mg/l 5-day BOD5 (at t 20°C) 2.1 mg/l BODtot (at 20°C) 3 mg/l Background pH of water body Chlorides 300 Sulfates 100 Ammonium 0.5	Most stringent

[18] Decree of the Ministry of Agriculture of the RF of 13.12.2016 # 552 "On approval of water quality standards for fishery water bodies, including standards for maximum permissible concentrations of harmful substances in the waters of fishery water bodies".

[19] When the concentration of natural suspended matter in the water bodies of fishery significance in low water period is higher than 30 mg/dm3, its increase up to 5% is allowed. It is prohibited to discharge return (waste-) water containing suspended matter with a settling velocity of more than 0.4 mm/s into streams; with a settling velocity exceeding 0.2 mm/s - into water bodies.

Topic	National standards/ requirements	International Standards/ Guidelines		Adopted Project Standard	Rationale
	Russia	IFC EHS General Guidelines (or IFC PS)	Other (including IFC industry sector specific guidelines)		
	Manganese 0.01 Lead 0.06 Strontium 0.4 Nickel (Ni) 0.01 Zinc (Zn) 0.01 Cobalt 0.01 Chromium 0.07 Cadmium 0.005 Mercury (Hg) nil (0,00001) Potassium (K) 50 Calcium (Ca) 180 Magnesium (Mg) 40 Selenium (Se) 0.002 Oil 0.05 Phenol 0.001			Phosphate (as P) 0.05 for oligotrophic, 0.15 for mesotrophic, 0.2 for eutrophic water bodies Iron (Fe) 0.1 Copper (Cu) 0.001 Nitrate (NO3) 40 Nitrite (NO2) 0.08 Manganese 0.01 Lead 0.06 Strontium 0.4 Nickel (Ni) 0.01 Zinc (Zn) 0.01 Cobalt 0.01 Chromium 0.07 Cadmium 0.005 Mercury (Hg) nil (0,00001) Potassium (K) 50 Calcium (Ca) 180 Magnesium (Mg) 40 Selenium (Se) 0.002 Oil 0.05 Phenol 0.001	

Topic	National standards/ requirements	International Standards/ Guidelines		Adopted Project Standard	Rationale
	Russia	IFC EHS General Guidelines (or IFC PS)	Other (including IFC industry sector specific guidelines)		
Wastewater discharge into water bodies: stormwater from the site and wastewater	The current National legislation does not have effluent quality standards. Allowable discharge limits are to be calculated and depend on values of established (upon agreement with state supervising authorities) control point below discharge point (maximum 500 m). Surface water quality standards (MPC)[20] shall be met (refer the line above). Water quality standard for fishery water bodies: suspended solids - background level + 0.25 mg/l, maximum When the concentration of natural suspended matter in the water bodies of fishery significance in low water period is higher than 30 mg/dm3, its increase up to 5% is allowed. It is prohibited to discharge return (waste-) water containing suspended matter with a settling velocity of more than 0.4 mm/s into streams; with a	Temperature of wastewater prior to discharge does not result in an increase greater than 3°C of ambient temperature at the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use and assimilative capacity among other considerations. Indicative values for treated sanitary sewage discharges, mg/l pH 6 – 9 BOD mg/l 30 COD mg/l 125 Total nitrogen mg/l 10 Total phosphorus mg/l 2 Petroleum products mg/l 10 Total SS mg/l 50 Total coliform bacteria MPN/100 ml 400	pH -- 6-9 **EHS Guidelines for thermal power plants** TSS 50 Oil and grease 10 Total residual chlorine 0.2 Chromium (total) 0.5 Copper 0.5 Iron 1.0 Zinc (Zn) 1.0 Lead 0.5 Cadmium 0.1 Mercury 0.005 Arsenic 0.5 **EHS Guidelines for Large Volume Petroleum-based Organic Chemicals and Petroleum-based Polymers Manufacturing** Temperature Increase °C by 3, max. BOD5 25	The current National legislation does not have effluent quality standards. Allowable discharge limits are to be calculated and depend on values of established (upon agreement with state supervising authorities) control point below discharge point (maximum 500 m). Surface water quality standards (MPC) shall be meet (please refer the line above).	Russian standards

[20] Where compliance with water quality standards at a control station (section) cannot be achieved due to background contamination of the water body, discharge limits for these parameters are set by referring the water body water quality standards to those of waste/drainage water (Methods for developing permissible standards of substances' and microorganisms' discharge into water bodies for users of the water bodies, p.9)

Topic	National standards/ requirements	International Standards/ Guidelines		Adopted Project Standard	Rationale
	Russia	IFC EHS General Guidelines (or IFC PS)	Other (including IFC industry sector specific guidelines)		
	settling velocity exceeding 0.2 mm/s - into water bodies. Absolute temperature of receiving water body not to increase under the impact of economic activities (including discharge of wastewater) by more than 5ºC above the natural level, and not to raise above 20ºC in summer and 5ºC in winter for cold water fishes (salmonids and whitefish) and not more than 28ºC in summer and 8ºC in winter for other waters. The winter water temperature in the burbot spawning grounds shall not be raised more than by 2 °C. Floating impurities (substances) - films of petroleum products, grease, oils and accumulation of other impurities are not to be detected on the water surface within anthropogenic impact area.	Temperature increase by less than 3°C at a distance of 100 m from the mixing zone edge	COD 150 Total nitrogen 10 Total phosphorous 2 Sulphide 1 Oil and petroleum products 10 TSS 30 Cadmium 0.1 Chromium (total) 0.5 Chromium (hexavalent) 0.1 Copper 0.5 Zinc (Zn) 2 Lead 0.5 Nickel (Ni) 0.5 Mercury 0.01 Phenol 0.5 Benzene 0.05 Vinyl chloride 0.05 1,2 Dichloroethane 1 Adsorbable Organic Halogens (AOX) 0.3		

Table 3-4: Drinking Water Standards

Parameter	Unit	RF Standard[21]	WHO Standard[22]	Project Standard[23]	
Physical Quality					
pH	---	6-9	6-9	RF	6-9
Total Dissolved Solids	mg/l	1000 (1500)*	---	RF	1000 (1500)*
Hardness	Mg-eqv/l	7.0 (10)*	---	RF	7.0 (10) Mg-eqv/l/
Turbidity	EMF (formasine) or mg/l (caoline)	2.6 (3.5)* 1.5 (2)*	---	RF	2.6 (3.5)* 1.5 (2)*
Taste	points	2	---	RF	2
Odour	points	2	---	RF	2
Colour	degree	20 (35)*	---	RF	20 (35)*
Microbial Quality					
Total Coliform	Coli / ml	Not detectable in any 100ml sample	---	RF	Not detectable in any 100ml sample
E.Coli or Thermotolerant Coliform Bacteria	E.Coli / 100ml	Not detectable in any 100ml sample	Not detectable in any 100ml sample	RF	Not detectable in any 100ml sample
Inorganic Chemical Quality					
Aluminium (Al)	mg/l	0.5	---	RF	0.2
Ammonium ion (NH4)	mg/l	2.0	---	RF	0.5
Antimony (Sb)	mg/l	0.05	0.02	WHO	0.02
Arsenic (As)	mg/l	0.05	0.01	WHO	0.01
Barium (Ba)	mg/l	0.1	0.7	RF	0.1
Beryllium (Be)	mg/l	0.0002	---	RF	0.0002
Boron (B)	mg/l	0.5	0.5	RF	0.5
Cadmium (Cd)	mg/l	0.001	0.003	RF	0.001
Calcium ion(Ca 2+)	mg/l		---	RF	
Chloride ion (Cl-)	mg/l	350	---	RF	350

[21] Sanitary Rules and Norms SanPiN 2.1.4.1074-01 Drinking water. Hygienic requirements to water quality in central drinking water supply systems. Quality control

[22] Guidelines for Drinking Water Quality – Fourth Edition, 2011 https://www.who.int/water_sanitation_health/dwq/gdwq3rev/ru/

[23] The Project Standards are based on most stringent requirements for each parameter.

Parameter	Unit	RF Standard[21]	WHO Standard[22]	Project Standard[23]	
Chlorine (Cl)	mg/l	0.3-0.5 (free) 0.8-1.2 (bound)	5	RF	0.3-0.5 (free) 0.8-1.2 (bound)
Chromium (Cr+6) (Cr+3)	mg/l	0.05 0.5	0.05	RF	0.05 0.5
Copper (Cu)	mg/l	1.0	2	RF	1.0
Cyanide (CN)	mg/l	0.035	0.07	RF	0.035
Fluoride ion (F =)	mg/l	1.5**	1.5	RF	1.5**
Hydrogen sulphide (H2S)	mg/l	0.003	---	RF	0.003
Iron (Fe)	mg/l	0.3 (1.0)*	---	RF	0.2
Lead (Pb)	mg/l	0.3	0.02	WHO	0.02
Manganese (Mn)	mg/l	0.1 (0.5)*	0.4	RF	0.05
Mercury (Hg)	mg/l	0.0005	0.001	RF	0.0005
Molybdenum (Mo)	mg/l	0.25	0.07	RF	0.25
Nickel (Ni)	mg/l	0.1	0.02	WHO	0.02
Nitrate ion (asNO3-)	mg/l	45	50	RF	45
Nitrite ion (asNO2-)	mg/l	3.0	3 or 0.2	RF	3.0
Selenium (Se)	mg/l	0.1	0.01	WHO	0.01
Silver (Ag)	mg/l	0.05	---	RF	0.05
Sodium (Na)	mg/l	200	---	RF	200
Sulphate ion (SO4 2+)	mg/l	500	---	RF	500
Strontium (Sr)	mg/l	7.0	---	RF	7.0
Uranium (U)	mg/l		0.015	WHO	0.015
Vinyl chloride (C2H3Cl /H2C)	mg/l	0.05	0.0003	WHO	0.0003
Zinc (Zn)	mg/l	5.0	---	RF	5.0
Radiological Quality					
Total α radioactivity	Bq/l	0.1	0.5	RF	0.1
Total β radioactivity	Bq/l	1.0	1	RF	0.1

Note: * may be set for specific region ** for climatic regions I and II

Table 3-5: Water protection zones, protected shoreline belts, and fish protection zones[24]

Water protection zones	
For river or stream with length	Width of a water protection zone:
Up to 10 km	50 m
from 10 to 50 km	100 m
over 50 km	200 m
For head of river, stream	Radius of water protection zone 50 m
For lake, water reservoir (excluding lakes located inside wetland or lake, water reservoir with area less than 0.5 km2)	50 m
For water reservoir	Equal to width of a water protection zone for a stream where water reservoir is located
Shoreline protection belts:	
Bank slope:	Width of a Near-shore Protective Belt
≤ 0	30 m
up to 3 deg.	40 m
3 deg. or more	50 m
For lakes and related streams located within wetlands	50 m
For lakes, water reservoirs of fishery significance (breeding, feeding or wintering grounds for fish or other water biological resource)	200 m
Width of shoreline	
For water bodies of common water use (excluding canals, rivers and streams with length up to 10 km)	20 m
For rivers and streams with length up to 10 km	5 m

[24] RF Water Code of 03.06.2006 No.74-FZ

Table 3-6: Environmental standards for waste management

Topic	National standards/ standards	International guidelines/ standards IFC EHS General Guidelines
Waste treatment and disposal	All waste produced must be handled and disposed in accordance with federal law on waste of production and consumption (of 24.06.1998 #89-FZ). Hazard classification of waste: I class – extremely hazardous waste II class – highly hazardous waste III class – moderately hazardous waste IV class – low-hazard waste V class – practically non-hazardous waste Waste storage should be organized in accordance with SanPiN 2.1.7.1322-03 "Hygienic requirements for waste storage, disposal and treatment". Temporal waste storage is allowed: • in production and axillary premises; • in temporary warehouse facilities; • in reservoirs, tanks and other specially equipped AST and USTs; • in wagons, car-tanks and other transportable means; • in open specially equipped waste storage areas. Spatial isolation and separated storage of I and II class hazardous waste in individual compartments on pallets shall be organized in closed warehouses used for temporal storage of I and II class hazardous waste. Accumulation and storage of industrial waste is carried out based on shop principle or centralized. Storage of solid waste of I hazardous class is allowed only in insulated replaceable vessels (containers, barrels, tanks); II class – in close containers (plastic bags); III – in paper bags and hoppers, cotton bags; IV – in bulk. When stored in temporal warehouses, in open areas without containers (in bulk): • waste storage areas shall be located in lee side in relation to residential area; • surface shall have artificial waterproof chemically resistant coating (asphalt, ceramsite concrete, paving-tile, etc.),	No relevant numeric standard Treatment/purification or transportation to dedicated and adequately equipped landfills/dumps. The storage should prevent the contact between incompatible waste, and should allow for inspection to monitor leaks or spills. Store should be in close containers, away from the environmental factors (direct sunlight, rain and wind). Secondary containment should be constructed with material compatible with the waste being stored. Secondary containment is included wherever liquid wastes are stored in volumes greater than 220 liters. Available volume of secondary containment should be at least 110% of the largest storage container, or 25% of the total storage capacity (whichever is greater). Provide adequate ventilation where volatile wastes are stored.

Topic	National standards/ standards	International guidelines/ standards IFC EHS General Guidelines
	• area shall be equipped with bunding and isolated drainage system on perimeter connected with wastewater treatment, • surface of waste in bulk or opened storage area shall be protected from the environmental factors (direct sunlight, rain and wind) (covered with tent, equipped with a shed etc.). Storage of fine waste in open area (in bulk) without dust suppression system is not allowed. Waste storage in natural or artificial topographic low is allowed only after special bed preparation. Low hazard waste cat be stored both within the site or outside in specially planned heaps, storage areas.	

Table 3-7: Environmental noise standards

Topic	National Standards/ Requirements	International guidelines/ standards		Adopted Project Standard	Rationale
	Russia	IFC EHS General Guidelines	IFC EHS Guidelines for LNG production, transportation and re-gasification		
Night time noise limits for human protection	Noise emissions at the night time (23:00-07:00) should not exceed the following levels[25] (SN 2.2.4/2.1.8.562-96 Noise at Workplaces, inside Residential and Public Buildings, and within Residential Areas, item 5.3.1.): • In residential and public buildings: – Hospitals, health centres: 25 dB(A); – Dwelling rooms: 30 dB(A); – Rooms in hotels and hostels; Territory directly surrounding hospital buildings and health centres: 35 dB(A); – Territory directly surrounding residential, clinics, rest homes, homes for the elderly and disabled, educational institutions, libraries; Recreation areas within the territory of residential, rest homes, houses for the elderly and disabled, children's playgrounds, schools and other educational institutions: 45 dB(A); – Halls of cafes, restaurants, canteens: 55 dB(A); – Shops trade halls, passenger halls in airports and stations, consumer services centres: 60 dB(A)	Noise emissions should not exceed the following levels or result in a maximum increase in background levels of 3 dB at the nearest receptor location off-site: Residential; institutional, educational: Night time (22:00-07:00): 45 dB(A) Industrial, commercial, educational facilities: Night time (22:00-07:00): 70 dB(A)	No relevant numeric standard	Russian standards apply with night time defined as 22:00 – 07:00 in line with IFC EHS General Guidelines.	Most stringent standards that ensure completeness of the measurement criteria

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Topic	National Standards/ Requirements	International guidelines/ standards		Adopted Project Standard	Rationale
	Russia	IFC EHS General Guidelines	IFC EHS Guidelines for LNG production, transportation and re-gasification		
Day time noise limits for human protection	Noise emissions at the daytime (07:00-23:00) should not exceed in residential and public buildings, and outdoors in residential areas: - 55 dB(A) and 45 dB(A) in office buildings – 60 dB(A), in production facilities – 80 dB(A) (SanPiN 2.1.2.2645-10, par 6.2.1.).	Noise emissions should not exceed the following levels or result in a maximum increase in background levels of 3 dB at the nearest receptor location off-site: Residential; institutional, educational: Daytime (07:00-22:00): 55 dB(A) Industrial, commercial facilities: Night time (22:00-07:00): 70 dB(A)	No relevant numeric standard	Russian standards apply with night time defined as 22:00 – 07:00 in line with IFC EHS General Guidelines.	Most stringent standards that ensure completeness of the measurement criteria

Table 3-8: Soil Quality Standards

Parameter	Unit	RF standards (GN 2.1.7.2041-06) [26]	The Netherlands Standards[27]	Project Standard (most stringent)
Total petroleum hydrocarbons	mg/kg soil	1000[28]	5000	1000
Benz(a)pyrene	mg/kg soil	0.02	-	0.02
Gasoline	mg/kg soil	0.1		0.1
Benzene	mg/kg soil	0.3	1.1	0.3
Vanadium	mg/kg soil	150.0	-	150.0
Vanadium+Manganese	mg/kg soil	100+1000	-	100+1000
Dimethylbenzene (1,2- dimethylbenzene; 1,3- dimethylbenzene; 1,4- dimethylbenzene)	mg/kg soil	0.3	-	0.3
Complex granulated fertilizer	mg/kg soil	120.0	-	120.0
Complex liquid fertilizer	mg/kg soil	80.0	-	80.0
Manganese	mg/kg soil	1500	-	1500
Methanal	mg/kg soil	7.0	-	7.0
Methylbenzene	mg/kg soil	0.3	-	0.3
(1-methylethenil) benzene	mg/kg soil	0.5	-	0.5
(1-methylethyl) benzene	mg/kg soil	0.5	-	0.5
Arsenic	mg/kg soil	2.0	76	2.0

[26] GN 2.1.7.2041-06. 2/1/7/. Soil, cleaning of residential areas, industrial and domestic waste, health safety of soil. Maximum permissible concentrations (MPC) of chemicals in soil. Hygienic standards

[27] Soil Remediation Circular 2013 http://rwsenvironment.eu/subjects/soil/legislation-and/soil-remediation/

[28] No MPC for hydrocarbons in soils is set in Russia. However, if hydrocarbon concentrations exceed 1000 mg/kg, the environmental authorities can impose a fine for soil contamination. "The procedure of determination of damage associated with soil contamination with chemical substances", Moscow, 1993.

Parameter	Unit	RF standards (GN 2.1.7.2041-06)[26]	The Netherlands Standards[27]	Project Standard (most stringent)
Nitrates (by NO3)	mg/kg soil	130.0	-	130.0
Carbon flotation tailings	mg/kg soil	3000.0	-	3000.0
Mercury	mg/kg soil	2.1	-	2.1
Lead	mg/kg soil	32.0	530	32.0
Lead+Mercury	mg/kg soil	20.0+1.0	-	20.0+1.0
Sulphur	mg/kg soil	160.0	-	160.0
Sulphuric acid (as S)	mg/kg soil	160.0	-	160.0
Hydrogen sulphide (as S)	mg/kg soil	0.4	-	0.4
Superphosphate (as P2O5)	mg/kg soil	200.0	-	200.0
Antimony	mg/kg soil	4.5	22	4.5
Furan-2-carbaldehyde	mg/kg soil	3.0	-	3.0
Potassium chloride	mg/kg soil	360.0	-	360.0
Hexavalent chromium	mg/kg soil	0.05	78	0.05
Ethanal	mg/kg soil	10	-	10
Ethenilbenzene	mg/kg soil	0.1	-	0.1
Cobalt	mg/kg soil	5.0	190	5.0
Manganese	mg/kg soil	**Sod-podzol soils** *Extracted by 0.1n H_2SO_4:* 300.0 (pH 4.0) 400.0 (pH 5.1-6.0) 500.0 (pH >=6.0) *Extracted by ammonium acetate buffer with pH 4.8:* 60.0 (pH 4.0) 80.0 (pH 5.1-6.0) 100.0 (pH >=6.0)	-	*Extracted by 0.1n H_2SO_4:* 300.0 (pH 4.0) 400.0 (pH 5.1-6.0) 500.0 (pH >=6.0) *Extracted by ammonium acetate buffer with pH 4.8:* 60.0 (pH 4.0) 80.0 (pH 5.1-6.0) 100.0 (pH >=6.0)

Parameter	Unit	RF standards (GN 2.1.7.2041-06) [26]	The Netherlands Standards[27]	Project Standard (most stringent)
Copper	mg/kg soil	3.0	190	3.0
Nickel	mg/kg soil	4.0	100	4.0
Lead	mg/kg soil	6.0	530	6.0
Fluorine	mg/kg soil	2.8	-	2.8
Trivalent chromium	mg/kg soil	6.0	180	6.0
Zink	mg/kg soil	23.0	720	23.0
Fluorine	mg/kg soil	10.0	-	10.0

Table 3-9: Social environment and working conditions

Topic	National standards/ Requirements	International guidelines/ standards		Project Standard
	RF Labour Code of 30.12.2001 # 197-FZ	ILO Convention No. 138	IFC PS2 Labour and Working Conditions	
Minimum age of employment	It is permitted to employ persons at the age of 16 years and more. Persons having received general education or received general education and reached the age of 15 years are entitled to conclude employment agreements for performing light activities, which do not affect their health. With a permission from one of the parents (guardian) and a guardianship agency, an employment agreement can be concluded with a person, who has received general education and reached the age of 14 years, to perform light activities, which do not affect his/her health, during his/her time free from education and without any harm for his/her learning program. The following limitations are set with regard to working time: - for employees in the age under 16 years – not more than 24 hours per week; - for employees in the age from 16 to 18 years – not more than 35 hours per week. It is prohibited to admit to employment any persons under the age of 18 years to perform any work with harmful and/or hazardous working conditions and any work at underground operations. A list of work types prohibited for employees under the age of 18 years has been approved by the RF Government (RF Government Decree No.163 dated 25.02.2000 "On approval of a list of heavy work types and work types with harmful and/or hazardous working conditions, admission to which is prohibited for persons under the age of 18 years").	The minimum age for admission to employment or work in any occupation shall not be less than the age of completion of compulsory schooling and, in any case, shall not be less than 15 years. The minimum age for admission to any type of employment or work which by its nature or the circumstances in which it is carried out is likely to jeopardise the health, safety or morals of young persons shall not be less than 18 years.	The client will identify the presence of all persons under the age of 18. Where national laws have provisions for the employment of minors, the client will follow those laws applicable to the client. Children under the age of 18 will not be employed in hazardous work. All work of persons under the age of 18 will be subject to an appropriate risk assessment and regular monitoring of health, working conditions, and hours of work.	The minimum age for admission to employment or work in any occupation shall not be less than 15 years. The minimum age for admission to any type of employment or work which by its nature or the circumstances in which it is carried out is likely to jeopardise the health, safety or morals of young persons shall not be less than 18 years.

