Baimsky GOK, Peschanka Copper Project

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

Non-technical summary

Document No. 05

English version 1

Issued: 28/01/2020

BAIMSKY GOK, PESCHANKA COPPER PROJECT

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

Non-Technical Summary

Prepared by:
Ecoline Environmental Assessment Centre
Moscow, Russia
Director: Marina Khotuleva
____

Sustainable Environmental Solutions
Pretoria, South Africa

ISSUE AND REVISION RECORD

Version	Date	Number of version	Description
A	17/10/2019	Version 0	For internal discussions
B	28/01/2020	Version 1	Updated based on the results of public consultations

This Report shall be written in Russian and in English. Both language versions are considered to be equally authentic. In the event of any discrepancy between the two aforementioned versions, the English version shall prevail in determining the content of the Report.

LIST OF AUTHORS

Name	Company	Position in Project
Sean O'Beirne	SE Solutions (Pty) Ltd, Director	ESIA Team Leader

TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

1. INTRODUCTION

GDK Baimskaya LLC owns the license (AND 14673 TR) to survey, explore and mine non-ferrous and precious metals within the Baimka License Area in the Bilibinskiy Municipal District of the Chukotka Autonomous Okrug (Chukotka AO or Chukotka). Exploration continues currently in the Peschanka Ore Field with a view to developing a mine and processing plant (the Project) for exploitation of copper and gold reserves with a marshalling yard at the port of Pevek– a facility that will be used for temporary storage of incoming goods and shipping out the finished product (Figure 1).

In parallel with the feasibility study for the mine and processing plant it is necessary to conduct an environmental and social assessment on the Project and all associated infrastructure. Such assessments consist of two major components of which the first is a formalised Environmental and Social Impact Assessment (ESIA) (this document) that complies with international lender requirements. The second component is meeting the Russian regulatory requirements needed for approval of the Project, made up of the national Environmental Impact Assessment (in Russian – OVOS) and the preparation of Design Documentation. Although two separate processes, the ESIA draws heavily on the technical investigations completed for the OVOS process inter alia:

- Sampling of soils, surface water, and snow cover;
- Groundwater well drilling and groundwater quality testing;
- Winter route records of traces of game;
- Spring survey of the migratory birds;
- Summer surveys of the flora and fauna;
- Radiological studies;
- Social baseline studies; and
- Integrated Environmental Engineering Investigations (EEI).

1.1. <u>Objectives of the ESIA Report</u>

The objectives of the ESIA Report are to:

- Identify and evaluate environmental and social risks and impacts;
- Propose mitigation that follows the mitigation hierarchy of anticipate and avoid, or where avoidance is not possible, minimize, and, where residual impacts remain, compensate/offset for risks and impacts to workers, Affected Communities, and the environment.
- Establish a solid foundation for good practice environmental and social performance in implementing the Project through the effective use of management systems; and,
- Initiate the process of promoting and providing means for engagement with Affected Communities.

2. LENDER REQUIREMENTS AND LEGAL FRAMEWORK

2.1. International Finance Corporation (IFC) Requirements

The International Finance Corporation (IFC) is the private sector component of the World Bank Group and has largely set the benchmark for environmental and social assessment and management for most international lenders. The IFC has a Sustainability Framework that articulates a commitment to sustainable development. The framework consists of:

- A Policy on Environmental and Social Sustainability;
- Performance Standards on environmental and social sustainability, which define clients' responsibilities for managing their environmental and social risks; and,
- An Access to Information Policy, which articulates IFC's commitment to transparency.