Table 3-10: BAT Technological indicators for ethylene production (technology: pyrolysis of LHG and ethane fraction)

Indicators	ITS 18-2016 Production of basic organic chemicals;
Use of raw materials and energy resources	
Row materials, kg/t, up to	1950-2150
Electricity, kWh/t (Gcal/t)	1,280-1,400 (1.1-1.2)
Steam, Gcal/t	1.8-2.0
Fuel gas, kgoe/t	1100-1200
Pollutants in air emissions, kg/t	
NOx	≤ 1.6
CO	≤ 0.5
Sum of hydrocarbons (without methane)	≤ 1.7
Pollutants in effluents, kg/t	
Oil products	≤ 8.0
COD	≤ 15
pH	8.4-11.7

Table 3-11: BAT technological indicators for butene-1 production (α-olefins)

Indicators	ITS 31-2017 Production of fine organic synthesis products;	the RF Ministry of Natural Resource, Order of 12.04.2019 No. 231
Use of raw materials and energy resources		
Row materials, kg/t, up to	-	-
Electricity, kWh/t	1574	-
Thermal energy, Gcal/t	4.24	-
Fuel gas, TOE/t	1.294	-
Circulating water, m^3/t	692	-
Pollutants in air emissions, kg/t		
Nitrogen dioxide	≤ 5.85	≤ 5.85
Nitrogen oxide	≤ 0.95	≤ 0.95
Sulphur dioxide	≤ 0.0375	≤ 0.0375
Carbon oxide	≤ 11.11	≤ 11.11

Table 3-12: BAT Technological indicators for polyethylene production (gas phase production technology)

Indicators	ITS 32-2017 Production of polymers, including biodegradable	the RF Ministry of Natural Resource, Order of 24.04.2019 No. 271.
Use of raw materials and energy resources		
Ethylene for copolymer production, kg/t	≤ 1022	-
Ethylene + sum of comonomers, kg/t	≤ 1117	-
Electricity, kWh/t	160-870	-
Fuel gas, Gcal/t	0.16-1.68	-
Air, m^3/t	7.78-32.21	-
Nitrogen, m^3/t	6.86-284	-
Circulating water, m^3/t	0.21-0.37	-
Pollutants in air emissions, kg/t		
Nitrogen dioxide	≤ 0.25	≤ 0.25
Nitrogen oxide	≤ 0.08	≤ 0.08

Carbon oxide	≤ 2.04	≤ 2.04
Acetaldehyde	≤ 0.002	≤ 0.002
Ethylene	≤ 3.33	≤ 3.33
Pollutants in effluents, kg/t		
Sulphate anion (sulphates)	≤ 3.8	≤ 3.8
Chloride anion (Chlorides)	≤ 0.7	≤ 0.7
Dry residue	≤ 7.6	≤ 7.6
Suspended solids	≤ 0.2	≤ 0.2

Table 3-13: General BAT for ethylene, butene-1 and polyethylene production

BAT index	BAT description
Environmental Management Systems	
BAT 1	Improvement of environmental performance (efficiency) by introducing and maintaining Environmental Management System (EMS) compliant to GOST R ISO 24002 or ISO 14001, or application of EMS tools
Emissions to air	
BAT 2	Minimisation of combustion products emissions through optimisation of fuel and vent gas combustion processes
BAT 3	Capturing of gaseous by-products and vent gases which are not usable as feedstock components and their utilization as fuel gas
BAT 4	More efficient utilization of by-products of processes and production facilities
BAT 5	Application of electrostatic precipitation with minimum dust removal performance of 80%
BAT 8	Application of cyclone filters (for two-step gas dedusting processes)
BAT 6	Application of wet scrubbers
BAT 7	Application of oil removal scrubbers
BAT 9	Prevention or minimization of fugitive pollution emissions by complying with technical requirements and regulations and ensuring adequate maintenance of equipment
BAT 10	Monitoring of marker pollutant emissions to air in compliance with applicable requirements
Water consumption and wastewater disposal optimisation	
BAT 11	Water demand optimization and recycling
BAT 12	Compliance with specified requirements for wastewater discharge to central wastewater disposal system (for industries that rely on municipal sewerage systems for treatment of their wastewater)
BAT 13	Adequate treatment of wastewater at own treatment facilities
BAT 14	Wastewater discharge to drainage network of industrial site and subsequent treatment at own central wastewater treatment plant
Waste	
BAT 15	Optimization of waste management system to meet the applicable requirements
BAT 16	Waste briquettes recycling units with recycling of fine flakes in water
BAT 17	Collection and utilization of polymer waste for production of industrial rubber goods and other non-critical articles
BAT 18	Transfer of solid waste (spent catalyst, sorbent, etc.) for disposal to waste consuming entities licensed for waste management activities
Use of raw materials	
BAT 19	Extension of catalysts service life, ensuring high feedstock conversion rate; application of one or more of the following methods: reasoned selection of optimum catalyst; prevention of catalyst deactivation; catalyst performance monitoring.
BAT 20	Development of industrial plant capable of poducing a wide range of products
BAT 21	Process upgrading with capacity increase

BAT index	BAT description
BAT 22	Process system stabilization through even distribution of production programme
BAT 23	Introduction of units with higher unit capacities at all stages of synthesis, whenever practical considering the master plan and economic feasibility
Energy performance	
BAT 24	Consideration of the methods for improvement of energy efficiency listed in ITS 48
BAT 25	Reduction of energy resource (heat and steam) consumption by utilization of waste-gas heat
BAT 26	Reduction of specific energy consumption (electric power, fuel and heat).
BAT 27	Enhancement of automation for energy saving
Management and engineering	
BAT 28	Upgrading the process systems to allow for a wider range of products and possibility of quick “shifting between grades”.
BAT 29	Upgrading of automatic process control systems.
BAT 30	Optimized formulation for polymerization formulation, stopping and stabilization of rubber and plastic materials, and their mixing.
BAT 31	Introduction of new chemicals with better efficiency and environmental performance.
BAT 32	Training of operational personnel. Introduction of training simulators.

ANNEX A

LIST OF THE MAIN APPLICABLE RF REGULATIONS

- RF Constitution of 12.12.1993
- RF Urban Development Code of 29.12.2004 # 190-FZ
- RF Land Code of 25.10.2001 #136-FZ
- RF Water Code of 03.06.2006 # 74 FZ
- RF Forest Code of 04.12.2006 # 200-FZ
- RF Labour Code of 31.12.2001 # 197-FZ
- Inland Water Transport Code of the Russian Federation of 07.03.2001 No.24-FZ
- Federal Law On Environmental Protection of 10.01.2002 7-FZ
- Federal Law On Air Protection of 04.05.1999 # 96-FZ
- Federal Law On Environmental Review of 23.11.1995 # 174-FZ
- Federal Law On Subsurface Resources of 21.02.1992 # 2395-1
- Federal Law On Waste of Production and Consumption of 24.06.1998 # 89-FZ
- Federal Law On Animals of 24.04.1995 # 52-FZ
- Federal Law On Fishery and Water Biological Resource Conservation of 20.12.2004 # 166-FZ
- Federal Law On Protected Natural Areas of 14.03.1995 # 33-FZ
- Federal Law On Public Sanitation and Epidemiology Welfare of 30.03.1999 # 52-FZ
- Federal Law On Backgrounds of Health Protection of the Citizens of the Russian Federation of 21.11.2011 # 323-FZ
- Federal Law On Radiation Safety of 09.01.1996 # 3-FZ
- Federal Law On Water Supply and Wastewater Discharge of 07.12.2011 # 416-FZ
- Federal Law On Cultural Heritage (cultural sites) of the Peoples of the Russian Federation of 25.06.2002 # 73-FZ
- Federal Law On lands' and land plots' reclassification of 21.12.2004 # 172-FZ
- Federal Law On Technical Regulations of 27.12.2002 #184- FZ
- Federal Law On Certain Activities' Licensing of 04.05.2011 # 99- FZ
- Federal Law On the Protection of the Public and Areas against Emergencies of Natural and Technogenic Nature of 21.12.1994 # 68-FZ
- Federal Law On Industrial Safety of Hazardous Industrial Sites of 02.07.2013 # 116-FZ
- Federal Law On Hydraulic Structures' Safety of 21.07.1997 No. 117-FZ
- Federal Law On the Building and Structure Safety Technical Standards 384-FZ of 30.12.2009
- Federal Law On Fire Safety of 21.12.1994 # 69-FZ
- Federal Law On mandatory insurance of civil liability of a hazardous facility's owner for bringing harm as a result of an emergency at hazardous production facility of 27.07.2010 # 225-FZ
- Federal Law On Guaranteed Rights of Low Numbered Indigenous Peoples of the Russian Federation of 30.04.1999 # 82-FZ
- Federal Law On Areas of Traditional Nature Uses by Indigenous Low-Numbered Peoples of the North, Siberia, and Far East of the Russian Federation of 07.05.2001 # 49-FZ
- Federal Law On Energy Savings and Increase of Energy Efficiency of 23.11.2009 # 261-FZ
- Federal Law On Hunting and Conservation of Hunting Resources of 24.07.2009 # 209-FZ
- RF Government Decree On endorsement of criteria for enterprises that have negative environmental impact to I, II, III and IV categories of 28.09.2015 # 1029
- RF Government Decree On approval of the Rules for establishing and keeping the State Register of operations with adverse environmental impacts of 23.06.2016 # 572
- RF Government Decree On the approval of criteria for determination of facilities subject to federal environmental supervision of 28.08.2015 # 903

- RF Government Resolution No. 426 of 08.05.2014 "On the Federal Environmental Supervision"
- RF Government Decree On the structure of project documentation and its contents of 16.02.2008 # 87
- RF Government Decree On organizing and conducting the state expert review of design documentation and engineering surveys' findings of 05.03.2007 # 145
- RF Government Decree On adoption of Rules for compensation to owners of land plots, land users and tenants of land plots for damage caused by withdrawal or temporary occupation of land plots, limitation of land owners' rights or by worsening land quality as a result of other persons' activities of 07.05.2003 # 262
- *RF Government Resolution of 10.07.2018 No.800 "On land remediation and conservation"* (together with "Rules for land reclamation and conservation") sets the rules for land reclamation and conservation.
- RF Government Decree On approval of Rules on surface water bodies protection of 05.02.2016 # 79-FZ
- RF Government Decree On approval of Rules of underground water bodies protection of 11.02.2016 # 94-FZ
- RF Government Decree On Procedure for drafting and making a decision on a water body's allocation for use of 30.12.2006 # 844
- RF Government Decree On Water Use Agreement Preparation and Conclusion of 12.03.2008 # 165
- RF Government Decree On procedure for adoption of permissible standards of substances' and microorganisms' discharge into water bodies for users of the water bodies of 23.07.2007 # 469
- RF Government Decree On Approval of Rules on Establishment of Fishery Protection Zones of 06.10.2008 # 743
- RF Government Decree On Approval of Regulation on Measures of Aquatic Biological Resources and Habitats Conservation of 29.04.2013 # 380
- RF Government Decree On approval of the Rules for demarcation of the boundaries of water protection zones and shore protective belts of water bodies of 10.01.2009 # 17
- RF Government Decree On approval of construction and renovation of capital facilities, implementation of new technological processes, and conduction of other activities affecting aquatic biological resources and their habitats by the Federal Agency for Fishery of 30.04.2013 # 384
- RF Government Decree On Maximum Permissible Emissions into the Atmospheric Air and Adverse Physical Impacts of 02.03.2000 # 183
- Government Decree No. 222 of 03.03.2018 "On the Approval of Rules of Allocation of Sanitary Protection Zones and Use of Land Plots within the Boundaries of Sanitary Protection Zones".
- RF Government Decree On Red Book of the Russian Federation of 19.02.1996 # 158
- RF Government Decree On endorsing Regulations on the prevention of killing animals due to industrial processes, and due to transport link, pipeline, communications line and power transfer line operations of 13.08.1996 # 997
- RF Government Decree On the procedure for issuing, re-issuing, revision, introduction of changes and revocation of comprehensive environmental permits No. 143 of 13.02.2019
- RF Government Decree On the Approval of Rules for creation and operation of automatic system of monitoring of pollution emissions and/or discharges of 13.03.2019 # 262
- RF Government Decree On requirements for automatic equipment for measuring of pollution emissions and/or discharges indicators, requirements for equipment for measuring and transfer of data to State Register of operations with adverse environmental impacts on pollution emissions and/or discharges indicators of 13.03.2019 # 263
- RF Government Resolution of 30.12.2003 No. 1081 "On approval of the hydraulic structures preservation and liquidation regulations"
- RF Government Decree On Procedure for Oil Spill Prevention and Response Measures in the Russian Federation of 15.04.2002 #240

- RF Government Decree On adoption of Provision on disclosure of information on natural environment conditions, its pollution and emergencies of technogenic nature, that did/do/might cause an adverse environmental impact of 14.02.2000 # 128
- RF Government Decree On RF Procedure for collection and exchange of information on public and areas protection from natural and technogenic emergencies of 24.03.1997 # 334
- RF Government Decree On RF System of Prevention and Response to Emergency Situations of 30.12.2003 # 794
- RF Government Decree On establishment of local warning systems within potentially hazardous facilities location of 01.03.1993 # 178
- RF Government Decree On Procedure for Establishment and Use of Reserves of Physical Resources for Natural and Technogenic Emergencies Response of 10.11.1996 #1340 "
- RF Government Decree On natural and technogenic emergencies classification of 21.05.2007 # 304
- RF Government Decree On approval of the Regulation on development of plans for containment and mitigation of the consequences of emergencies at hazardous production facilities of 26.08.2013 # 730
- RF Government Decree On licensing the operation of explosion, fire, and chemically hazardous production facilities of hazard class I, II, and III (combined with "Regulation on licensing the operation of explosion, fire, and chemically hazardous production facilities of hazard class I, II, and III") of 10.06.2013 # 492
- RF Government Decree On registration of facilities in the state register of hazardous production facilities of 24.11.1998 # 1371
- RF Government Decree On organization and performance of industrial monitoring of compliance with the industrial safety requirements at hazardous production facility of 10.03.1999 # 263
- RF Government Decree On approval of the Rules for submission of the declaration of industrial safety of hazardous production facilities of 11.05.1999 # 526
- RF Government Decree On approval of requirements for documentation support of industrial safety management systems of 26.06.2013 # 536
- RF Government Decree On urgent accident-related oil spill response measures in the Russian Federation of 21.08.2000 #613
- RF Government Decree On Procedure for Oil Spill Prevention and Response Measures in the Russian Federation of 15.04.2002 #240
- RF Government Decree On approval of the list of types of heavy work and work with harmful or dangerous conditions, in which the use of female labour is prohibited of 25.02.2000 # 162
- RF Government Decree On Approval of Fire Safety Rules in Forests of 30.06.2007 # 417
- RF Government Decree On Sanitary Safety Rules in Forests of 20.05.2017 # 607
- RF Government Decree On approval of List of traditional living areas and traditional commercial activities of Small-Numbered peoples of the RF and List of their traditional commercial activities of 08.05.2009 # 631-r
- RF Government Decree of 13.03.2019 # 428-r On the Approval of kinds of equipment for category I facilities where stationary sources of pollution emissions/discharges are to be equipped with automatic pollution measuring and registration devices, and equipment for recording and communication of pollution emission/discharge information to the State Register of operations with adverse environmental impacts
- RF Government Decree On the Approval of the list of pollutants subject to state environmental regulation No.1316-r of 08.01.2015
- Decree of the President of the Russian Federation On the Climate doctrine of the Russian Federation of 17.12.2009 # 861-rp
- RF Government Decree On the Approval of the Action Plan for reduction of GHG emissions by year 2020 to a maximum level of 75% of GHG emissions in 1990 of 02.04.2014 # 504-r
- Decree of the President of the Russian Federation of 30.09.2013 No. 752 "On reduction of greenhouse gas emissions"

- RF Government Decree On the Approval of the basic Concept of the system of GHG emissions monitoring, reporting and verification in the Russian Federation of 22.04.2015 # 716-r
- Goscomecologia Regulation On Environmental Impact Assessment in the Russian Federation of 16.09.2000 # 372
- Rostechnadzor Order On approval of the Federal standards and rules in the field of industrial safety "Safety Rules for Hazardous Production Facilities of Trunk Pipelines of 06.11.2013 # 520
- Rostechnadzor Order On approval of the Safety Guidelines "Methodological Basis for Hazard Analysis and Risk Assessment for Emergencies at Hazardous Production Facilities"of 11.04.2016 # 144
- Rostechnadzor Order On adoption of procedure for execution of industrial safety declaration of hazardous production facilities and list of data to be included in the above (RD-03-14-2005) of 29.11.2005 # 893
- Rostechnadzor Order On approval of the Federal standards and rules in the field of industrial safety "Industrial Safety Rules for Hazardous Production Facilities Using Overpressure Equipment of 25.03.2014 # 116
- Rostechnadzor Order of 19.08.2011 # 480 On approval of the procedure of technical investigation of the causes of accidents and cases of loss of industrial explosive materials in operations supervised by the Federal Service for Environmental, Technological, and Nuclear Supervision
- Rostechnadzor Order No. 96 of 06.11.2013 On the approval of Federal rules and regulations on industrial safety "General rules on explosion safety for chemical and petrochemical plants and oil refineries with fire and explosion hazards".
- Rostechnadzor Order No.306 of 15.07.2013 On the approval of the Federal norms and regulations on industrial safety "General requirements for rationale for hazardous production facility safety".
- Rostechnadzor Order On the Procedure for training of employees of organisations supervised by the Federal Service for Environmental, Technological and Nuclear Supervision of 29.01.2007 # 37
- RF Ministry of Natural Resource, Order of 30.06.2015 No.300 "On approval of "Guideline methodology and instructions for quantitative assessment of GHG emissions from entities conducting business and other operations in the Russian Federation"
- Minprirody RF Order On Procedure for development and adoption of standards for waste generation and limits of their disposal of 25.02.2010 # 50
- RF Ministry of Natural Resources Order of 12.04.2019 No.231 "On approval of environmental regulation document "Process parameters of best available technologies for production of fine organic synthesis products";
- RF Ministry of Natural Resources Order of 24.04.2019 No.271 "On approval of environmental regulation document "Process parameters of best available technologies for production of polymers, including biodegradable polymers";
- RF Ministry of Natural Resources Order of 24.04.2019 No.270 "On approval of environmental regulation document "Process parameters of best available technologies for thermal waste treatment (waste incineration)""
- Minprirody RF Order On adoption of Methods for developing permissible standards of substances' and microorganisms' discharge into water bodies for users of the water bodies of 17.12.2007 # 333
- Minprirody RF Order On the approval of requirements for the content of the Operational Environmental Monitoring Programme, the procedure and schedule for reporting on the functioning and results of the Operational Environmental Monitoring of 28.02.2018 # 74
- Minprirody RF Order On Adoption of the Administrative Regulation by the Federal Service for Nature Management Supervision for provision of the state service to issue permits for harmful (polluting) substances' emissions into the atmospheric air (with exception of radioactive substances) of 25.07.2011 # 650
- RF MNR Order of 06.06.2017 No.273 "On approval of the Harmful (pollution) emissions dispersion analysis methodology"
- Rosprirodnadzor Order of 22.05.2017 No. 242 "On approval of the Federal Waste Classification Catalogue"

- Minselkhoz RF Order On approval of water quality standards for fishery water bodies, including standards for maximum permissible concentrations of harmful substances in the waters of fishery water objects of 13.12.2016 # 552
- RF Fisheries Agency Order of 04.08.2009 No. 695 "On approval of guideline methodology for development of water quality standards for fishery water bodies, including standards for maximum permissible concentrations of harmful substances in the waters of fishery water bodies"
- Minzdravsocrazvitiya Order On adoption of norms and conditions for provision of employees working under harmful conditions with milk and other food products of equal value at no cost; Manner of compensation payment equivalent of milk cost and cost of food products of equal value; List of harmful occupational factors, under which exposure it is recommended for prophylactic purposes to consume milk and other food products of equal value of 16.02.2009 # 45n
- Minzdravsocrazvitiya Order On adoption of a List of harmful and/ or hazardous occupational factors, which occurrence require prophylactic regular medical examinations and Procedure of such examinations' conducting of 12.04.2011 # 302n
- Roslekhoz Order On Approval of Rules for Use of Forests for Construction, Reconstruction and Operation of Linear Facilities of 10.06.2011 # 223
- SP 47.13330.2012 Construction engineering surveys. Main provisions. Revised edition of SNiP 11-02-96 Approved by the Minstroy RF, Order of 30 December 2016 No. 1033
- SNiP 115.13330 "SNiP 22-01-95 Hazardous Natural Impact Geophysics" Approved by the Minstroy RF, Order of 16.12.2016 No. 956.
- SP 116.13330.2012 Hazardous Geological Process Protection of Areas, Buildings and Facilities. Main provisions. Revised edition of SNiP 22.02.2003.
- SP 11-102-97 Construction project engineering surveys guidelines. Environmental engineering surveys for construction projects, 1997
- SP 51.13330.2011 Noise protection. Updated version of SNiP 23-03-2003
- SP 131.13330.2012 Building climatology. Updated version of SNiP 23-01-99.
- SP 116.13330.2012 Hazardous Geological Process Protection of Areas, Buildings and Facilities. Main provisions. Revised edition of SNiP 22.02.2003.
- SNiP 33-01 2003 Hydraulic Structures. Main provisions.
- SanPiN 2.2.4.3359-16 "Health requirements for workplace physical impacts" (approved by RF Chief State Sanitary Officer, Resolution No.81 of 21.06.2016)
- SanPiN 2.2.1/2.1.1.1200-03 "Sanitary Protection Zones and Sanitary Classification of Enterprises, Structures, and Other Facilities" Approved by RF Chief State Sanitary Officer Resolution No.74 of 25.09.2007)
- SanPiN 2.1.5.980-00. 2/1/5/. Wastewater disposal in populated areas, sanitary protection of water bodies. Hygienic requirements for protection of surface water bodies Sanitary regulations
- Sanitary Rules and Norms SanPiN 2.1.4.1074-01 Drinking water. Hygienic requirements to water quality in central drinking water supply systems. Quality control
- SP 2.1.4.1110-02. 2/1/4/. Drinking water and residential areas water supply. Sanitary protection zones of water supply sources and potable water pipelines. Sanitary regulations
- SanPiN 2.6.1.2523-09 Radiation safety standards (NRB-99/2009).
- SanPiN 2.1.8/2.2.4.1383-03. 2/1/8/. Environmental physical factors. 2/2/4/. Physical factors in workplace environment. Hygienic requirements for the placement and operation of radio engineering facilities. Sanitary & Epidemiological Rules and Norms
- SanPiN 2.1.2.2645-10 Sanitary and Epidemiological Requirements to residence conditions in dwellings
- SanPiN 2.5.2-703-98. 2/5/2/. Water transport. Inland and combined river-sea navigation vessels. Sanitary regulations (approved by RF Chief State Sanitary Officer, Resolution No.16 of 30.04.1998)
- Regulations on prevention of pollution from ships operating in the sea areas and the inland waterways of the Russian Federation ND 2-020101-100

- GN 2.1.6.3492-17. Maximum permissible concentrations (MPCs) of polluting substances in air atmospheric air in residential areas (appr. by the RF Chief State Sanitary Officer, Resolution No.165 of 22.12.2017)
- GN 2.1.6.2309-07. 2/1/6/. Atmospheric air and air of premises, sanitary air protection. Safe reference level of impact (SRLI) of pollutants in atmospheric air of residential areas. Hygienic standards
- GN 2.2.5.3532-18. Maximum permissible concentrations (MPC) of harmful substances in workplace ambient air. (appr. by the RF Chief State Sanitary Officer, Resolution No.25 of 13.02.2018)
- GN 2.1.7.2041-06. 2/1/7/. Soil, cleaning of residential areas, industrial and domestic waste, health safety of soil. Maximum permissible concentrations (MPC) of chemicals in soil. Hygienic standards
- GOST 12.1.005-88. General hygiene requirements for air of working zone.
- GOST 12.1.001-89. Ultrasound. General requirements for safety.
- GOST R 50831-95 Boiler plants. Heat-mechanical equipment. General technical requirements
- RD 52.04.52-85 Methodological Guidelines. Emission Control in Adverse Weather
- SN 2.2.4/2.1.8.583-96. 2/2/4/. Physical factors in workplace environment. 2/1/8/. Environmental physical factors. Infrasound in the workplace, in residential and public buildings and in residential areas. Sanitary norms
- SN 2.2.4/2.1.8.566-96. 2/2/4/. Physical factors in workplace environment. 2/1/8/. Environmental physical factors. Operational vibration, vibration in dwellings and public buildings. Sanitary norms
- SN 2.2.4/2.1.8.562-96. 2/2/4/. Physical factors in workplace environment. 2/1/8/. Environmental physical factors. Noise at workplaces, dwellings, public buildings, and outdoor noise in residential areas. Sanitary norms
- *Sanitary regulations for production of synthetic polymers and synthetic polymers processing enterprises (approved on* 12.12.1988 No. 4783-88)
- ITS 18-2016 Production of basic organic chemicals;
- ITS 31-2017 Production of fine organic synthesis products;
- ITS 32-2017 Production of polymers, including biodegradable
- ITS 8-2015 Wastewater treatment in manufacture of products (goods), performance of works and provision of services at large enterprises;
- ITS 47-2017 Waste water and waste gas treatment/management systems in the chemical sector;
- ITS 22-2016 Purification of harmful (polluting) emissions to air from manufacturing of products (goods), works and services at large enterprises;
- ITS 22.1-2016 General principles of industrial environmental monitoring and its metrological support;
- ITS 46−2019 Reduction of pollution emissions and discharges from storage of products (goods);
- ITS 48-2017 Increase of energy efficiency;
- ITS 50-2017 Natural and associated gas processing;
- ITS 9-2015 Thermal waste treatment (waste incineration);

ANNEX B

REGULATORY REGIME IN THE TERRITORY OF THE FUTURE PROJECT FACILITIES: USE-RESTRICTED AREAS AND REFERENCES TO THE APPLICABLE REQUIREMENTS

<table>
<tr><th colspan="2">Categorisation of use-restricted areas and boundaries</th><th>Referenced sources of information and regulatory requirements</th></tr>
<tr><td colspan="2">Boundaries of municipalities and settlements
Existing and proposed functional zones, use-restricted residential zones</td><td>Irkutsk Region Law No. 93-oz of 16.12.2004 (as amended on 07.07.2015)
Ust-Kut Urban Settlement Master Plan. Supporting materials. - Institute of territorial planning “GRAD”, 2015.
Changes to the land management and development Regulations of Ust-Kut city municipality, Urban Settlement Design Planning Workshop “Master-Plan” Ltd., 2015.
Land management and development regulations in the inter-settlement territories of Ust-Kut Urban Settlement. - Design Planning Workshop “Master-Plan” Ltd., 2016.
Urban development zoning map - Changes to land management and development regulations in Ust-Kut Urban Settlement of Irkutsk Region concerning territories outside the city of Ust-Kut. - Omsk: SE “Omsk center TIZ”, 2016.
Land management and development regulations. Urban planning regulations - Ust-Kut: Ust-Kut Urban Settlement Administration, 2018</td></tr>
<tr><td colspan="2">Boundaries of land plots and conditions of their usage</td><td>Public cadastre map of the Federal Service for state registration, cadastre and cartography (Rosreestr)
Land lease agreements of INK Ltd.
Master plans of the future facilities of INK and contractors
Land planning and demarcation documentation</td></tr>
<tr><td rowspan="7">Land allocated for linear infrastructure facilities of</td><td>electric grid facilities</td><td>Land allocation standards for 0.38-759 kV electric grids (14278tm-t1) adopted by Head of the Electric Energy Department of the RF Mintopenergo on 20.05.1994</td></tr>
<tr><td>trunk pipelines</td><td>SN 452-73. Land allocation standards for trunk pipelines - Appr. by the USSR Gosstroy, Resolution No. 45 of 30.03.1973
SP 36.13330.2012. Trunk pipelines. Guidelines. - Approved by the Federal agency of construction, housing and municipal services, order No.108/GSV of 25.12.2012 (as amended on 29.04.2019)</td></tr>
<tr><td>process pipelines</td><td>GOST 32569-2013. Steel process pipelines. Requirements for design and operation of explosion, fire, and chemically hazardous production facilities. - Approved and put into effect by the Federal Agency for Technical Regulations and Metrology, Order No. 331-st of 08.04.2014</td></tr>
<tr><td>Water supply and drainage system</td><td>SN 456-73. Land allocation standards for trunk water pipelines and sewers. - Appr. by State Committee for construction at the Council of Ministers of the USSR on 28.12.1973</td></tr>
<tr><td>networks and communication facilities</td><td>SN 461-74. Land allocation standards for communication lines. - Appr. by State Committee for construction at the Council of Ministers of the USSR on 03.06.1974</td></tr>
<tr><td>motor roads</td><td>The RF Government Resolution of 02.09.2009 No.717 (as amended on 11.03.2011)</td></tr>
<tr><td>rail roads</td><td>OSN 3.02.01-97 Standards and regulations for land allocation for rail roads. - Approved by the Ministry of Railways, Resolution No.S-1360u of 24.11.1997
the RF Government Resolution of 12.10.2006 No.611 (as amended on 17.04.2019)
the RF Ministry of Transport Order No. 126 of 06.08.2008</td></tr>
<tr><td>Buffer zones and mandatory forest clearing areas</td><td>electric grid facilities</td><td>RF Government Resolution of 26.02.2009 No.160 as amended on 21.12.2018.
Electrical Installation Code (PUE) 7th edition, appr. by Mintopenergo, Order No.204 of 08.07.2002
Public cadastre map of the Federal Service for state registration, cadastre and cartography (Rosreestr), available on the Internet at https://pkk5.rosreestr.ru/</td></tr>
</table>

Categorisation of use-restricted areas and boundaries		Referenced sources of information and regulatory requirements
		Urban development zoning map / Changes to land management and development regulations in Ust-Kut Urban Settlement of Irkutsk Region concerning territories outside the city of Ust-Kut. - Omsk: SE "Omsk center TIZ", 2016
	trunk pipelines	Regulations for the protection of gas mains. adopted by the RF Gosgortechnadzor Rezolution of 22/04/1992 No.9 as amended on 23.11.1994 SP 36.13330.2012. Trunk pipelines. Guidelines. - Approved by the Federal agency of construction, housing and municipal services, order No.108/GSV of 25.12.2012 (as amended on 29.04.2019) VSN 51-1-80. Guidance for construction activities within the buffer zones of gas mains controlled by the Ministry of Gas Industry. - Appr. by the USSR Ministry of gas industry, Order No.VD-440 of 5.03.1980
	gas supply system facilities	the RF Government Resolution of 20.11.2000 No.878, as amended on 17.05. 2016
	networks and communication facilities	the RF Government Resolution of 09.06.1995 No. 578
Roadsides of motor ways		Federal Law "On the Motorways and Road Works in the Russian Federation..." No.257 of 08.11.2007 (as amended on 27.12.2018)
Sanitary protection zones, clearances, corridores		SanPiN 2.2.1/2.1.1.1200-03 as amended on 25.04.2014. Environmental survey materials with information (letters) from municipalities and the territorial authority of Rospotrebnadzor Territorial planning scheme of municipalities
Restricted development areas, minimal buffer zones, fire breaks		Technical Regulation of fire safety (Federal Law of 22.07.2008 # 123-FZ with amendments put into force on 31.07.2018) SP 4.13130.2013. Fire protection systems. Fire containment at protected facilities. Requirements for space planning and structural design. Guidelines. - Approved and put into action by the RF Ministry of Civil Defense, Emergencies and Disaster Relief, Order No.288 of 24.04.2013. ISO 42.13330.2016. Urban Development. Planning and development of residential areas. Guidelines. - Approved and put into action by the RF Ministry of Construction, Housing and Utilities, Order No.1034/pr of 30.12.2016. SP 62.13330.2011. Gas distribution systems. Guidelines. - Approved and put into effect by the RF Ministry of regional development, Order of 27.12.2010 (as amended on 03.12.2016). SP 32.13330.2012. Wastewater disposal system External networks and structures Guidelines. - Approved and put into effect by the RF Ministry of regional development, Order of 29.12.2011 No. 635/11 (as amended on 03.12.2016)
URZs associated with surface water bodies		RF Water Code of 03.06.2006 # 74 FZ (as amended on 27.12.2018) Order of the Ministry of Natural Resources and Environment of Irkutsk Region of 30.11.2017 No.36-mpr "On demarcation of shoreline, water protection zones and near-shore protective belts on the Lena River and Kuta River within the boundaries of Verkhnemarkovo, Podymakhino, Ust-Kut settlements of Ust-Kut District". Survey reports including information from regional authorities of Rosvodresursy (Enisei River Basin Authority of the Federal Agency of Water Resources, Water Resource Department for Irkutsk Region), of the RF Fisheries Agency (Angara-Baikal Territory Authority) on the sizes of water protection zones and shore protective belts of water bodies

<table>
<tr><th colspan="2">Categorisation of use-restricted areas and boundaries</th><th>Referenced sources of information and regulatory requirements</th></tr>
<tr><td colspan="2">Sanitary protection zones of water supply sources and drinking water supply facilities</td><td>SanPiN 2.1.4.1110-02 as amended on 25.04.2014.
Environmental survey materials with information (letters) from municipalities and the territorial authority of Rospotrebnadzor</td></tr>
<tr><td rowspan="2">URZs associated with objects of the geological environment</td><td>Subsoil allotments, sanitary protection zones of underground water supply sources</td><td>Subsoil licenses
Engineering designs for industrial development of mineral and underground water reserves</td></tr>
<tr><td>Common mineral and underground water reserves</td><td>Survey reports containing respective information from the Department for Subsoil Resources Management in Central Siberia (CentrSibNedra) and municipal administrations</td></tr>
<tr><td colspan="2">Protection zones of historical and cultural heritage sites</td><td>Environmental survey and supplementary archaeological survey materials.
Information (letters) from the Heritage Conservation Service of Irkutsk Region</td></tr>
<tr><td colspan="2">Protective forests / valuable forests / protective forests of spawning areas</td><td>Forest Management Regulation for Ust-Kut Forestry Department of Irkutsk Region (approved by Order of the Forest Resource Ministry of Irkutsk Region of 11.10.2018 No.78-mpr).
Acts of field survey of forest land
Forest lease agreements of INK Ltd.
Forest development projects of INK Ltd.
Resolutions of the expert committee at the Forest Resource Ministry of Irkutsk Region on conducting the state expert review of forest development projects of INK Ltd.</td></tr>
<tr><td colspan="2">Designated Conservation Areas (DCAs)</td><td>Survey reports with information (letters) from the Ministry of Natural Resources and Environment of Irkutsk Region (regarding locations of nature conservation areas of regional significance) and from municipal administrations (nature conservation areas of local significance).
Official website of RF Ministry of Natural Resource (since 2018, provision of information on nature conservation areas of federal significance in ritten from is no longer required)</td></tr>
<tr><td colspan="2">Migration routes and areas of the presence of large quantities of terrestrial vertebrate animals</td><td>Environmental survey materials with information (letters) from the Wildlife Conservation and Use Service of Irkutsk Region (in 2018 the Service was reorganized, it’s functions were passed to the Forest Resource Ministry of Irkutsk Region)</td></tr>
<tr><td colspan="2">Tribal lands, areas of customary residence and practices of indigenous small-numbered peoples</td><td>Environmental survey materials with information (letters) from municipalities</td></tr>
<tr><td colspan="2">Sources of natural focal infectious diseases, animal burial sites, biothermic pits, other burial sites or territories considered prone to spread of hazardous infectious diseases</td><td>Environmental survey materials with information (letter) from the Veterinary Service of Irkutsk Region on locations of such sites</td></tr>
</table>

ANNEX C

OVERVIEW OF THE APPLICABLE INTERNATIONAL CONVENTIONS

Date of Signature	Title	Comment, brief description
Environmental Impact Assessment		
February 25, 1991, Espoo	Convention on Environmental Impact Assessment in a Transboundary Context (Espoo Convention)	The Convention has not yet been ratified by the Russian Federation; however, this document is listed here as the Russian Federation contemplates its ratification. It should also be noted that this will only be relevant if the Project AoI as identified in the ESIA extends beyond international boundaries.
Animal and Plant Protection Convention		
June 5, 1992, Rio de Janeiro	Convention on Biological Diversity	Ratified by the Federal Law No.16-FZ of 17.02.1995. It sets out the following requirements to be met while pursuing economic activity so as to protect biodiversity: • carry out environmental impact assessment of all proposed projects that may have adverse effects on biodiversity; • ensure public participation in environmental assessment procedures; • take measures to ensure that the environmental consequences of programmes and policies that are likely to have significant adverse impacts on biological diversity are duly taken into account; • facilitate information exchange. The Convention is relevant to this project, since some natural ecosystems fall within the oil field impact zone.
June 23, 1979, Bonn	Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)	Russian Federation is not a party to the Convention. Nevertheless, IFC Performance Standard 6 is guided by and promotes the observance of the applicable international laws and conventions. The Convention may be applicable, if the AoI of the Project and its facilities includes migration routes of species listed in its annexes. The project shall be implemented with due regard to the principle of conservation of migratory species of wild animals and their habitats listed in Annexes I and II of the Convention.
September 19, 1979, Bern	Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention), Bern	Russia has been a party to the Council of Europe since 1995, but is not a party to the Bern Convention. The representative of the Ministry of Natural Resources of the Russian Federation participates in the events in the capacity of observer. The Convention is designed to protect the most vulnerable plant and animal species that are declining in Europe, and also migratory species, by protecting their habitats. Species requiring special protection measures are listed in the Annexes of the Convention. The Convention provides for attainment of the goals in terms of protection of flora and fauna, and respective habitats, by

Date of Signature	Title	Comment, brief description
		incorporating appropriate measures into the political plans and economic development projects, and through monitoring and control of pollution of the environment. The Convention establishes the duty to promote awareness and disseminate information on the importance of conservation of wildlife and habitats. The Convention is applicable if the Project AoI includes habitats of wildlife species protected by the Convention.
2 February 1971, Ramsar	Convention on Wetlands of International Importance, especially as Waterfowl Habitat	Entered into force for Russia 11 February 1977. Provides the framework for national action and international cooperation for the conservation and wise use of all wetlands and their resources through local, regional and national actions and international cooperation, as a contribution towards achieving sustainable development. There are no Ramsar (or candidate Ramsar) sites within the Project AoI.
March 3, 1973, Washington	Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES).	The Convention has entered into force for the USSR 08.12.1976. The Convention endeavours to protect wild plants and animals from threat of vanishing, due to international trade.
Climate Conventions		
9 May 1992, New York	UN Framework Convention on Climate Change	Produced at the Earth Summit. It expresses in general terms the concern of the world community in view of man-made climate changes, including global warming as a result of the greenhouse effect, and lays down general recommendations on cutting down greenhouse gas emissions. The Kyoto Protocol to the Convention (Kyoto, 1997), ratified by the Russian Federation, sets maximum allowable limits on carbon dioxide and other greenhouse gas emissions, establishes emission allowances for member countries, and emissions trading procedures. The Convention has relevance to this project, since some Project facilities may produce greenhouse gas emissions. Paris Agreement under the UN Framework Convention on Climate Change regulates the carbon dioxide emission control measures for the period starting from 2020. The Agreement was prepared to replace the Kyoto Protocol. Russia signed the Agreement but has not yet ratified it.
11 December 1997, Kyoto	Kyoto Protocol	
December 12, 2015, Paris	Paris Climate Agreement	
Air Protection Conventions		
22 March 1985, Vienna/	Vienna Convention for the Protection of the Ozone Layer and the Montreal	The Convention has entered into force for the USSR 22.09.1988.