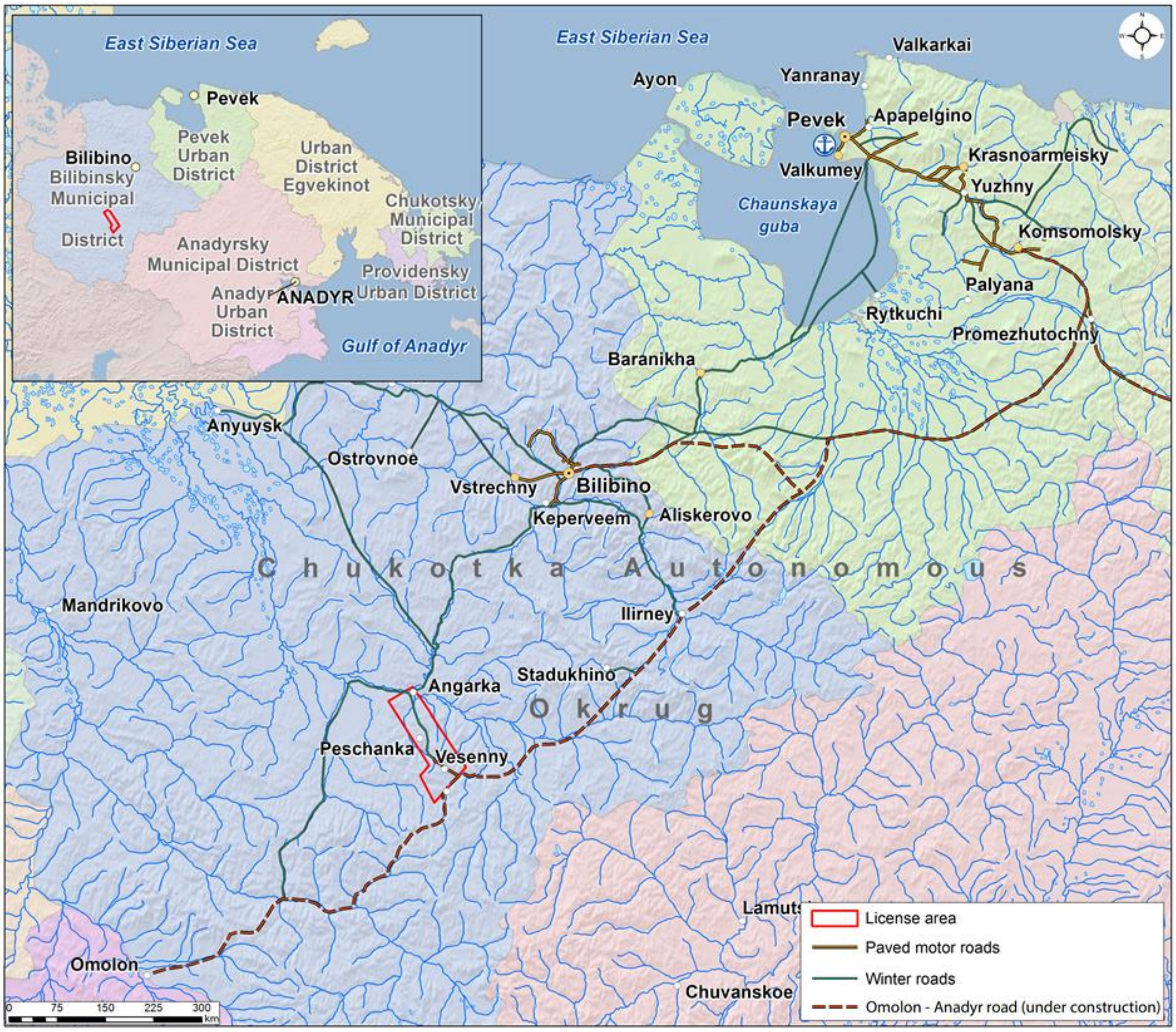

Figure 1. The location of the* Baimsky GOK, *Peschanka Copper Project in Northeastern Siberia

2.2. The Equator Principles

The Equator Principles (EP) are how commercial banks give effect to the commitment to sustainability espoused by the IFC. A key element of the EP is the adoption of the IFC's PS and the requirement for borrowers and/or investees to comply with the PS.

2.3. Russian Legal Requirements

Russian EHS legislation is diverse, and presented more fully in the Russian OVOS documentation. Russian legal requirements applicable to the Peschanka Copper Project include:

- Environmental Impact Assessment and Public Consultations;
- Environmental Management;
- Labour and Working Conditions, Occupational Health and Safety;
- Resource Efficiency and Pollution Prevention;
- Climate Change and GHG Emissions;
- Community Health and Safety;
- Land Acquisition and Involuntary Resettlement;
- Biodiversity Conservation and Sustainable Management of Living;
- Natural Resources;
- Cultural Heritage; and,
- Indigenous Peoples.

3. THE PROPOSED PROJECT

3.1. Project History

The Peschanka gold-copper-molybdenum deposit was discovered in 1972 and explored in the 1970s–1980s. The Company initiated its involvement in 2009. Further investigations culminating in a JORC geological model indicating 1,428 Megatonnes (Mt) of Measured and Indicated ore and 774 Mt of Inferred and Unclassified ore (in 2016). The Final Mining Feasibility Study (in Russian 'TEO Postoyannykh Konditsiy') (TEO) was developed in 2017 with an estimate of 1,237,813.8 ktonnes reserves of sulphide ore (cut-off grade of 0.4% of copper equivalent). Since that time the Company has described the geology of the deposit and developed a structural model of the ore mineralization and tectonic conditions, and developed a mine plan.

3.2. Location of the Deposit and the Project Site

The deposit is located in north-eastern Siberia, Russia, in the Bilibinsky Municipal District of the Chukotka AO. The main Peschanka project site is 187 km southwest of the district centre of Bilibino and 650 km west of the regional capital of Anadyr. The deposit lies in the valley of the Peschanka River at an elevation of +/- 400m.