Date of Signature	Title	Comment, brief description
16 September 1987, Montreal	Protocol on Substances that Deplete the Ozone Layer	These are of relevance to this project, since during the construction and commissioning of new facilities substances that deplete the ozone layer may be emitted
13 November 1979, Geneva	Convention on long-range transboundary air pollution and Sofia Protocol on the Control of Emissions of Nitrogen Oxides or their Transboundary Fluxes	The Convention has entered into force for the USSR 29.04.1980. The Convention's primary objective is to protect the man and his environment from air pollution and to seek to limit, gradually reduce, and prevent the contamination of ambient air, including long-range transboundary air pollution. The Convention is relevant, because the construction and operation of GPP facilities and pipeline systems inevitably produce polluting emissions.
Waste/ management of hazardous substances		
22 March 1989, Basel	Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal	The Convention has entered into force for Russia 01.05.1995. The provisions of the Convention center around the following principal aims: • the reduction of hazardous waste generation and the promotion of environmentally sound management of hazardous wastes; • the restriction of transboundary movements of hazardous wastes; and • a regulatory system applying to cases where transboundary movements are permissible.
October 10, 2013, Kumamoto	Minamata Convention on Mercury	The Convention is signed (September 24, 2014) but not ratified by Russia. The Convention is intended to protect people and environment from man-caused emissions and free mercury and its compounds which can cause mercury poisoning. According to the Convention, the use of mercury should be regulated, production of certain devices containing mercury should be reduced. Also, the Convention restricts certain industrial processes and sectors. Since 2020 the Convention prohibits production, export and import of several kinds of products containing mercury, including electric batteries, electric switches and relays, certain kinds of compact fluorescent lamps, cold cathode fluorescent lamps or fluorescent lamps with external electrode, mercury thermometers and pressure measurement devices.

Date of Signature	Title	Comment, brief description
Social issues / consultations		
June, 26 1998, Aarhus	UNECE Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters	The Convention has not yet been ratified by the Russian Federation; however, this document is listed here as the Russian Federation contemplates its ratification. The Convention is relevant to the project in view of the need to inform the public of how the project bears on the state of the environment.
16 November 1972, Paris	Convention Concerning the Protection of the World Cultural and Natural Heritage	The Convention has entered into force for the USSR 12.01.1989. Parties have a duty to the identification, protection, and conservation, of cultural and natural heritage covered by the Convention. Natural heritage includes natural features that are of outstanding universal value from the aesthetic or scientific point of view, and areas that constitute the habitat of threatened species of animals and plants of outstanding value from the point of view of science or conservation.
October 17, 2003, Paris	Convention for the Safeguarding of the Intangible Cultural Heritage	Russia is not yet a party of the Convention.
Principal conventions on labor protection and health		
1948, San Francisco	ILO Convention 87 -Freedom of Association and Protection of the Right to Organise	These Conventions are fundamental and shall be taken under advisement during project implementation, as Polys Gold will be using hired labor of workers and operatives who enjoy certain rights in accordance with the said Conventions.
1949, Geneva	ILO Convention 98 - Right to Organise and Collective Bargaining	
1930, Geneva	ILO Convention 29 concerning Forced Labor	
1957, Geneva	ILO Convention 105 concerning the Abolition of Forced Labor	
1973, Geneva	ILO Convention 138 on Minimum Age (of Employment)	
1999, Geneva	ILO Convention 182 - Worst Forms of Child Labour	

Date of Signature	Title	Comment, brief description
1951, Geneva	ILO Convention 100 on Equal Remuneration	
1958, Geneva	ILO Convention 111 Concerning Discrimination in Respect of Employment and Occupation	
1981, Geneva	ILO 155 - Occupational Safety and Health Convention	The Project will provide for measures to prevent accidents and injury to health arising out of, linked with or occurring in the course of work, by minimising, so far as is reasonably practicable, the causes of hazards inherent in the working environment.
November 20, 1989	UN Convention on the Rights of the Child	The Convention has entered into force for the USSR 15.09.1990. Article 32: States Parties recognise the right of the child to be protected from economic exploitation and from performing any work that is likely to be hazardous or to interfere with the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral or social development. In particular, the member states: • establish minimum age(s) of employment; and • determine the requirements as to working hours and conditions.
December 18, 1990, New York	International Convention on the Protection of the Rights of all Migrant Workers and their Families	The Convention took effect on July 1, 2003. Russia is not a party of the Convention. The Convention does not introduce any new rights of migrants, but is intended to promote fair treatment and equal working conditions for migrants and citizens of host country. The convention is built around the basic premise that certain minimum rights of all migrants should be protected. The Convention recognises that legal migrants should enjoy broader rights than illegal, however it highlights that basic human rights of illegal migrants should still be respected. At the same time, the Convention suggests that measures should be taken to identify and prevent illegal or secret movements of labour migrants and their family members, including by the following methods: • counteraction to misleading information and abetting people for illegal migration;

Date of Signature	Title	Comment, brief description
		• application of sanctions against persons, groups or formations engaged with organization, implementation or facilitation of illegal migration, including taking measures against employers of illegal migrants.
Industrial safety		
March 17, 1992, Helsinki	Convention on the Transboundary Effects of Industrial Accidents (as amended in 2008)	The Convention has entered into force for the RF 19.04.2000. This Convention applies to the prevention of, preparedness for and response to industrial accidents capable of causing transboundary effects, including the effects of such accidents caused by natural disasters, and to international cooperation concerning mutual assistance, research and development, exchange of information and exchange of technology in the area of prevention of, preparedness for and response to industrial accidents. For a proposed or existing hazardous activity, the Party of origin shall, for the purposes of ensuring adequate and effective consultations, provide for the notification at appropriate levels of any Party that it considers may be an affected Party as early as possible and no later than when informing its own public about that proposed or existing activity.

APPENDIX 3

SPECIES COMPOSITION FAUNA REPORTED IN THE PROJECT AREA

Table A3.1: Mammal species reported in the Project area

Species	Status	Range	Habitat characteristics	Commercial significance	Protection measures
Brown long-eared bat (*Plecotus auritus*)	Rare	Southern Palearctic	Forest glades, cuttings, roads, dwellings, service buildings	None	Protection of areas of summer and winter concentrations
Water bat (*Myotis daubentoni*)	Normal	Southern Palearctic	River valleys, dwellings and service buildings	None	Protection of areas of summer and winter concentrations
Northern bat (*Eptesicus nilssoni*)	Rare	Southern Palearctic	Forest glades, cuttings, roads, dwellings, service buildings	None	Protection of areas of summer and winter concentrations
Common shrew (*Sorex araneus*)	Rare	Western Palearctic	Forests, shrubs	None	Not required
Isodont shrew (*S. isodon*)	Rare	East-Asian	Forests, shrubs, meadows	None	Not required
Tundra shrew (*S. tundrensis*)	Normal	Eastern Palearctic	Forests, shrubs	None	Not required
Medium shrew (*S. caecutiens*)	Rare	Transpalearctic	Forests, shrubs	None	Not required
Lesser shrew (*S. minutus*)	Normal	Western Palearctic	Meadows, shrubs	None	Not required
Pigmy shrew (*S. minutissimus*)	Rare	Transpalearctic	Forests, shrubs	None	Not required
Birch mouse (*Sacista betulina*)	Rare	Western Palearctic	Forests, shrubs	None	Not required
House mouse (*Mus musculus*)	Very rare, in summer	Southern Palearctic	Synanthropic	None	Not required
Harvest mouse (*Micromys minutis)*	Rare	Transpalearctic	Meadows, shrubs, river valleys	None	Not required
Norway rat (*Rattus norvegicus*)	Normal	Ubiquist	Synanthropic	None	Not required
Northern red-backed vole (*Clethrionomys rutilus*)	Rare	Transpalearctic	Forests, shrubs	None	Not required
Large-toothed red-back vole (*C. rufocanus*)	Normal	Transpalearctic	Forests, shrubs	None	Not required
Root vole (*Microtus oeconomus*)	Normal	Transpalearctic	Meadows, shrubs and fallow land	None	Not required
Field vole (*M. agrestis*)	Rare	Western Palearctic	Small-leaved forests, meadows, shrubs	None	Not required

Species	Status	Range	Habitat characteristics	Commercial significance	Protection measures
East-Asian mouse (*Apodemus peninsulae*)	Rare	Eastern Palearctic	Light coniferous and small-leaved forests	None	Not required
Wood lemming (*Myopus schisticolor*)	Very rare	Transpalearctic	Taiga forests and shrubs	None	Not required
Mountain hare (*Lepus timidus*)	Very rare	Transpalearctic	Forests, shrubs	Game animal	Regulated hunting
Chipmunk (*Tamias sibiricus*)	Very rare	Eastern Palearctic	Coniferous forests	None	Not required
Common squirrel (*Sciurus vulgaris*)	Very rare	Transpalearctic	Dark and light coniferous forests	Game animal	Regulated hunting

Table A3.2: Bird species reported in the Project area

Bird species	Status	Range	Habitat characterization	Commercial significance	Required protection measures
Black kite *(Milvus korschun Gm.)*	Rare	Transpalearctic	Meadow and shrub river valleys	None	Protection of nests
Northern goshawk (*Accipiter gentilis*)	Rare	Transpalearctic	Forested and recovering areas affected by forest fires	None	Not required
Rock pigeon *(Columba rupestris Pall.)*	Rare	South-Asian	Residential settlements	None	Not required
Oriental turtle-dove *(Streptopelia orientalis Lath.)*	Rare	South-Asian	Forest habitats	None	Not required
Common cuckoo *(Cuculus canorus L.)*	Normal	Transpalearctic	Eurytopic	None	Not required
Oriental cuckoo *(Cuculus saturatus Blvth.)*	Rare	Transpalearctic	Coniferous and mixed forest	None	Not required
White-rumped swift *(Apus pacificus Lath.)*	Normal	East-Asian	Taiga forests	None	Not required
Great spotted woodpecker *(Dendrocopus major L.)*	Normal	Transpalearctic	Forested and recovering areas affected by forest fires	None	Not required
Skylark *(Alauda arvensis L.)*	Rare	Transpalearctic	Meadows in river valleys	None	Not required
White wagtail *(Motacilla alba L.)*	Normal	Transpalearctic	Residential settlements	None	Not required
Yellow wagtail *(Motacilla flava L.)*	Rare	Transpalearctic	River valleys	None	Not required

Bird species	Status	Range	Habitat characterization	Commercial significance	Required protection measures
Gray wagtail *(Motacilla cinerea Twist.)*	Rare	Eastern Palearctic	Valleys of minor rivers	None	Not required
Steppe pipit *(Anthus richardi Vieill.)*	Rare	South-Asian	Meadows	None	Not required
Siberian shrike *(Lanius cristatus L.)*	Normal	Transpalearctic	Meadow and shrub thickets	None	Not required
Indian tree pipit *(Anthus hodgsoni Richm.)*	Rare	Eastern Palearctic	Light coniferous and small-leaved forests	None	Not required
Tree pipit *(Anthus trivialis*	Normal	Western Palearctic	Light coniferous and small-leaved forests	None	Not required
Red-throated thrush (*Turdus ruficollis Pall.)*	Rare	East-Asian	Coniferous and mixed forests	None	Not required
Fieldfare *(T. pilaris L.)*	Rare	East-Asian	Mixed forests	None	Not required
Common redstart *(Phoenicurus phoenicurus L.)*	Rare	Western Palearctic	Mixed forests	None	Not required
Daurian redstart *(Ph. auroreus Pall.)*	Rare	Eastern Palearctic	Forest margins, shrub thickets in river valleys	None	Not required
Greenish warbler *(Phylloscopus trochiloides Sund.)*	Rare	Transpalearctic	Shrubs and small-leaved forests	None	Not required
Dusky warbler *(Ph. fuscatus Blyth.)*	Rare	East-Asian	Taiga forests and shrubs in river valleys	None	Not required
Red-breasted flycatcher *(Muscicapa parva Bech.)*	Rare	Transpalearctic	Taiga forests	None	Not required
Black-and-orange flycatcher *(M. mugimaki Temm.)*	Rare	East-Asian	Taiga forests	None	Not required
Great tit *(Pants major L.)*	Normal	Transpalearctic	Forests and shrubs along rivers	None	Not required
Willow tit *(P. montanus Bald.)*	Abundant	Transpalearctic	Taiga forests	None	Not required
Wood nuthatch *(Sitta europea L.)*	Normal	Transpalearctic	Coniferous forests	None	Not required
Bullfinch *(Pyrrhula pyrrhula L.)*	Rare	Transpalearctic	Coniferous and small-leaved forests	None	Not required

Bird species	Status	Range	Habitat characterization	Commercial significance	Required protection measures
Siberian uragus *(Uragus sibiricus Kefs, et Bias.)*	Rare	Eastern Palearctic	Forest margins and shrub thickets in river valleys	None	Not required
Pine bunting *(Emberiza leucocephalos Gm.)*	Normal	Eastern Palearctic	River valley forests, shrubs and areas affected by fires	None	Not required
Golden bunting *(E. aureola Pall.)*	Normal	Transpalearctic	Meadow and shrub valleys of rivers	None	Not required
Masked bunting *(E. spodocephala Pall.)*	Rare	Eastern Palearctic	Forest margins and shrub thickets in river valleys	None	Not required
Scarlet rosefinch *(Carpodacus erythrinus Pall.)*	Normal	Transpalearctic	Taiga forests in river valleys	None	Not required
House sparrow *(Passer domesticus L.)*	Abundant	Transpalearctic	Residential settlements	None	Not required
Tree sparrow *(P. montanus L.)*	Abundant	Transpalearctic	Residential settlements	None	Not required
Common sandpiper *(Actitis hypoleucos L.)*	Rare	Transpalearctic	Coastal habitats	None	Not required
Great spotted woodpecker *(Dendrocopos major L.)*	Normal	Transpalearctic	Forests, recovering areas affected by forest fires	None	Not required
Black woodpecker *(Dryocopus martius L.)*	Normal	Transpalearctic	Dark and light coniferous forests	None	Not required
Nutcracker *(Nucifraga caryocatactes L.)*	Rare	Transpalearctic	Dark coniferous taiga forests	None	Not required
Crow *(Corvus corone L.)*	Normal	Eastern Palearctic	Residential settlements and surrounding habitats	None	Not required
Common magpie *(Pica pica L.)*	Normal	Transpalearctic	Residential settlements and surrounding habitats	None	Not required
Azure-winged magpie *(Cyanopica cyanus Pall.)*	Very rare, visitant	East-Asian	Mixed forests in river valleys; garden plots	None	Not required

Table A3.3: Species composition of the ichthyofauna of the Lena River

Species description	Latin name
Family *Petromyzonidae*	
Siberian lamprey	*Lampetra japonika kessleri (Anikin)*
Family *Acipenseridae*	
Hatys sturgeon	*Asipenser baeri hatys Drjagin Brandt*
Family *Salmonidae*	
Taimen	*Hucho taimen (Pallas)*
Lenok	*Brachymystax lenok (Pallas)*
Family *Coregonidae*	
Siberian cisco (pidschian)	*Coregonuslavaretus pidschian (Gmelin)*
Pilot fish	*Prosopium cylindraceum (Pallas et Pennant)*
Muksun (whitefish)	*(Coregonus muksun)*
Family *Thymallidae*	
Lena grayling	*Thymallus sp.*
Siberian grayling	*Thimallus arcticus (Pallas)*
Family *Esocidae*	
Pike	*Esox lucius (L.)*
Family *Cyprinidae*	
Siberian roach	*Rutilus rutilus lacustris (Pallas)*
Siberian dace	*Leuciscu leuciscus baicalensis (Dybowski)*
Nerfling	*Leuciscus idus (L.)*
Czekanowski's minnow	*Phoxinus czekanowskii (Dybowski 1869)*
Common minnow	*Phoxinus phoxinus (L.)*
Lena gudgeon	*Gobio soldatovi tundyssicus (Borisov)*
Family *Cobitidae*	
Siberian loach	*Nemachilus barbatulus toni Dybowski*
Siberian spined loach	*Cobitis taenia sibirica Gladkov*
Family *Gadidae*	
Burbot	*Lota lota (L.)*
Family *Percidae*	
River perch	*Perka fluviatilis (L.)*
Pope	*Gymnocephalus cernuus (L.)*

APPENDIX 4

SCHEMATIC MAP OF INK’S UST-KUT INDUSTRIAL DISTRICT AND ADJACENT TERRITORIES

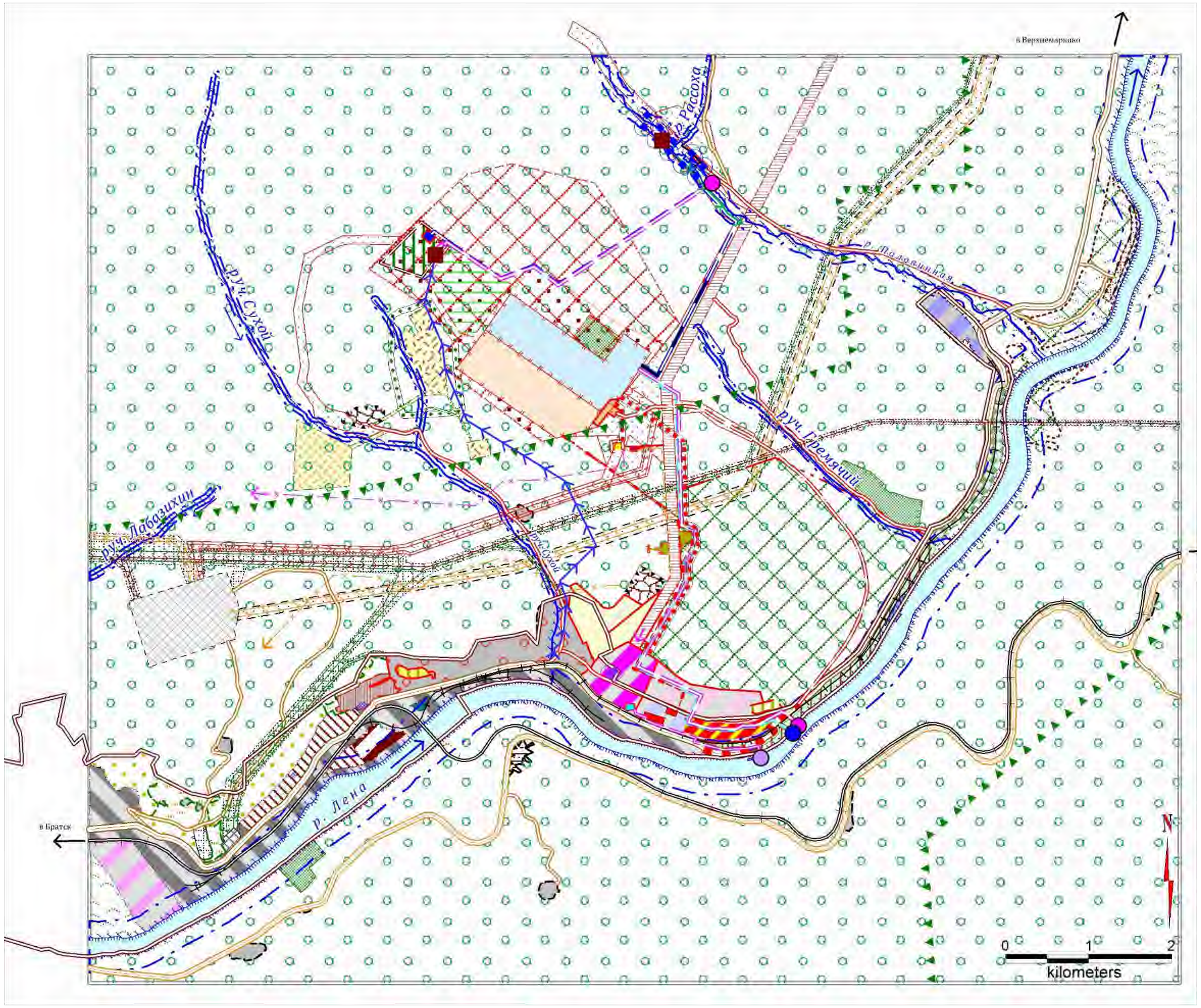

Figure A4.1: Ust-Kut industrial district and adjacent territories: schematic layout of INK and third-party facilities

Legend

INK activity

Operational facilities

- ROW from the field area (main gas pipeline, 10kV OHPTL, cable communications line, service driveway)
- Main gas pipeline related near-route facilities
- LPG RSSC, including:
  - *groundwater intake facility (artesian wells);*
  - *local wastewater treatment facilities;*
  - *treated wastewater sewer;*
  - *point of discharge of treated wastewater into the Lena river;*
  - *land plots outside the main site, intended for housing riverside facilities*
- TTA base

Constructed facilities

GFP
- main site
- reserved site

LPG RSSC
- *(area includes proposed facilities of the IPP shipping zone)*

LPG/LGC RSSC expansion
- *(area includes proposed facilities of the IPP shipping zone)*

Transport infrastructure facilities
- *(land plot includes access railway tracks)*

Construction materials quarries
- *(carbonate rocks)*

Sections of ground roads
- *(used by contractors)*

Temporary accomodation camps
- *in operation;*
- *under construction*

Prospective gas pipelines (shown schematically)

- to Ust-Kut
- to Ust-Ilimsk

Designed facilities

Land acquisition area
- Forest areas leased by INK for 49 years, including
  - a 430.49 ha forest land plot to be recategorized as industrial land (includes the IPP process zone)
- Reserved forest land plots leased by INK in 2016-2017, intended for the IPP process site according to the alternative choice
- Forest land plots leased by INK, intended for the IPP associated facilities (pipeline ROWs, motor road ROWs)
- Onshore water supply and wastewater removal facilities sites
- Prospective land acquisition for linear facilities (borders roughly outlined by Consultant)

IPP process site (Zone 1)
- Polymer plant
- MEG plant
- general plant facilities

IPP export terminals (Zone 2)
- Polymer plant
- MEG plant

Process pipelines
- DSG pipeline
- MEG pipeline
- ROWs
- Pig receiver
- GDS

Motor roads
- Inter-site motor road
- Reconstruction of Federal Highway A-331 Vilyui

Power supply facilities
- Power line 220 kV
- Power line 10 kV
- Power substation 'Lesnye prichaly'
- CTS

Water supply and wastewater removal facilities

Water intake facilities:
- *groundwater (artesian wells);*
- *surface water (river channel)*

Water pipelines with:
- *groundwater*
- *potable water*
- *process water*
- *treated wastewater*

- first stage pumping station
- water treatmenrt plant
- waste water treatment unit
- facilities of treated wastewater discharge
- point of discharge of treated wastewater into the Lena river

Temporary construction facilities
- Accomodation camp for 7000 people
- Accomodation camp for 700 people
- TBI
- Power line 10 kV

Berth facilities:
- *river side;*
- *water area*

Activities of third parties and general infrastructure

Industrial zone
- Industrial and municipal-warehouse bases of Mikura LLC and Mostootryad No.5, a wood processing complex of TSLK LLC with wood berth and other objects

Transport corridors
- The territory of the longshore passage of the Federal Highway A-331 'Vilyui' and access railroads with berthing facilities and other site facilities
- Same thing, without berthing facilities and site facilities

Motor roads
- Federal Highway A-331 'Vilyui'
- Motor road 25H26
- Subsidiary

Rail roads
- BAR
- Access railways

Power supply objects
- 220 kV 'Yakurim' substation (in operation)
- 500/220 kV 'Ust-Kut' substation (under construction)

Power line in operation:
- *220 kV;*
- *110 kV*
- *Protected zone of power line*

Power line under construction:
- *500 kV*
- *Protected zone of power line*

SC 'Alrosa' facilities:
- *SC 'Alrosa' industrial base (including an explosives w*
- *berthing facilities of LLC 'Alrosa-Terminal*

Fuel storage unit
- Oil base of JSC 'Irkutsknefteproduct'

Objects of water disposal system
- Sewage treatment facilities
- Sewerage pump station

Sawmill residue disposal objects:
- *Sites and access road to them;*
- *prospective site;*
- *firebreak line*

Other objects
- Waste disposal area
- Cemetery

Water objects

- Course of the Lena river
- Bank of the Lena river
- Small rivers and waterstreams

Areas with controlled environmental quality standards

- Mid-rise housing in Mostootryad microdistrict
- Low-rise (single-storey) housing in Yakurim, Mostootryad microdistricts
- Subsidiary household plots in Mostootryad microdistrict
- Low-rise (single-storey) housing in rural population center (village of Polovinka)
- GA (Gardening Association)
- Groundwater intake facilities (sanitary protection zones are not shown)
- The Town of Ust-Kut boundary

Vegetation and land use conditions of undeveloped areas

Areas of the forest fund (Ust-Kut forestry)
- *Forests disturbed by industrial activities (multiage felling, burning, clearing, highways)*
- *Boundary between operational and protective forests (spawning forest habitats are confined to the Lena River valley)*

Undeveloped areas within the borders of Ust-Kut:
- *urban forests, locally disturbed by economic activity;*
- *meadow and wood-shrub vegetation of disturbed areas (secondary meadows, self-overgrowth areas, forest fragments in combination with areas without vegetation cover);*

Other undeveloped areas
- *Meadow (mainly) and woody shrub vegetation of the floodplain terrace complex of the Lena River valley, disturbed by economic activity;*
- *areas of valley meadows, presumably used for haymaking;*
- *areas without vegetation cover as a result of unauthorized waste disposal and other activities*

APPENDIX 5

LIST OF WASTE, ITS VOLUME AND CHARACTERISTICS AND THE WAYS OF WASTE HANDLING DURING IPP OPERATION

Table A5.1: Waste generation at operation of the Irkutsk Polymer Plant of INK, volumes, characteristics and methods of management

FCCW code	Description	Waste generating process	Waste hazard class	Physical and chemical properties			Intervals of waste production	Characteristics of temporary accumulation facilities	Removal intervals	Management method
				Physical state	Components	Quantity tpa				
Pyrolysis unit										
4 41 001 04 49 3	Spent active aluminium oxide catalyst with palladium	Methanation section	3	Other loose materials	Aluminium oxide - 95% Palladium oxide - 5%	4.3	once every 6 years	No accumulation	As produced	Regeneration prior to discharge. Removal by catalyst supplier.
		Ethylene section			Aluminium oxide – 99%, palladium oxide – 1%	31.2	once every 10 years		As produced	
		Ethylene section - MAPD converter			Aluminium oxide - 95% Palladium oxide - 5%	3.0	once every 10 years		As produced	
		Ethylene section - hydrogenation reactor			Aluminium oxide – 99%, palladium oxide – 1%	14.4	once every 5 years		As produced	
		Ethylene section - DPG stage 1 reactor			Aluminium oxide – 99%, palladium oxide – 1%	26.2	once every 5 years		As produced	
4 41 012 99 49 4	Spent silicon oxide and aluminium oxide catalyst	Ethylene section - DPG stage 2 reactor	4	Other loose materials	Silicon oxide - 50% Aluminium oxide - 40% Sodium oxide - 30% Potassium oxide - 15% Quartz - 3% Aluminosilicate – 2%	26.3	once every 5 years	No accumulation	As produced	Regeneration prior to discharge. Removal by catalyst supplier.
4 42 505 02 20 4	Spent coke contaminated with petroleum products (petroleum products content less than 15%)	Ethylene section during decoking cycles	4	Solid	Coke - 100%	9.0	once a year	No accumulation	As produced	On-site thermal treatment. Disposal of produced ash at IMSW landfill

FCCW code	Description	Waste generating process	Waste hazard class	Physical and chemical properties			Intervals of waste production	Characteristics of temporary accumulation facilities	Removal intervals	Management method
				Physical state	Components	Quantity tpa				
4 42 101 01 49 5	Spent zeolite from air and gas dehydration, not contaminated	Ethylene section - dehydration of pyrolysis gas, hydrogen, ethylene, bottoms	5	Other loose materials	Zeolite >70% Minerals <30% Quartz <3%	84.3	once every 6 years	No accumulation	As produced	Regeneration prior to discharge. Disposal at specialized landfill
4 61 010 01 20 5	Scrap and waste containing uncontaminated ferrous metals in the form of products and pieces, unsorted	Feed water preparation block. Use of chemicals and auxiliary materials	5	Solid	Ferrous metal - 100%	1.0	Intermittent	Outdoor site with asphalt concrete paving 20 m^2	monthly	Recycling at specialized metal scrap recycling facility
	Pyrolysis resin from quench column	Ethylene unit	3			3360 (0.4 t/h)	Hourly		As produced	On-site thermal treatment. Disposal of produced ash at IMSW landfill
PE unit (gas phase technology)										
4 42 501 00 00 0	Sent zeolite contaminated with hazardous substances	Change of spent zeolite in ethylene purification adsorbers	4	Other loose materials	Zeolite - 97%, hexane – 0.76%, pentane – 2%, ethylene – 0.14%, butene – 0.1%	36.0	once every 3 years	No accumulation	As produced	Regeneration prior to discharge. Disposal at specialized landfill
		comonomer purification adsorbers				46.4				
		hydrogen adsorbers				0.1	once every 5 years			
		nitrogen purification adsorbers				0.01	once every 3 years			

FCCW code	Description	Waste generating process	Waste hazard class	Physical and chemical properties			Intervals of waste production	Characteristics of temporary accumulation facilities	Removal intervals	Management method
				Physical state	Components	Quantity tpa				
4 42 102 01 49 5	Spent alumogel from air and gas dehydration, not contaminated	Changing spent adsorbents and molecular sieve dryers: Ethylene purification reactor for removal of O2 and acetylene; Hydrogen catalytic purification reactor for removal of O2	5	Other loose materials	Al_2O_3 – 100%	22.2	once every 3-5 years	No accumulation	As produced	Regeneration prior to discharge. Disposal at specialized landfill
4 42 601 01 20 3	Spent zinc oxide sorbent	MP nitrogen purification reactor for removal of O2; HP nitrogen purification reactor for removal of O2; Ethylene purification reactor for removal of CO	3	Other loose materials	CuO ≥ 25%-<25%; ZnO ≥ 20%-<50%; Residue: Al_2O_3 and promotors –≤ 25%	5.4	once every 5 years	No accumulation	As produced	Regeneration prior to discharge. Disposal at specialized landfill
		MP nitrogen purification reactor for removal of O2/CO				0.1	once every 3 years			
4 41 011 00 00 0	Spent catalysts with predominant content of titanium and its compounds	Ziegler catalyst. Maintenance Polymerization zone Reactor block (Ziegler catalyst Novacat T and SDX)	3	Other loose materials	Novacat T: -metal alkyls <30% -tetrahydrofuran <11% -titanium tetrachloride ~ 2% -titanium trichloride ~ 2% -pentane - 0-2% -isopentane - 0-2% -heptane - 0-2% - n-hexane - 0-2% SDX:	0.1	Intermittent	Area 5x10 m with a shed and asphalt concrete paving	Progressively, as waste is accumulated but no less than once every 11 months.	Regeneration prior to discharge. Removal by catalyst supplier

<table>
<tr><th rowspan="2">FCCW code</th><th rowspan="2">Description</th><th rowspan="2">Waste generating process</th><th rowspan="2">Waste hazard class</th><th colspan="3">Physical and chemical properties</th><th rowspan="2">Intervals of waste production</th><th rowspan="2">Characteristics of temporary accumulation facilities</th><th rowspan="2">Removal intervals</th><th rowspan="2">Management method</th></tr>
<tr><th>Physical state</th><th>Components</th><th>Quantity tpa</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td>- n-hexane - <5%
- pure SDX->95%</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>4 06 190 01 31 3</td><td>Other waste mineral oils</td><td>Spent oil vessel of catalyst vent hydraulic lock</td><td>3</td><td>Liquid in liquid</td><td>Waste oil, Ziegler catalyst - 100%</td><td>0.6</td><td>Intermittent</td><td>Metal drums per GOST 13950-91 (1 pc vol. 200 l) at 5x10 m site with asphalt concrete paving</td><td>monthly</td><td>Neutralization at specialized facility</td></tr>
<tr><td rowspan="3">4 59 110 99 51 5</td><td rowspan="3">Other spent ceramic articles, uncontaminated</td><td>Changing spent ceramic balls in
- MP nitrogen purification reactor for removal of O2 - spent inert balls T-162 or equivalent 25 mm;</td><td rowspan="3">5</td><td rowspan="3">Single-material article</td><td rowspan="3">Porcelain, including:
SiO_2 – 74.5%;
AI_2O_3 – 21.4%;
K_2O – 4.4%</td><td>0.1</td><td rowspan="3">once every 3-5 years</td><td rowspan="3">No accumulation</td><td rowspan="3">As produced</td><td rowspan="3">Regeneration prior to discharge. Disposal at specialized landfill</td></tr>
<tr><td>- HP nitrogen purification reactor for removal of O2;
- ethylene purification reactor for removal of O2 and acetylene;
- hydrogen purification reactor for removal of O2- spent inert balls T-162 or equivalent 6 mm;</td><td>0.1</td></tr>
<tr><td>- MP nitrogen purification reactor for removal of O2/CO;
- comonomer purification adsorbers
-- spent inert balls T-162 or equivalent 13 mm;</td><td>0.1</td></tr>
</table>

FCCW code	Description	Waste generating process	Waste hazard class	Physical and chemical properties			Intervals of waste production	Characteristics of temporary accumulation facilities	Removal intervals	Management method
				Physical state	Components	Quantity tpa				
		- ethylene purification reactor for removal CO - spent inert balls T-162 or equivalent 12 mm;				0.2				
		- hydrogen adsorbers - spent inert balls Denstone 57 or equivalent 1/8''				0.01				
		- HP nitrogen purification adsorbers for removal of CO/H_2O; - pentane dehydration adsorbers; - comonomer purification adsorbers - spent inert balls Denstone 57 or equivalent 1/4''				0.04				
		- ethylene purification adsorbers - spent inert balls Denstone 99 or equivalent 1/8'', 1/4''				0.12 0.36	once every 3 years	No accumulation	As produced	
3 35 271 11 20 4	Spilled polypropylene and polyethylene at manufacturing of articles from	Polymer waste of technological process: - grading - off-grade powder, off-grade polymer grain	4	Solid	Polymer – 100%	139.0	Continuous	Area 5x10 m with asphalt concrete paving	Progressively, as waste is accumulated but no less than once every 11 months.	Sell to consumers as off-spec material. In absence of consumers - transfer for
		- granules drier - copolymer residue;				2.8				

FCCW code	Description	Waste generating process	Waste hazard class	Physical and chemical properties			Intervals of waste production	Characteristics of temporary accumulation facilities	Removal intervals	Management method
				Physical state	Components	Quantity tpa				
	the above materials	- water filtration - granules dispersion waste;				20.8				recycling to specialized contractors.
		- maintenance (paddle feeders, etc.) - powder/granules				29.2	Intermittent, during maintenance			
9 19 204 02 60 4	Cleaning material contaminated with oil or petroleum products (oil or petroleum products content less than 15%)	Equipment maintenance and repair	4	Articles of fibre material	Textile - 70-95%. Petroleum products <15%, may also contain: water, silicon dioxide	1.3	weekly	Leak-proof container capacity 1 m^3 at 1.5x6 m site with asphalt concrete paving	Progressively, as waste is accumulated but no less than once every 11 months.	On-site thermal treatment. Disposal of produced ash at IMSW landfill
4 06 130 01 31 3	Waste mineral industrial oil	Change of spent oil in - extruder oil tanks; - compressor oil tanks; - air blower oil tanks	3	Liquid in liquid	Petroleum products – 97.0%; Water - 2.0%; Solid particles - 1.0%	6.4	Intermittent	Area 5x10 m with asphalt concrete paving	Progressively, as waste is accumulated but no less than once every 11 months.	Neutralization at specialized facility
		Change of spent oil in extruder oil tanks			Spent oil, heat transfer media Marlotherm-LH (benzyl toluene) – 100%	3.0	once every 3 years			
4 68 115 21 51 4	Ferrous metal containers contaminated with organic non-halogenated solvents	Unloading of additive B1 (butyl chloride)	4	Single-material article	Steel – 99.5%, Additive (butyl chloride) - 0.5%	0.4	Intermittent	Area 5x10 m with asphalt concrete paving	monthly	Recycling at specialized facility
4 68 111 02 51 4	Ferrous metal containers contaminated	Unloading of Ziegler catalyst	4	Single-material article	Steel – 99.5%, Catalyst (hexane, titanium trichloride,	1.9	Intermittent	Area 5x10 m with asphalt concrete paving	monthly	Recycling at specialized facility

FCCW code	Description	Waste generating process	Waste hazard class	Physical and chemical properties			Intervals of waste production	Characteristics of temporary accumulation facilities	Removal intervals	Management method
				Physical state	Components	Quantity tpa				
	with petroleum products (petroleum products content 15% and higher)				aluminium alkyls) - 0.5%					
4 05 915 72 60 4	Paper and/or cardboard packaging contaminated with solid polymers	Unpacking of chemicals: - calcium stearate; - zinc stearate; - zinc oxide; - Irganox1010; - Irganox1076; - Irgafos168; - PEPQ; - DSTDP; - erucamide; - silicon dioxide; - Chimassorb 944	4	Articles of fibre material	Paper – 95%, PE – 3%, reagents – 2%	5.7	Intermittent	Leak-proof metal container capacity 6 m^3 at 1.5x6 m site with asphalt concrete paving	monthly	Recycling at specialized facility
Linear alpha-olefin unit										
43 900 00 00 0	Other waste filters and spent filter materials	Filter press sludge	4	Liquid	Water content – 30%; Cr (III) – 42 777 mg/l; Al^{3+} - 44 449 mg/l; Mg^{2+} - 6 565 mg/l; $CaSO_4$, $2H_2O$ – 403 637 mg/l	5.3	every 2 days	Leak-proof metal container capacity (1 pc., 6 m^3) at site with asphalt concrete paving	Progressively, as waste is accumulated but no less than once every 11 months.	Disposal at specialized landfill
4 41 000 00 00 0	Other spent catalysts	Spent catalyst V-208A/B,	3	Other loose materials	But-1-ene - 9.71%; Butane - 0.02%; Olefins C6 - 21.93%; Cyclohexane - 4.88%; Octanes - 12.85%;	16.7	monthly	No accumulation	As produced	Regeneration prior to discharge. Disposal at specialized landfill

FCCW code	Description	Waste generating process	Waste hazard class	Physical and chemical properties: Physical state	Physical and chemical properties: Components	Physical and chemical properties: Quantity tpa	Intervals of waste production	Characteristics of temporary accumulation facilities	Removal intervals	Management method
					Spent catalyst incl. 15% wt. of amine - 50.61%					
4 42 102 01 49 5	Spent alumogel from air and gas dehydration, not contaminated	Spent molecular sieves AxSorb 537,	5	Other loose materials	Al2O3 – 97.5% SiO2 – 2.5%	1.1	once every 5 years	No accumulation	As produced	Disposal at specialized landfill
		Spent molecular sieves AxSorb 543,			50 <= Al2O3 < 100	0.1				
		Spent molecular sieves AxSorb A,			Al2O3 – 93.5% Na2O – 6.5%	0.05				
		Spent inert aluminium balls ¼,			Al2O3 – 99.4% SiO2 – 0.15%	0.2				
		Spent inert aluminium balls ¾,			Al2O3 – 99.4% SiO2 – 0.15%	0.4				
4 59 110 99 51 5	Other spent ceramic articles, uncontaminated	Spent ceramic balls 1/4	5	Single-material article	SiO2 – 69% Al2O3 – 23%	0.02	once every 5 years	No accumulation	As produced	Disposal at specialized landfill
		Spent ceramic balls 3/4			SiO2 – 69% Al2O3 – 23%	0.1				
4 06 190 01 31 3	Other waste mineral oils	Linear alpha-olefin unit	3	Liquid in liquid	Paraffinic mineral oil - 100% , TEA - traces	0.6	once every 5 years	No accumulation	As produced	Neutralization at specialized facility
4 132 00 01 31 3	Waste synthetic and semi-synthetic industrial oil	Hydraulic cutting pump maintenance	3	Liquid in liquid	Petroleum products – 97.0%; Water - 2.0%; Suspended solids - 1%	0.03	1-2 times a year	No accumulation	As produced	Neutralization at specialized facility
4 06 130 01 31 3	Waste mineral industrial oil	Maintenance of pumps and compressor, fittings	3	Liquid in liquid	Saturated and unsaturated hydrocarbons 0 94.3%; Water - 4.0%; Suspended solids - 1.7%	0.07	1-2 times a year	No accumulation	As produced	Neutralization at specialized facility
9 19 204 01 60 3	Cleaning material contaminated with oil or	Maintenance of equipment and pipeline fittings	4	Article of fibre material	Petroleum oil - 37.2%; Solid particles - 29.6%; Cotton fabric - 20.8%;	0.01	Intermittent	Leak-proof metal container capacity 1 m^3 at	Progressively, as waste is accumulated but no less	On-site thermal treatment. Disposal of

FCCW code	Description	Waste generating process	Waste hazard class	Physical and chemical properties			Intervals of waste production	Characteristics of temporary accumulation facilities	Removal intervals	Management method
				Physical state	Components	Quantity tpa				
	petroleum products (petroleum products content is 15% and higher)				Water - 16.9%			site with asphalt concrete paving	than once every 11 months.	produced ash at IMSW landfill
9 19 201 02 39 4	Sand contaminated with oil or petroleum products (oil or petroleum products content is less than 15%)	Cleaning of accidental spills of petroleum products and lubrication oil application areas	4	Other disperse systems	Silicic anhydride – 78.4%; Water content - 12.9%; Petroleum products – 8.7%	0.01	Intermittent	Leak-proof container capacity 1 m^3 at site with asphalt concrete paving	Progressively, as waste is accumulated but no less than once every 11 months.	Disposal at specialized landfill
4 55 700 00 71 4	Waste rubber-asbestos articles, uncontaminated	Maintenance of equipment and fittings flanges	4	Mixed solid materials (including fibres)	Synthetic rubber - 61.0% Asbestos - 39.0%	0.001	Intermittent	Leak-proof container capacity 1 m^3 at site with asphalt concrete paving	Progressively, as waste is accumulated but no less than once every 11 months.	Recycling at specialized facility
4 56 200 51 42 4	Fines of waste abrasive materials	Repair and preventive maintenance of equipment and pipelines during maintenance operations	4	Fines	White alumina (monocrystalline alumina) AI2O3 - 100%	0.001	Intermittent	Leak-proof container capacity 1 m^3 at site with asphalt concrete paving	Progressively, as waste is accumulated but no less than once every 11 months.	Disposal at specialized facility
4 56 200 52 41 4	Powdered waste abrasive materials	Repair and preventive maintenance of equipment and pipelines during maintenance operations	4	Powder	White alumina (monocrystalline alumina) AI2O3 - 100%	0.001	Intermittent	Leak-proof container capacity 1 m^3 at site with asphalt concrete paving	Progressively, as waste is accumulated but no less than once	Disposal at specialized facility

FCCW code	Description	Waste generating process	Waste hazard class	Physical and chemical properties			Intervals of waste production	Characteristics of temporary accumulation facilities	Removal intervals	Management method
				Physical state	Components	Quantity tpa				
									every 11 months.	
4 61 010 01 20 5	Scrap and waste containing uncontaminated ferrous metals in the form of products and pieces, unsorted	Replacement of worn-out equipment and pipelines during maintenance operations	5	Solid	Iron - 95.5-98.0%; Iron oxides - 2.0-1.0%. Carbon - 3.0%, max.	0.03	Intermittent	Site with asphalt concrete paving	Progressively, as waste is accumulated but no less than once every 11 months.	Recycling at specialized facility
9 19 100 01 20 5	Remainders and stubs of steel welding electrodes	Repair and preventive maintenance of equipment and pipelines during maintenance operations	5	Solid	Iron - 93.48%; Carbon - 4.6%; Manganese – 1%%; Iron oxide - 1.5%; Manganese – -0.42%;	0.001	Intermittent	Leak-proof container capacity 1 m^3 at site with asphalt concrete paving	Progressively, as waste is accumulated but no less than once every 11 months.	Recycling at specialized facility
4 56 100 01 51 5	Spent abrasion wheels, broken spent abrasion wheels	Repair and preventive maintenance of equipment and pipelines during maintenance operations	5	Single-material article	Silicic anhydride – 88%; Aluminium oxide - 8%; Mechanical impurities - 4%	0.001	Intermittent	Leak-proof container capacity 1 m^3 at site with asphalt concrete paving	Progressively, as waste is accumulated but no less than once every 11 months.	Disposal at specialized landfill
3 61 212 03 22 5	Ferro metal chips, unsorted, uncontaminated	Repair and preventive maintenance of equipment and pipelines during maintenance operations	5	Chips	Iron - 84%; Carbon - 10%; Iron oxide (Fe2O3) – 6%	0.001	Intermittent	Leak-proof container capacity 1 m^3 at site with asphalt concrete paving	Progressively, as waste is accumulated but no less than once every 11 months.	Recycling at specialized facility

FCCW code	Description	Waste generating process	Waste hazard class	Physical and chemical properties			Intervals of waste production	Characteristics of temporary accumulation facilities	Removal intervals	Management method
				Physical state	Components	Quantity tpa				
Polymer products packaging, storage and offloading area										
9 20 110 01 53 2	Spent lead batteries, intact, filled with electrolyte	Electric fork lifts repair and maintenance	2	Liquid-filled articles	Lead – 70-85%; polypropylene - 15%; acid - 15%	36.0	once every 3 years	Indoor storage facility	Progressively, as waste is accumulated but no less than once every 11 months.	Neutralization at specialized facility
9 19 204 02 60 4	Cleaning material contaminated with oil or petroleum products (oil or petroleum products content less than 15%)	Equipment maintenance and repair	4	Articles of fibre material	Textile - 70-95%. Petroleum products <15%	0.07	weekly	Leak-proof container capacity 1 m^3 at 1.5x10 m site with asphalt concrete paving	Progressively, as waste is accumulated but no less than once every 11 months.	On-site thermal treatment. Disposal of produced ash at IMSW landfill
7 33 390 01 71 4	Sweepings from the enterprise territory, low hazard	Site area cleaning	4	Mixed solid materials (including fibres)	Plant refuse - 15% Silicon dioxide - 55-70%, may also contain: paper, PE, glass, water, aluminium oxide, potassium oxide, magnesium oxide	277.8	twice a week	Leak-proof metal container capacity (3 pc., 6 m^3 each) at site with asphalt concrete paving	twice a week	Disposal at specialized landfill
9 21 130 02 50 4	Spent pneumatic tyre covers with metal cord	Electric fork lifts repair and maintenance	4	Articles of solid materials, without fibres	Polymers/rubber – 85-95%; metal – 5-15%; textile – 7%	2.5	once a year	Bulk on site with asphalt concrete paving 20 m^2	Progressively, as waste is accumulated but no less than once every 11 months.	Recycling at specialized facility

FCCW code	Description	Waste generating process	Waste hazard class	Physical and chemical properties			Intervals of waste production	Characteristics of temporary accumulation facilities	Removal intervals	Management method
				Physical state	Components	Quantity tpa				
4 55 700 00 71 4	Waste rubber-asbestos articles, uncontaminated	Electric fork lifts repair and maintenance, brake blocks replacement	4	Articles of multiple materials	Ferrous metal - 80 - 85%, Asbestos – 5-10%, rubber, sulphur, graphite-brass chips – 5-25%	0.6	Vehicles maintenance	Leak-proof container capacity 1 m^3 at site with asphalt concrete paving	Progressively, as waste is accumulated but no less than once every 11 months.	Recycling at specialized facility
4 34 110 03 51 5	Waste polyethylene and PE articles, uncontaminated (other than packaging)	Sleeved blow film production premises	5	Single-material article	Polyethylene – 100%	297.2	Intermittent	Leak-proof container capacity 12 m^3 at site with asphalt concrete paving	every 2-3 days	On-site preparation and sale as off-spec product. In absence of consumers - transfer for recycling to specialized contractors.
4 68 112 02 51 4	Ferrous metal containers contaminated with paint (paint content less than 5%)	Paint store, paintwork materials unpacking	4	Single-material article	Ferrous metal > 95%; Paintwork materials < 5.0%	1.1	Intermittent	Outdoor site with asphalt concrete paving 5 m^2	Progressively, as waste is accumulated but no less than once every 11 months.	Recycling at specialized facility
4 68 112 02 51 4	Polyethylene packaging contaminated with paintwork materials (less than 5% of paint)	Paint store, paintwork materials unpacking	4	Single-material article	Polyethylene > 95%; Paintwork materials < 5.0%	0.5	Intermittent	Outdoor site with asphalt concrete paving 5 m^2	Progressively, as waste is accumulated but no less than once every 11 months.	Disposal at specialized landfill
4 34 110 04 51 5	Waste polyethylene	Additives store (PE bags) #8, PE pellets store (big bags)	5	Single-material article	Polyethylene – 100%	3.3	Intermittent	Leak-proof metal container capacity 6 m^3 at	monthly	Transfer to specialized

<table>
<tr><th rowspan="2">FCCW code</th><th rowspan="2">Description</th><th rowspan="2">Waste generating process</th><th rowspan="2">Waste hazard class</th><th colspan="3">Physical and chemical properties</th><th rowspan="2">Intervals of waste production</th><th rowspan="2">Characteristics of temporary accumulation facilities</th><th rowspan="2">Removal intervals</th><th rowspan="2">Management method</th></tr>
<tr><th>Physical state</th><th>Components</th><th>Quantity tpa</th></tr>
<tr><td></td><td>packaging, uncontaminated</td><td></td><td></td><td></td><td></td><td></td><td></td><td>outdoor site with asphalt concrete paving</td><td></td><td>contractors for recycling.</td></tr>
<tr><td rowspan="14">3 35 217 11 20 4</td><td rowspan="14">Dust from gas purification system at PE articles manufacturing facilities</td><td>Dust trapping and pneumatic transport stack for common PE grades with PES metering unit:</td><td rowspan="14">4</td><td rowspan="14">Solid</td><td rowspan="14">PE powder- 100%</td><td>-</td><td rowspan="14">Continuous</td><td rowspan="14">Leak-proof metal container capacity 6 m^3 at outdoor site with asphalt concrete paving</td><td rowspan="14">Progressively, as waste is accumulated but no less than once every 11 months.</td><td rowspan="14">Disposal at specialized landfill</td></tr>
<tr><td>PE of natural colour</td><td>43.8
31.3</td></tr>
<tr><td>Black PE</td><td>13.1</td></tr>
<tr><td>PES dedusting unit:</td><td>-</td></tr>
<tr><td>PE of natural colour</td><td>4.7
3.5</td></tr>
<tr><td>Black PE</td><td>1.5</td></tr>
<tr><td>Dust trapping and PE pneumatic transport stack with PES metering unit (PEG)</td><td>62.5</td></tr>
<tr><td>Dedusting unit (PEG)</td><td>6.9</td></tr>
<tr><td>Dust trapping and PP pneumatic transport stack with metering unit (PP):</td><td>-</td></tr>
<tr><td>Line 1</td><td>43.8</td></tr>
<tr><td>Line 2</td><td>56.3</td></tr>
<tr><td>Dedusting unit (PP):</td><td>-</td></tr>
</table>

FCCW code	Description	Waste generating process	Waste hazard class	Physical and chemical properties			Intervals of waste production	Characteristics of temporary accumulation facilities	Removal intervals	Management method
				Physical state	Components	Quantity tpa				
		Line 1				4.9				
		Line 2				6.3				
4 34 110 03 51 5	Waste polyethylene and PE articles, uncontaminated (other than packaging)	PES packaging premises (PE pellets (transfer))	5	Single-material article	Polyethylene – 100%	44.6	Intermittent	Leak-proof metal container capacity 12 m^3 at outdoor site with asphalt concrete paving	every 2-3 days	On-site preparation and sale as off-spec product. In absence of consumers - transfer for recycling to specialized contractors.
		PEG packaging premises (PE pellets (transfer))				63.2				
		PP packaging premises (PE pellets (transfer))				-				
		- Line 1				44.0				
		- Line 2				56.8				
4 34 110 04 51 5	Waste polyethylene packaging, uncontaminated	PES packaging premises (new bags)	5	Single-material article	Polyethylene – 100%	0.3	Intermittent	Leak-proof metal container capacity 6 m^3 at outdoor site with asphalt concrete paving	monthly	Transfer to specialized contractors for recycling.
		PEG packaging premises (new bags)				0.4				
		PP packaging premises (new bags)				-				
		- Line 1				0.3				
		- Line 2				0.3				
4 61 010 01 20 5	Scrap and waste containing uncontaminated ferrous metals in the form of products and pieces	Electric fork lifts repair and maintenance	5	Solid	Iron - 95.5-98.0%; Iron oxides - 2.0-1.0%. Carbon - 3.0%, max.	0.6	Intermittent	Hard-paved outdoor site 3x8 m	Progressively, as waste is accumulated but no less than once every 11 months.	Recycling at specialized facility

FCCW code	Description	Waste generating process	Waste hazard class	Physical and chemical properties			Intervals of waste production	Characteristics of temporary accumulation facilities	Removal intervals	Management method
				Physical state	Components	Quantity tpa				
406 190 01 31 3	Other waste mineral oils	Air blower	3	Liquid in liquid (emulsion)	Petroleum products - 90-98% Water - 2-10%, may contain mechanical impurities	0.7	once in 6 months	No accumulation	As produced	Recycling at specialized facility
406 150 01 31 3	Waste mineral transmission oil	Electric fork lifts repair and maintenance	3	Liquid in liquid	Petroleum products - 90-98% Water - 2-10%, may contain mechanical impurities	1.7	After each 400 hours of operation	Leak-proof metal drums per GOST 13950-91, unit vol. 200 l at site with asphalt concrete paving	Progressively, as waste is accumulated but no less than once every 11 months.	Recycling at specialized facility
4 06 120 01 31 3	Waste mineral hydraulic oil, free of halogens	Electric fork lifts repair and maintenance	3	Liquid in liquid	Petroleum products - 90-98% Water - 2-10%, may contain mechanical impurities	0.4	once a year	No accumulation	As produced	Recycling at specialized facility
	Waste electronic equipment (computers and office appliances, accumulators and household appliances, and electric tools)	Office activities	4	Solid			Intermittent	Leak-tight metal container	Progressively, as waste is accumulated but no less than once every 11 months	Disposal at IMSW landfill Starting from 2021 - recycling at specialized facility
Ethylene store										
4 57 201 01 20 4	Waste expanded perlitic sand, uncontaminated	Perlite discharge from ethylene tanks	4	Solid	Silicon oxide 65-77%, Aluminium oxide 11-16%, Iron oxide - 0.5-6%, Calcium oxide - 0.1-3.5%,	44.7	once every 30 years	No accumulation	As produced	Disposal at specialized landfill

FCCW code	Description	Waste generating process	Waste hazard class	Physical and chemical properties			Intervals of waste production	Characteristics of temporary accumulation facilities	Removal intervals	Management method
				Physical state	Components	Quantity tpa				
					Potassium oxide and sodium oxide 3-10%					
9 21 210 01 31 3	Waste ethylene glycol anti-freeze	Changing liquid in ethylene vaporisation and overheating block	3	Liquid in liquid	Ethylene glycol - 60% Water - 40%	4.2	once every 5 years	No accumulation	As produced	Disposal at specialized landfill
4 06 130 01 31 3	Waste mineral industrial oil	Compressor oil change Chilling units	3	Liquid in liquid	Petroleum products - 90-98% Water - 2-10%, may contain mechanical impurities	0.3	once a year	No accumulation	As produced	Neutralization at specialized facility
4 34 110 04 51 5	Waste polyethylene packaging, uncontaminated	Perlite discharge from ethylene tanks (PE bags from perlite)	5	Single-material article	Polyethylene – 100%	0.1	once every 30 years	No accumulation	As produced	Transfer to specialized contractors for recycling
4 68 111 02 51 4	Ferrous metal containers contaminated with petroleum products (petroleum products content 15% and higher)	Compressor oil change in chilling unit, drums from oil	4	Single-material article	Iron, carbon - 97.5%, petroleum products - 2.5%	0.04	once a year	No accumulation	As produced	Recycling at specialized facility
Reagent facilities. Catalysts, reagents, oil store										
4 05 183 01 60 5	Waste packing board, uncontaminated	Materials unpacking. Reception, offloading and batching section, built-in premises with domestic facilities	5	Article of fibre material	Cardboard - 100%	0.04	Daily	Leak-proof container capacity 1 m^3 at outdoor site with asphalt concrete paving	Progressively, as waste is accumulated but no less than once every 11 months.	Transfer to specialized contractors for recycling

FCCW code	Description	Waste generating process	Waste hazard class	Physical and chemical properties			Intervals of waste production	Characteristics of temporary accumulation facilities	Removal intervals	Management method
				Physical state	Components	Quantity tpa				
7 33 220 01 72 4	Waste and sweepings from cleaning of storage facilities, low-hazard	Store premises cleaning	4	Mixed solid materials (including fibres) and articles	Paper, cardboard - 65%; Glass - 7%; Plastic - 14%; Dust, sand - 13%	6.4	Daily	Leak-proof container capacity 1 m^3 (2 pcs) at outdoor site with asphalt concrete paving	2 times per month	Disposal at specialized landfill.
Wastewater treatment plant										
	Biological sludge from wastewater treatment process (excess activated sludge)	Wastewater treatment plant	4			210	Continuous		Daily	On-site thermal treatment. Disposal of produced ash at IMSW landfill
	Screenings from wastewater treatment plant	Wastewater treatment plant	4			50	Continuous		Daily	Disposal at specialized landfill
	Spent sorbent (activated carbon)	Wastewater treatment plant	4			50	Intermittent		weekly	On-site thermal treatment. Disposal of produced ash at IMSW landfill
	Waste petroleum products removed by wastewater treatment	Wastewater treatment plant	3			1.4	Continuous		Daily	On-site thermal treatment. Disposal of produced ash at IMSW landfill

FCCW code	Description	Waste generating process	Waste hazard class	Physical and chemical properties			Intervals of waste production	Characteristics of temporary accumulation facilities	Removal intervals	Management method
				Physical state	Components	Quantity tpa				
	Sludge from wastewater treatment plant (from sedimentation tanks)	Wastewater treatment plant	4			1158.8	Intermittent		As produced	Disposal at specialized landfill
	Concentrate from wastewater desalination unit	Wastewater treatment plant	4			115.6 (105.1 m3/year)	Intermittent		As produced	Injection to formation

APPENDIX 6
FGBU “IRKUTSK UGMS” REFERENCE MEMO

Министерство природных ресурсов
и экологии Российской Федерации

Федеральная служба по гидрометеорологии
и мониторингу окружающей среды
(Росгидромет)

Федеральное государственное
бюджетное учреждение
«Иркутское управление по гидрометеорологии
и мониторингу окружающей среды»
(ФГБУ «Иркутское УГМС»)
Партизанская ул., № 76, г. Иркутск, 664047,
тел./факс: (3952) 20-68-90, e-mail: cks@irmeteo.ru

03.06. 2019 г. № 1862/32
На № 01-24/05/19 от 24.05.2019г.

Генеральному директору
ООО «Рэмболл Си-Ай-Эс»
И.Н.Сенченя

О предоставлении гидрологической информации

Высылаем интересующие Вас гидрологические данные по р.Лена – г.Усть-Кут.

Данные приведены в таблице 1 Приложения.

Приложение на 1 стр.

Начальник ФГБУ «Иркутское УГМС» А.М.Насыров

Исп. Овод Т.В.
Тел. 20-66-09

Приложение

Таблица 1

Гидрологические характеристики
р.Лена – г.Усть-Кут

Отметка нуля поста 281,47 м БС

Характеристика	Значение
Высший уровень воды за год, см:	
1%-ной обеспеченности	893
10%-ной обеспеченности	716
Высший наблюденный / год	934/2001

Примечание: уровни приведены над нулем поста.

Начальник ФГБУ «Иркутское УГМС» А.М.Насыров

APPENDIX 7

LAND RESOURCES OF INK’S UST-KUT INDUSTRIAL HUB AND LAND USE LIMITATIONS IN THE ADJACENT AREA

Index	INK facilities and activities		Land resources	Special land use conditions zones (SLUC Zones): Existing	Special land use conditions zones (SLUC Zones): Proposed
INK LLC Gas Program facilities under design, construction, and in operation					
I.1a	Pipeline system for the transportation of natural and associated petroleum gas processing products from the Yarakta OGCF, the Markovo OGCF to Ust-Kut	Linear section	A **130-meter**-wide ROW consists of land plot 38:18:000000:1322. The LPG pipeline and its service driveway, the cable communications line, and the 10kV overhead power transmission line use the same corridor. Besides, a brand-new facility, III.12, is being designed in the same corridor (a dry stripped gas (DSG) pipeline)	Buffer zone of the LPG trunk pipeline which extends **100 m** each side of the pipeline axis. A restricted development zone which extends **15 to 3000 m** from the pipeline axis, depending on the category of the facility. According to the general plan of the IPP (Irkutsk Polymer Plant), developed in 2017, the restricted development zone associated with the LPG gas pipeline is **300 m** wide within the area in question with respect to the IPP process zone. Buffer zone of the communications cable line which extends at least **2 m** each side. Buffer zone of the 10kV overhead power transmission line which extends **10 m** each side. Mandatory clear-cut strips should have the standard width of at least **6 m** (3 m on each side) along the communications cable route, and for the 10kV overhead line they should ensure the horizontal gap of **at least 3 m** from the outer wires to the crowns of nearby trees. Part of the corridor is located within the SPZ of the industrial hub, which includes the LPG and LGC Reception, Storage and Shipment Terminal (RSST), and the Gas Fractionation Unit (GFU).	Buffer zone of the proposed class I gas pipeline (for the transportation of DSG) will be **25 m** wide, i.e. no expansion of the existing **100 m wide** buffer zone is expected to be required. The minimum width of the restricted development zone will depend on the diameter of the pipeline and will be **50/20 m** for diameters ranging from 300 ÷ 600 mm for coniferous/deciduous forests and up to 500 m for industrial enterprises. Thus, the commissioning of the gas pipeline within the existing corridor will not require expansion of firebreaks, or such expansion will be negligible.
I.1b		Near-route installations	Within the borders of the Ust-Kut industrial district, there are two sites for near-route installations: 1) a hookup/pig receiver site at kilometer post (PK) 932 + 99, with the area of approximately **2.8** hectares; 2) a site for power plant intended for linear installations, with the area of approximately **1.8** hectares. Corresponding land plots have not been formed. Both sites can be used for housing near-route installations of Facility III.12 (a DSG pipeline)	Buffer zone which consists of a land plot with a closed boundary which is located **100 m** away from the borders of the specified facilities in every direction. One of the sites of near-route installations is within the SPZ of the industrial hub which includes the LPG/LGC RSST, and the GFU. Buffer zone of underground cable power transmission lines (UCPTL) which extends 1 m each side of the axis (for single-wire UCPTLs) or from outermost cables. A restricted development zone which extends 0.6 m from the UCPTL	It is assumed that the existing sites of near-route installations can be used for the construction of onshore DSG pipeline facilities
I.2	LPG reception, storage and shipment terminal		Located across six adjacent land plots, cadastral numbers 38:18:080101:176, :185, :175, :570(2), :47, :73, :1344, and :1279, with a total area of **48.6513** ha. It has a common border with Facilities I.1 and II.2.	An SPZ of the industrial hub which includes the LPG/LGC RSST, and the GFU. Firebreaks between the LPG storage tanks with a total capacity from 40,000 to 60,000 m3 (with LPG stored isothermally in above-ground tanks) and other facilities: 100 m from access railway tracks (the foot of the embankment or the edge of the cut) and common roads (the edge of the roadway); at least 1.5 times the height of the towers from overhead power transmission lines; 300 m from buildings and installations of the production, storage, and auxiliary areas of logistical bases or warehouses; 500 m from buildings and installations of the plant facilities (administrative) area; 200 m from flare units (flare stacks); 300 m from the borders (fences) of the adjacent areas; 100/20 m from coniferous/deciduous forests (from fences surrounding logistical bases or warehouses);300/3000 m from marine and river transport facilities, hydraulic structures, and bridges, with the warehouses located upstream/downstream; outside the corresponding SPZ but at least 500 m from residential and public buildings. Plots 38:18:080101:570 and :1344 are located within the water conservation zone and, in part, within the riparian protective belt of the river Lena. Plot 38:18:080101:1378 is classified as a protective forest (valuable forest, spawning protection forest belt) of the forest fund of the Osetrovsky forest district of the Ust-Kut forestry	No brand-new facilities will be constructed
II.1	LPG reception, storage and shipment terminal (expansion). LGC reception, storage and shipment terminal		Located across two land plots, cadastral numbers 38:18:080101:43 and :25, with a total area of **22.4089** hectares. It has a common border with Facility I.2		See pos. I.2
II.1res	Reserved (additional) land plots, cadastral numbers 38:18:080101:191, :1378, :1570, :188, :190, and :189, with a total area of **73.5947** hectares, adjacent to Facilities I.2 and II.1 and intended for expanding INK's Ust-Kut industrial hub, which border on the LPG RSST and the LGC RSST and are also part of the industrial complex. Approximately 40% of the area is already being used by the Company, particularly for housing temporary construction facilities. The same area will be used for the export terminal (Zone 2) of the IPP (hereinafter IPP shall mean Irkutsk Polymer Plant, including polymer production zone and MEG Plant with offsite facilities) with utility corridors. Plot :190, adjacent to the ROW of Federal Highway A-331 "Vilyui", was previously formed to provide a rest area for transit vehicles.				Prescribed minimum distances from storage facilities for combustible and flammable liquids (including methanol, ethanol, MEG) to buildings and installations of the loading area and the adjacent land plots
Ii.2	Ust-Kut GFU		The GFU footprint includes the adjacent plots with cadastral numbers 38:18:080101:39, :204 and :1619 with a total area of **29.6237** ha	An SPZ of the industrial hub which includes the LPG/LGC RSST, and the GFU. Protective forests (valuable forests, spawning protection forest belts) of the forest fund of the Osetrovsky forest district of the Ust-Kut forestry Buffer zones and restricted development zones associated with the GFU facilities	No brand-new facilities will be constructed
II.2res	Reserved (additional) land plots, cadastral numbers 38:18:080101:1742, and :1487, with a total area of **14.6878** ha, adjacent to Facility II.2. They border on INK's limestone quarry from the north (the quarry plot is not formed; the quarry and the mining allotment areas may overlap with the II.2res plots)				
III.1res	Reserved forest fund plots with a total area of **644.2813** ha, leased by INK until 2017 for a period of 49 years (cadastral numbers: 38:18:000000:1623**, :1634, :1624, :1625, :1435, :1430, :**1405, :1571) for constructing the IPP facilities and utility corridors as originally planned (Cape Tolstyi, spawn protection forests). Mostly unused (the southern part of plot :1623 is used to accommodate temporary construction facilities). The approved location of the			Protective forests (valuable forests, spawning protection forest belts) of the forest fund of the Osetrovsky forest district of the Ust-Kut forestry	SLUC zones associated with INK's proposed linear structures. Inter-site motor road (pos. III.5), technical corridors (pos. III.3, III.4, III.12)

Index	INK facilities and activities		Land resources	Special land use conditions zones (SLUC Zones) Existing	Special land use conditions zones (SLUC Zones) Proposed
	IPP site eliminates the need for constructing areal facilities on those plots; at the same time, the plots will be crossed by utility corridors (an inter-site highway, a gas pipeline, and other utilities)			SPZ of the industrial hub which includes the LPG/LGC RSST, and the GFU (partially) Buffer zones of 220 and 110 kV OHPTLs (partially)	SLUC zones associated with the 500 kV OHPTL under construction: a buffer zone (shown in accordance with the municipality's territorial planning materials), a sanitary gap (30 m to each side of the outermost wires)
III.1a	Polymer Production Facility (PPF)	Zone 1: process site	A land plot with an area of approximately **110 ha** adjacent to plot III.2a, bounded by cadastral plot No. 38:18:000010:1438 (leased by INK for the period of 49 years, i.e. until 2066, under Contract No. 91-163/17 dated June 26, 2017). A part of the "Option 1" site with the area of 430.4900 hectares, chosen for recategorizing forest lands as industrial lands (Forest Land Plot 86 Selection Certificate dated November 12, 2018, approved by Directive No. 3924-mr dated November 19,2018 of the Ministry of Forestry of the Irkutsk Region)	The forest plot may only be developed in accordance with the project documentation approved by the Ministry of Forestry of the Irkutsk region taking into account the requirements for the lessee contained in the forest lease	The size of an SPZ is set based on calculations of air pollution dispersal and physical factors (noise, vibration, electromagnetic fields, etc.), and subsequent field studies and measurements. The prescribed size of an SPZ is 1000 m from the IPP site borders The minimum distances from production facilities to the edges of forests are 100 m for coniferous forests, 50 m for mixed forests, and 20 m for deciduous forests[1] Prescribed minimum distances from storage facilities for combustible, flammable, and toxic liquids (including process pipelines connecting the IPP's Zone 1 and Zone 2 with one another and with the other areal facilities of INK's Ust-Kut industrial district (GDS, GFU, LPG/LGC RSST)
III.1b		Zone 2: export terminal	A land plot with an area of approximately **20 hectares** within the borders previously established to accommodate the LGC RSST (II.1) and the LPG RSST expansion (II.1res)	SPZ of the industrial hub which includes the LPG/LGC RSST, and the GFU. Prescribed minimum distances from storage facilities for combustible and flammable liquids and other buildings and installations of the LPG RSST	
III.2a	MEG Plant (IGCP)	Zone 1: process site	A land plot with an area of approximately **94 hectares** adjacent to plot III.1a, bounded by cadastral plots Nos. 38:18:000010:1438 (see pos. III.1a) and :1624 (formed to accommodate linear facilities). A part of the "Option 1" site with an area of 430.4900 hectares, chosen for recategorizing forest lands as industrial lands (Forest Land Plot 86 Selection Certificate dated November 12, 2018, approved by Directive No. 3924-mr dated November 19,2018 of the Ministry of Forestry of the Irkutsk Region)	From the west, the land plot borders on a mineralized firebreak surrounding the sawmill residue disposal site. The forest plot may only be developed in accordance with the project documentation approved by the Ministry of Forestry of the Irkutsk region taking into account the requirements for the lessee contained in the forest lease	
III.2b		Zone 2: export terminal	Two plots with a total area of approximately **3.4 hectares** inside the II.1 footprint	SPZ of the industrial hub which includes the LPG/LGC RSST, and the GFU. Prescribed minimum distances from storage facilities for combustible and flammable liquids and other buildings and installations of the LPG RSST	
III.2c		MEG process pipeline between Zone 1 and Zone 2	No plots have been formed. The length of the pipeline between Zones 1 and 2 of the MEG Plant is **4730 m**, the off-site segment length is approximately **3600 m** (part of the pipeline will pass through the LPG/LGC RSST site). The size of the ROW will be determined by the project documentation and can be approximately assumed to be **20 m** (the minimum width of a trunk pipeline ROW on forest lands), which corresponds to a land plot of **7.2 hectares.** Excluding the areas already included in INK's existing utility corridors, an additional 2.4 ha of land should be allocated according to the Consultant's preliminary estimate.	SPZ of the industrial hub which includes the LPG/LGC RSST, and the GFU. Prescribed minimum distances from storage facilities for combustible and flammable liquids and other buildings and installations of the LPG RSST Buffer zones of the ROW facilities in operation, provided under pos. I.1 Protective forests (valuable forests, spawning protection forest belts) of the forest fund of the Osetrovsky forest district of the Ust-Kut forestry	
III.3a	Construction of plant facilities and an accommodation camp at the Irkutsk Polymer Plant, and streamlining of communication links between INK's enterprises in the Ust-Kut industrial district	Plant facilities area	A land plot with an estimated area of **4 hectares**, adjacent to plots III.1a and III.2a, allocated to accommodate the plant facilities area common to the PPF and the MEG Plant. Adjacent to the IPP process site (Zone 1 of the PPF and the MEG Plant). Located within the bounds of cadastral plot No. 38:18:000010:1438	The forest plot may only be developed in accordance with the project documentation approved by the Ministry of Forestry of the Irkutsk region taking into account the requirements for the lessee contained in the forest lease	
III.3b		Rotational accommodation camp (RAC) for 7,000 people.	A land plot with an estimated area of **16.4 hectares** adjacent to the PPF process zone from the north. Located within the bounds of cadastral plots Nos. 38:18:000010:1438 and :1628		Land use is planned during the construction phase of the PPF since rotational personnel is not allowed to stay within the SPZ for more than 2 weeks. The contribution of rotational accommodation camp sources should be taken into account when planning construction-phase environmental impacts.
III.3c		Temporary buildings and installations (TBI) site	A land plot with an estimated area of **61.6 hectares** adjacent to the PPF process zone from the northwest. Located within the bounds of cadastral plots Nos. 38:18:000010:1438 and :1628		Land use is planned during the construction phase of the PPF and the MEG Plant. The contribution of sources at the temporary buildings and installations site should be taken into account when planning construction-phase environmental impacts of the IPP. Upon completion of the construction, the territory will become part of the IPP's buffer zones and sanitary gaps.
III.3d		Reserved area adjacent to the IPP process site	Formed by the parts of cadastral plots Nos. 38:18:000010:1438, :1488, :1489, :1628, which are not occupied by the IPP process site (735.8274 hectares minus the area occupied by the IPP process site and IPP plant facilities, approximately **514 hectares**). The plots with cadastral numbers :1488 and :1489 are leased for the period of 49 years (until 2067) under Contract No. 91-212/18 dated April 16, 2018. A part of this forest land has been approved for recategorization as industrial land (Forest Land Plot 86 Selection Certificate		Upon completion of the construction, part of the reserved territory will be subject to the limitations of the IPP's buffer zones and sanitary gaps

[1] As a general rule, when constructing production facilities in forests, if clearcutting is required for the construction, the specified distances to coniferous forests may be reduced by half. For petrochemical enterprises, such a reduction is not allowed, and a plowed strip of land at least 5 m wide around the enterprise should be established alongside the forest edge. In the absence of special requirements for gas chemical industry enterprises, the Consultant recommends using the figures prescribed for petrochemical industry enterprises as guidance.

Index	INK facilities and activities		Land resources	Special land use conditions zones (SLUC Zones)	
				Existing	Proposed
			dated November 12, 2018, approved by Directive No. 3924-mr dated November 19,2018 of the Ministry of Forestry of the Irkutsk Region)		
III.3e		Sites for the proposed linear infrastructure facilities associated with the IPP process site	Formed by cadastral plots Nos. 38:18:000010:1513 (36.8540 hectares), :1509 (6.4021 hectares), :1511 (56.4508 hectares), :1510 (15.4047 hectares), :1650 (7.8550 hectares), :1651 (28.7114 hectares), :1652 (13.9110 hectares), :1644 (43.7908 hectares), :1648 (68.3650 hectares), and also by 2 plots with registered borders but without any numbers or attributes being assigned. The total area of the plots, **294 ha,** is preliminary since the formation process has not been completed. According to the Consultant's preliminary estimates, the minimum area of land plots which are necessary in addition to the ones already formed for the construction of INK's linear facilities (pos. III.2c, III.3f, III.4b, III.4d, III.4f, III.4h, III.5, III.9b, III.9c, III.12) is 62 ha, and the total area for that position is 357 ha. Unlike the process sites, those plots will not be used in their entirety for the construction of any facilities. Their borders have been set in view of possible rerouting of the corresponding linear facilities during the design phase and will include a ROW for the construction of facilities and areas permanently allocated for the construction of above-ground installations (OHPTL towers, inspection manholes for water conduits and sewers, signage for all categories of underground pipelines, etc.)	In connection with their significant linear extent, the plots cross SLUC zones of several categories: the water conservation zone of the river Polovinnaya; the SPZ of the industrial hub which includes the LPG/LGC RSST, and the GFU; buffer zones of the ROW facilities in operation, provided under pos. I.1	Terms of land use will be determined by the composition and parameters of linear facilities located on the land plots
III.3f		The ROW between the GFU and the IPP Zone 1 sites for the installation of process pipelines (including an ethane/propane mixture pipeline for the PPF) and other linear facilities	No plots have been formed. The length of the off-site segment of the corridor is **3700 m** (a part of the pipeline will pass through the LPG RSST site). The size of the ROW will be determined by the project documentation and can be approximately assumed to be **20 m** (the minimum width of the ROW of a trunk gas pipeline on forest lands), which corresponds to the land plot area of **7. 4 hectares**	SPZ of the industrial hub which includes the LPG/LGC RSST, and the GFU. Prescribed minimum distances from storage facilities for combustible and flammable liquids and other buildings and installations of the LPG RSST Buffer zones of the ROW facilities in operation, provided under pos. I.1 Protective forests (valuable forests, spawning protection forest belts) of the forest fund of the Osetrovsky forest district of the Ust-Kut forestry	The composition and parameters of SLUC zones will be determined by the composition and technical characteristics of linear facilities within the ROW
III.3g		The ROW between the GDS and the IPP Zone 1 sites for the installation of process pipelines (including a fuel gas pipeline) and other linear facilities	The length of the off-site segment of the ROW is approximately **500 m**. The size of the ROW will be determined by the project documentation and can be approximately assumed to be **20 m** (the minimum width of the ROW of a trunk gas pipeline on forest lands), which corresponds to the land plot area of **1.0 ha.** The corridor fully fits inside the borders of the previously allocated land plots (pos. III.3e), so there's no need for additional land allocation.	Protective forests (valuable forests, spawning protection forest belts) of the forest fund of the Osetrovsky forest district of the Ust-Kut forestry	
III.4a	Construction of water supply and wastewater removal facilities at the Irkutsk Polymer Plant, an accommodation camp and a residential compound for Irkutsk Oil Company LLC	Onshore water technical water intake facilities and facilities for discharging treated wastewater into the Lena river with adjoining water conduit and sewer segments	Land plot 38:18:000000:2151 (a 4-contour plot with a total area of **0.9371 hectares**) is formed for the installation of a technical water conduit and a treated wastewater sewer via two parallel corridors from the Lena river waterline to the IPP Zone 2 (pos. III.1b), which will cross Federal Highway A-331 "Vilyui" and the access railway tracks to the Alrosa facilities.	Water conservation zone, riparian protective belt, and riverside belt of the river Lena Roadside belt of Federal Highway A-331 "Vilyui" Buffer zone of the access railway tracks SPZ of the industrial hub which includes the LPG/LGC RSST, and the GFU	The distance between sewer networks and production water supply networks, regardless of the material and the diameter of the pipes, as well as of the nomenclature and characteristics of the soils, should be **at least 1.5 m**. The width of water conduit sanitary protection belt on both sides of the outermost water supply pipelines should be: (i) at least 10 m in the absence of groundwater for water pipeline diameters of up to 1000 mm and **at least 20 m** for water pipeline diameters over 1000 mm; ii) **at least 50 m** in the presence of groundwater, regardless of the diameter of the conduit. Restricted development zone which extends **5 m** each side of the outermost water supply pipelines and pressure sewers, and **3 m** each side of gravity sewers (gravity/pressure sewers will be used according to the project documentation). No sanitary protection zone is set for treated wastewater sewers. The quality of water transported by drainage channels is in accordance with the conditions for its discharge into surface water bodies; according to paragraph 10 of Article 65 of the Russian Federation Water Code, no water conservation zones are set for rivers or parts thereof which flow inside enclosed drainage channels.
III.4b		Water utilities: a conduit for technical water taken from the Lena river and a treated wastewater sewer (for discharging wastewater into the Lena)	Off-site segment of the ROW of water-carrying utilities (technical water and treated wastewater) from the LPG RSST border (pos. I.2) to the IPP process zone border (pos. III.1) with the length of **approximately 4 km**. No land plots have been formed for the utilities, including near-route installations. A twin-pipeline underground water conduit with the pipe diameter of 600 mm requires a **26 m** wide ROW which is equivalent to a land plot with the area of **10.4 hectares**; a treated wastewater sewer (400 mm diameter single-line gravity/pressure sewer) requires a **20 m wide ROW** and a **8 ha** land plot. Since the water conduits and the sewer will be installed in the same ROW as the gas pipelines, the additional land areas required for Facilities III.4b and III.3f are tentatively estimated at **36.4 ha** by the Consultant	SPZ of the industrial hub which includes the LPG/LGC RSST, and the GFU. Prescribed minimum distances from storage facilities for combustible and flammable liquids and other buildings and installations of the LPG RSST Buffer zones of the ROW facilities in operation, provided under pos. I.1 Protective forests (valuable forests, spawning protection forest belts) of the forest fund of the Osetrovsky forest district of the Ust-Kut forestry	

Index	INK facilities and activities		Land resources	Special land use conditions zones (SLUC Zones)	
				Existing	Proposed
III.4c		Local wastewater treatment plants (LWTP)	Two local wastewater treatment plants will be constructed: the first one within the borders of the IPP process site, the second one within the TAC site, III.3, for 700 people (both without the need for additional land acquisition)	SPZ of the industrial hub which includes the LPG/LGC RSST, and the GFU. Prescribed minimum distances from storage facilities for combustible and flammable liquids and other buildings and installations of the LPG RSST	SPZ with a prescribed size of 300 m (set for local treatment facilities comprising mechanical and biological wastewater treatment with thermomechanical treatment of sludge in enclosed areas with a total capacity of over 5,000 but no more than 50,000 m^3 per day). Sanitary protection zones which extend from wastewater treatment plant to the borders of residential areas, public building sites, and food industry enterprises (taking into account their future expansion) should be set in accordance with the sanitary regulations; any departure from such regulations should be approved with the sanitary and epidemiological supervision authorities.
III.4d		Groundwater intake structure with a first elevation water pumping station (WPS1)	Artesian wells (a total of 10), groundwater intake structure site with a WPS1 (0.56 ha) and a network of water conduits connecting the wells and the site near the Polovinka lodge, will be located on land plots 38:18:000010:1513 (36.8540 ha) and :1509 (6.4021 ha), will not occupy their entire area. The area to be occupied by the water conduits and the wells is yet to be determined.	Water conservation zone of the Polovinnaya river (the water intake site and part of the water conduit)	Mining allotment and a sanitary buffer zone (SBZ) of the underground water supply source. Since the wells are associated with the left and right sides of the valley of the Polovinnaya river, the expected SBZ boundaries will extend both in the opposite direction from the IPP process site (which will not impose any limitation on the use of the land plots formed by INK) and in the direction of the IPP, and in that case the matter of application of land use limitations will be decided based on the corresponding SBZ project depending on the feeding conditions of the productive aquifer. According to Consultant the likelihood of the IPP process zone ending up inside the first and the second SBZ belts where limitations are the strictest is negligible because the wells are located at a substantial distance (over 2 km) from the plant site. There is a likelihood of the third SBZ belt and the IPP SPZ partly overlapping, which will require expansion of the corresponding soil and geological environment monitoring program
III.4e		Wastewater treatment plant (WTP) with a second elevation water pumping station (WPS2)	Two siting alternatives are being considered for the WTP: (1) an area of approximately 1.3 ha on the 700-person TAC site (III.13) without the need for additional land acquisition; (2) an area located 1.1 km northeast of the IPP (PPF) process zone within the water pipeline ROW parallel to the trunk gas pipeline; the area will be located on land plot 38:18:000010: 1511 (56.4508 ha); its size and configuration are yet to be determined.	Certain limitations are possible due to the necessity of maintaining minimum gaps from the other TAC facilities (III.13) and the TBI site (III.c) for alternative 1, and from the trunk pipeline ROW facilities for alternative 2.	Sanitary buffer zone for water supply installations located outside the water intake structure site will be a first belt SBZ (subject to strict limitations), its width shall be **at least 30 m** from the walls of standby and regulating tanks, filters and contact flocculator; **at least 15 m** from the rest of the facilities (settling tanks, chemical feed plant, pumping stations, etc.)
III.4f		Water conduits connecting the water intake structure (III.4d) and the wastewater treatment plant (III.4e)	Due to the existing WTP (III.4e) siting alternatives, two water conduit siting alternatives are being considered: (1) from the water intake structure site to the southeast across land plots 38:18:000010:1513 and :1509, and then to the southwest inside a common ROW with the treated wastewater sewer up to the TAC (III.13) site, the offsite length being 3,100 m and the prescribed ROW width 23 m (7.1 ha); (2) from the water intake structure site to the southeast across land plots 38:18:000010:1513, :1509 and :1511 up to the trunk gas pipeline ROW, then to the south-southwest parallel to the ROW up to the WTP site, the offsite length being 1,580 m and the prescribed ROW width being 23 m (3.6 ha)		The distance between sewers and industrial water supply pipelines, irrespective of the material and diameter of the pipes and soil varieties and characteristics, should be **at least 1.5 m.** The width of the water conduits' sanitary protection belt is measured on both sides of the outermost pipelines: (i) in the absence of groundwater – **at least 10 m** with water conduit diameters up to 1000mm and **at least 20 m** with water conduit diameters over 1000mm; (ii) in the presence of groundwater – **at least 50 m** regardless of the water conduit diameter. Restricted development zone which extends **5 m** each side of the outermost water supply pipelines and pressure sewers, and **3 m** each side of gravity sewers (gravity/pressure sewers will be used according to the project documentation). No sanitary protection zone is set for treated wastewater sewers. The quality of water transported by drainage channels is in accordance with the conditions for its discharge into surface water bodies; according to paragraph 10 of Article 65 of the Russian Federation Water Code, no water conservation zones are set for rivers or parts thereof which flow inside enclosed drainage channels.
III.4g		Wastewater discharge facilities for discharging domestic wastewater and stormwater into the Polovinnaya river valley	An area of approximately 0.16 ha within the bounds of land plot 38:18:000010:1509	Water conservation zone and riparian protective belt of the Polovinnaya river	
III.4h		Gravity sewer for treated wastewater with the start point at the 700-person TAC's LWTP site (III.13) and the end point at the wastewater discharge facilities site (III.4g)	This option is an alternative to wastewater discharge into the Lena river (III.4a, III.4b), it provides for constructing two sewer lines inside a common ROW with the water conduit (III.4f), the offsite length being approximately 2,950 m and the prescribed ROW width being 23 m (6.8 ha)	For a part of the land plot – water conservation zone and riparian protective belt of the Polovinnaya river	

Index	INK facilities and activities	Land resources	Special land use conditions zones (SLUC Zones)	
			Existing	Proposed
III.5	Inter-site motor road	A linear facility with an axial length of approximately **5.8 km** (as designed), which connects the IPP's Zone 1 with Federal Highway A-331 "Vilyui". The design width of the Federal Highway roadway is 8 m. The average land acquisition requirement for a Category IV road with cross slopes ranging from 1:20 to 1:10 is 3.6 hectares per road kilometer, if acquired for permanent use, and 2.0 hectares per kilometer, if acquired for temporary use, which corresponds to **21 hectares** of land plots under long-term lease (or a **36 m** wide ROW) and another **12 hectares** of land under short-term lease[2]. Starting from the point when the road joins Federal Highway A-331 "Vilyui" inside its ROW (38:18:080101:84), the inter-site motor road will successively cross land plots Nos. :1570, :1571, :1634, :1430, :1624, :1625 (formed for the construction of INK's Ust-Kut Industrial hub facilities), :779, :777 (forest fund), :1322, :1510, and :1511. The location of the central axis of the motor road has been adjusted by the Consultant to conform to the borders of the formed land plot (near the point of intersection with the gas transportation system, Facility I.1a). With the ROW being 36 m wide, an additional 13.6 ha of land will be needed on top of the available land plots	For the most part, the ROW will pass through protective forests (valuable forests, spawning protection forest belts) of the forest fund of the Osetrovsky forest district of the Ust-Kut forestry. The ROW will cross 500kV, 220kV, and 110kV high-voltage power transmission lines (and their buffer zones), INK's ROWs (with their buffer zones and fire breaks). The site where the road will join Federal Highway A-331 "Vilyui" is located within the water conservation zone of the river Lena	The size of the roadside belt will be 50 m, which corresponds to the total area of the road with the roadside belt of approximately 62 hectares The distance from the edge of the roadway to the outer row of trees acting as a living snow fence is determined based on the estimated snowdrift amounts and can range from 19 to 156 m
III.6	Renovation of a section of the Tulun-Bratsk-Ust-Kut-Mirny-Yakutsk Federal Highway, A-331 "Vilyuy", km19 + 300 - km20 + 500, to ensure transportation of large-sized and heavy equipment to the prospective construction site of the Irkutsk Polymer Plant in Ust-Kut	The axial length of the road section under repair is **1381.6 m**. The ROW is comprised of a land plot of variable width, with a total area of approximately **3 hectares.**	The road under renovation is a Category IV road with a 50 m wide roadside belt. Some of its sections pass through the water conservation zone of the river Lena.	No changes will be made to the land use conditions for the roadside belt
III.7	Berth on the river Lena for unloading large-sized equipment	The onshore part of the berthing facilities includes land plot 38:18:080101:20 (0.4429 hectares) and :6 (0.3072 hectares), as well as the adjacent non-partitioned territory (the total area of the entire onshore portion being **1.8080 hectares**). According to the general plan (022-2018-00-OTR), the size of the adjacent water area of the river Lena is **1.0850 hectares**	The plots are located: - within the water conservation zone, and (partially) within the riparian protective belt and the riverside belt of the river Lena; - within the SPZ of the industrial hub which includes the LPG/LGC RSST, and the GFU; - within the roadside belt of Federal Highway A-331 "Vilyuy".	The facility will be used during the construction phase, therefore the question of setting up SCUC zones has not been considered
III.8	Power supply facilities of the Irkutsk Polymer Plant of Irkutsk Oil Company LLC	Will be constructed within the borders of the IPP process site and other areal installations.	SPZ of the industrial hub which includes the LPG/LGC RSST, and the GFU. Prescribed minimum distances from storage facilities for combustible and flammable liquids and other buildings and installations	The contribution of power supply facilities should be taken into account when setting up the IPP's SPZs
III.9	Power supply facilities of the Irkutsk Polymer Plant	Land acquisition will be required to accommodate twin 220 kV high-voltage overhead power transmission lines to be installed on the stretch of land from the site of the 500/220 kV Ust-Kut substation (No. 38:18:000010:1386) to the border of the IPP (Polymer) main process site; the length of the high-voltage line will be **8.3-8.5 km** if constructed according to the materials of preliminary planning of the land plot contained in the MEG Plant's general technical solutions document (volume code 70605-P-000-PZU-TCh), **7.2 km** if constructed on the land plot for the OHPTL's ROW, formed and registered in the cadaster, as proposed by the Consultant.[3] The prescribed ROW width for the construction of a 220kV overhead power transmission line is 12 to 32 m depending on the type of support towers to be used for the Project. The land plot formed to accommodate the overhead power transmission line, cadastral number :1648 (68.3650 ha), has variable width ranging from 100 to 120 m. In addition to the ROW, temporary plots will be allocated to the OHPTL during the construction phase for the installation of towers. The size of such plots for a 220kV OHPTL and steel towers will be 560-700 m^2. The plots allocated for the installation of OHPTL support towers, to be used on a continuous basis and in perpetuity, will be sized from 5.5 to 37 m^2 for intermediate towers, from 5.5 to 446 m^2 for angle anchor towers; the number of towers can be roughly estimated by analogy with the existing 220kV high voltage line (the new line will be constructed side by side with the existing one): approximately 20 intermediate towers and 4 angle anchor towers for each line, i.e. 40 intermediate and 8 angle anchor towers with land plots sized 43 to 220 m^2 for intermediate towers and 289-418 m^2 for angle towers. The average tower land plot sizes of the proposed 220 kV OHPTL being approximately 100 and 300 m^2, respectively, the total area of permanent land acquisition will be **0.64 ha**	On one of the plots, the ROW of the OHPTL will overlap with the SPZ of the industrial hub which includes the LPG/LGC RSST, and the GFU. When passing through the valley of Sukhoy stream, the power transmission line will cross its water conservation zone (50 m) and riparian protective belt (50 m).	Buffer zone: 20 m each side of the power transmission line, counting from the outermost wires in non-deflected position. Mandatory clear-cut strips (paths) whose width is determined depending on the prospective height of the plantings. The minimum allowable distance the crowns of the trees and the outermost wires of a 220kV overhead power transmission line is 5 m (measured horizontally)

[2] The proposed inter-site motor road has been tentatively categorized as a category IV road with two-lane traffic, intended for rough terrain, to be constructed on embankments with slopes of variable steepness. Further clarifications are required based on the design solutions taking into account the requirements of Article 26 of the Federal Law No. 257-FZ dated November 8, 2007 "On motor roads and road-related activities in the Russian Federation...", and Government Resolution No. 717 dated September 2, 2009

[3] The location of the 220kV OHPTL proposed by the Consultant differs from the one specified in the design documentation but corresponds to the borders of the land plots being formed; it prevents the OHPTL from overlapping with the GDS site and from crossing the gas transportation system (Facility I.1a)

Index	INK facilities and activities	Land resources	Special land use conditions zones (SLUC Zones)	
			Existing	Proposed
III.9b	Power supply facilities for the 700-person TAC (III.13) and the TBI site (III.3c)	An additional land acquisition with the estimated area of 2.9 ha (a ROW 8 m wide) for the construction of a temporary 10 kV power transmission line from the Lesniye Prichaly substation to the TAC complete transformer substation is proposed within the TAC footprint.	The main part of the PTL ROW will pass across protective forest land plots (valuable forests, spawning protection forest belts) of the of the forest fund of the Osetrovsky forest district of the Ust-Kut forestry. The PTL is expected to cross the ROWs of 110kV, 220kV and 500 kV PTLs. A part of the ROW will be located within the SPZ of the LPG/LGC RSST and GFU industrial hub	Buffer zone: 10 m each side of the power transmission line, counting from the outermost wires in non-deflected position. Mandatory clear-cut strips (cut-through paths) whose width is determined depending on the prospective height of the plantings. The minimum allowable distance the crowns of the trees and the outermost wires of a 220kV overhead power transmission line is 5 m (measured horizontally)
III.9c	Power supply facilities for the groundwater intake site	The connection point of the 10kV power transmission line (approximately 1400 m long) supplying power to the water intake structure is located inside the trunk gas pipeline ROW (land plot 38:18:000000:1322). Then the PTL passes across INK's forest land plots 38:18:000010:1511, :1509 and :1513, within which an 8 m wide ROW will occupy the area of approximately 1.1 ha. Since the PTL was sited along the borders of the previously formed land plots, the acquisition of additional forest areas of approximately 0.1 ha may be required once the PTL route has been finally determined. The PTL endpoint, the "Vodozabor" complete transformer substation, is located at the groundwater intake site.	A part of the PTL ROW is located within the water conservation zone of the Polovinnaya river and the buffer zone of the linear facilities built inside the trunk gas pipeline ROW.	
III.12	Yarakta OGCF - Markovo OGCF - Ust-Kut gas pipeline (Project Complex No. 1117. Code 1117-PP-001.000.000)	There are 3 main design options, each of which includes a set of linear facilities with service driveways and near-route areal installations. Under any of the options the pipeline will terminate at the gas distribution station (GDS). The main part of the pipeline will be located within the ROW previously formed for Facility I.1 which has the width of **130 m** (lands plot 38:18:000000:1322). The pig receiver site (0.4 ha) and the GDS site (1.6 ha) will be located on the right side of the pipeline ROW based on the direction of gas flow, at the distances of 320 and 500 m from the border of the ROW, respectively; no land plot has been formed for the former; the GDS site, as currently designed, partially falls within the borders of a previously formed land plot, which is still unnumbered. The length of the gas pipeline route passing between the existing ROW (:1322) and the GDS site will be approximately **500 m**	See pos. I.1	So far, no decisions have been made on the volume of gas to be transported and, accordingly, on the pipeline diameter. Those parameters will determine the width of the ROW, therefore a possibility exists no additional lands will need to be added to the existing ROW of Facility I.1. The proposed Class I gas pipeline (for DSG transportation) will have a **25 m** wide buffer zone; a **100 m** wide buffer zone will be set up around the near-route installations (see pos. I.1). The minimum width of the restricted development zone will depend on the diameter of the pipeline, and for the range between DN 300 ÷ 600 mm it will be **50/20 m** for coniferous/deciduous forests, and up to 500 m for industrial enterprises. Near-route facility will have a 100m buffer zone.
III.13	Accommodation camp for 700 people within INK's Ust-Kut industrial district	The exact location and parameters of the land plot are to be determined. It is known it will be located outside the prescribed SPZ of the Irkutsk Polymer Plant and within the borders of the land plots already leased by the Company.	Since the duration of continuous stay of rotational personnel within the SPZ (pos. III.3b) is limited to 2 weeks, the need to hire personnel that will spend more time at a temporary accommodation camp means that the accommodation camp should be placed outside the existing and proposed SPZs of the Ust-Kut industrial hub	
III.14	INK's accommodation camp for 3000 people within the urban settlement of Ust-Kut	The exact location and parameters of the land plot are to be determined. The REB, YaGU and Mostootryad neighborhoods in Ust-Kut are being considered as alternatives.		
Other INK facilities and activities				
IOK-1	INK's Technological Transport Administration (TTA) base	The acquired land comprises a large number (more than 20) of cadastral plots. It is roughly shown on schematic maps which combine adjacent parts of the base territory into a common area of approximately **17.3 ha**	SPZ of the industrial hub which includes the LPG/LGC RSST, and the GFU. Prescribed minimum distances from storage facilities for combustible and flammable liquids and other buildings and installations of the LPG RSST	No brand-new facilities will be constructed
IOK-2	Site for construction of access roads and railway tracks to the LPG/LGC RSST and GFU sites and for placement of temporary construction facilities	The acquired land comprises cadastral plots Nos. 38:18:000000:895, 38:18:070101:389, 38:18:080101:184, :186, :194, :200, :201, :202, :203, :204, :205 and others. The total area is approximately **104 hectares**		The size of sanitary gaps is set based on calculations of air pollution dispersal and physical factors (noise, vibration, electromagnetic fields, etc.) and on subsequent field studies and measurements
IOK-3	Extraction of limestone in quarries (IOK-3a - north of the II.2res land plots, IOK-3b - west of TSLK's sawmill residue storage site)	The land plot occupied by the IOK-3a quarry has not been formed. The quarry area is approximately **12 hectares**. Part of the IOK-3b quarry (with the total area of approximately **8 hectares**) is located within the borders of the forest land plot with the cadastral number 38:18:000000:746, the other part is within the contour of a previously formed land plot which has no assigned number or attribute information	SPZ of the industrial hub which includes the LPG/LGC RSST, and the GFU. Mining allotment	The planned gas pipeline in the direction of Ust-Kut crosses the site of the IOK-3a quarry. No information on its development timeframe or subsequent remediation has been provided by the Company.
IOK-4	Operation of dirt roads connecting the service driveway (plot I.1) with Federal Highway A-331 "Vilyui", and the IOK-3b quarry with plot IOK-2	Roads with a total length of approximately **15 km** cross lands of various categories (industrial, transport, and forest lands), including those leased by INK.	Two of the four roads pass through the valleys of small watercourses which are partly located within the water conservation zone; the third is located within the SPZ of the industrial hub which includes the LPG/LGC RSST, and the GFU; the fourth between the industrial hub and one of the limestone quarries	The facility will be used during the construction phase, therefore the question of setting up SCUC zones has not been considered
IOK-5	Operation of temporary accommodation camps (TACs)	The TACs are located on the land plots leased by INK. (See pos. INK-2, II.1res and III.1res)	One of the TACs (the western one) is located within the SPZ of the industrial hub which includes the LPG/LGC RSST, and the GFU.	
Prospective INK facilities				
IOK-6	Construction of a fuel gas pipeline in the direction of Ust-Kut and Ust-Ilimsk	The exact location and length of gas pipelines are to be determined. Both structures will be installed from the GDS site in the western direction.	SPZ of the industrial hub which includes the LPG/LGC RSST, and the GFU. Prescribed minimum distances from storage facilities for combustible and flammable liquids and other buildings and installations of the LPG RSST	For trunk gas pipelines, see pos. III.2. For gas distribution networks – 2 m buffer zone each side of the central axis and 6 m wide firebreaks in wooded areas

APPENDIX 8
ITEMISED LIST, SCOPE AND PARAMETERS OF PPF FACILITIES

Index	Description
	1. Polyethylene production process units
1100	Package pyrolysis unit
1200	PE unit for production of linear low density polyethylene / high density polyethylene
1300	Package reactor unit for linear alpha-olefins production (synthesis) from ethylene and fraction C5+ hydrogenation
	2. Polyethylene production OSF facilities at the process site
2110	Process units feedstock storage tank farm
2120	Process units feedstock storage tank farm pumping station
2130	Liquid ethane and ethylene vaporisation block
2150	Electric substation with instrument room
2210	Tank Farm 1. Propane and butene-1 tank farm with a pumping station, title 2220 (former)
2230	Tank Farm 2. Liquid hydrocarbons tank farm with a pumping station
2250	Ethane gas vessel
2270	Flare system
2300*[1]	Gas custody transfer metering station
2410	Hydrocarbon liquids discharge module
2420	Container site
2440*	Alkali reception and dilution facilities
2450*	Residual product vessels
2455*	Incinerator for disposal of residual products and exhaust air
2460	Hydrogen facilities
2465*	Process area inter-shop communications
2510/2520	Nitrogen station with air compressor
2620	Condensate station
	3. Polyethylene production OSF facilities at the offloading site
3100	Reagents, catalysts and chemicals unloading terminal
3200	Commercial polyethylene offloading terminal
3300	Container site at the offloading site
3310	Loaders' garage
3320	Office and welfare building ABK
3325*	Gas treatment station 2
3330*	Boiler house 2 with a water treatment unit
3340	Process-and-storm water pumping station and network
3345	Storm water pumping station and network
3350	Domestic water pumping station and network
3355	Domestic wastewater septic tank
3360	CDER facilities at the offloading site
3365	Stirn water tank
3375	River water settling tank
3370*	River water filtering building
3380/1.2	Process water tank
3385	Process-and-storm water tank
3390*	2nd lift pumping station building
3400	Weighbridge at the offloading site
3405	Offloading site check point
3410	Offloading site inter-shop communications

[1] Items marked with * will be re-designed, in accordance with INK letter of 12.07.2019 No. K-633 20-831

Index	Description
3415	Plant fence (offloading site)
3420	Motor road along offloading site external fence
	4. Polyethylene production water supply facilities at the process site
4100*	Water treatment unit
4150*	Gas treatment station 1 for boiler house 1
4200*	Boiler house 1 with heating units for boiler water (title 2430), heating water and circulating ethylene glycol solution (title 4270)
5100*	River water intake facilities with 1st lift pumping station
5105	Treated wastewater discharge outlet
5210*	Service water and fire water storage tanks
5220	Water recycling system 1
5215	Service water and fire water pumping station with a foaming agent storage facility (title 5213)
5250/1.2	Communications tower
5300*	Wastewater treatment facilities with biodegradation facilities for wastewater sludge and excess biological sludge
	5. Polyethylene production infrastructure facilities at the Facility / site
7000*	Office building for engineerign technicians
7010*	Central control room
7020	Laboratory facilities (laboratory building with a chemicals and materials store, title 7025)
7030	Former welfare building with a medical station, title 7060
7040	Emergency fire service facilities (including a garage, special machinery parking lot, title 7045, smoke and heat simulation training facility, title 7050, sports ground title 7055)
7070	Metrological laboratory building
7080*	Service facilities (mechanical repair, electrical, metals and welding laboratory) with a cold store for materials and equipment under maintenance, title 7085 and a warm store for spare components, title 7530
7090	Checkpoints at the process site
7100*	Laundry and dry-cleaning building
7120	Warm garage with a repair bay and outdoor parking lot
7115	Company vehicles parking lot
7170-2	CDER facilities at the process site
7180	Cargo vehicles parking lot
7190	Passenger vehicles parking lot
7200	Canteen with CDER facilities, title 7170-1
7300*	Plant main office building with a canteen, title 7200 - two halls 80+20=100 persons and shelter, title 7170-1
7400	On-site roads and pathways
7450	Plant fence (process site)
7460	Motor road along process site external fence
7470	Weighbridge at the process site
7510	Consumables store
7520	Chemicals and catalysts store
7530	Spare parts store (electrical, ICA, valves, etc.)
7540	Spent materials and packaging store
	6. Communications and other polyethylene production facilities
8000	Inter-zone process pipelines and communication, electrical, instrumentation lines (inter-plant pipelines between IPP process site and LPG RS&O, title 8100, inter-block process pipelines between the process site and offloading site, title 8200, inter-block process water and wastewater pipelines between the process site and water abstraction and discharge facilities, title 8300, inter-block drinking water pipelines from the intake, drinking water treatment plant to the process site, offloading site, and LPG RS&O, title 8400, inter-plant communication, electrical, instrumentation lines outside the process site, title 8720)

Index	Description
8500	Pipelines between IPP offloading site and LPG RS&O
8700	Railway tracks at the PE offloading site
8710/1.2	Transformer substations for OSF facilities
8730	Area lighting including perimeter (process site and offloading site)
8800*	DSG pipelines from automated gas distribution station to the plant boundary