3.3. Geology

The Peschanka gold-copper-molybdenum deposit is a porphyry type deposit. Porphyry copper deposits are large volumes of hydrothermal alteration centered on porphyritic intrusive stocks. Typical of deep-level copper porphyry systems, Peschanka hosts significant Cu+Au+Mo mineralisation. The Peschanka copper porphyry deposit is located on the Chukotka Peninsula in Russia, at 66° 36'N 164° 30'E in far northeastern Siberia. As one of the largest of a group of deposits that define the Baimka Ore Field, the copper porphyry at Peschanka is confined to a north-south trending, eastward dipping, sheet-like stockwork (a complex system of structurally controlled or randomly oriented veins containing the mineralisation).

3.4. Project Schedule

The project is planned to commence in 2021, with mine and concentrator operations starting in 2023 and 2025 respectively, and continuing to 2044.

3.5. Project Components

The Peschanka Copper Project would be an open pit operation (three pits) with the typical infrastructure of such an operation such as stockpiles, roads, accommodation and offices and so forth. There would also be a two-line concentrator and associated tailings storage facility (TSF), a waste incinerator and an aerodrome. The mineral extraction and concentration process are illustrated in Figure 2 and described in the sections that follow.

3.6. The Proposed Mine

Given the geology, a conventional shovel and haul truck operation would be deployed. Ore would be fed to the concentrator at 60 megatonnes per annum (Mt/a) and also stockpiled for later processing. The mine layout includes the three mining pits, waste rock dumps and oxide and low-grade stockpiles, together with the other appurtenant facilities. Activities in the pits would be primarily drilling and blasting and transporting the waste rock and ore. The facilities would be designed in accordance with Russian and applicable international codes and standards.

3.7. The Concentrator

The minerals processing plant or 'concentrator' would process around 60 megatonnes per annum and producing approximately 250 kt per annum of payable copper in concentrate and 400 koz of gold on average over the first ten years of the project. As the name suggests the function of the concentrator is to separate the mineral from the host rock thereby concentrating the mineral. The concentrate product would be transported by truck and ship to smelters, primarily in China.

3.7.1. Crushing and grinding

Trucks would transport ore from the mine to a crushing and grinding circuit. Within the circuit, ore would be broken down to a size where individual grains of ore (in sufficient quantities) contain the desired mineral only. Particles of the required grain size pass though sizing screens to the next stage of the process, with larger particles that do not pass being redirected to the grinding circuit. Water spraying would be used in the summer to control dust from the tipping of the ore and the crushing and grinding processes.

3.7.2. Flotation

The rock grains without the mineral are called 'gangue' and constitute a waste (which is ultimately disposed of in the TSF). Flotation processes are used to separate the desired minerals from the waste. Flotation uses the hydrophilic (water seeking properties) of the gangue versus the hydrophobic (water repelling properties) of the minerals. The separation is achieved by mixing the crushed material with water and reagents. Air is then blown through the mixture to create bubbles and the minerals attach to the bubbles and ultimately end up in the froth that forms on the surface of the mixture.

That froth contains a concentration of the required minerals. The flotation process has three stages namely rougher, cleaning and scavenging phases each of which serves to further separate out the desired minerals. The concentrator for the Peschanka Copper Project would be designed with two parallel processing lines of equal capacity that are sufficiently independent to allow for the processing of different ores from different sources on the mine.

3.7.3. Rougher stage

Product from the grinding circuit will report to the rougher flotation circuit. There will be two banks of rougher flotation circuits per processing line. To enable the flotation process, sodium sulphide, potassium amyl xanthate and dithiophosphate aqueous (collectors), lime slurry, and pine oil (frother) will be added in this step. These reagents are routinely used in concentrators globally. The bulk rougher flotation step will target maximum recovery of target metals into a concentrate stream for further upgrading. The tails (waste stream) from the rougher flotation step will report to the tailings storage facility. The rougher flotation areas will be equipped with containment and area sumps for cleanup, and will be located in the heated main concentrator building.

3.7.4. Cleaner and scavenging phases

Re-ground rougher concentrate will report to the cleaner/scavenger flotation circuit for further concentration. Product from this circuit will be concentrate slurry. It is further concentrated in the 2^{nd} stage cleaner flotation. Waste from the circuit (tailings) will report to the TSF. To enable the flotation process, potassium amyl xanthate and dithiophosphate aqueous (collectors), lime slurry, and pine oil (frother) will be added in this step. These reagents are routinely used in concentrators globally. The cleaner/scavenger flotation areas will be equipped with containment and area sumps for cleanup, and will be located in the heated main concentrator building.

3.7.5. Concentrate handling

The copper concentrate would be filtered to separate the concentrate from the process water before being placed in 2 tonne bulk bags for shipment. Concentrate would then be transported by truck to Pevek and from there by ship to the customer.

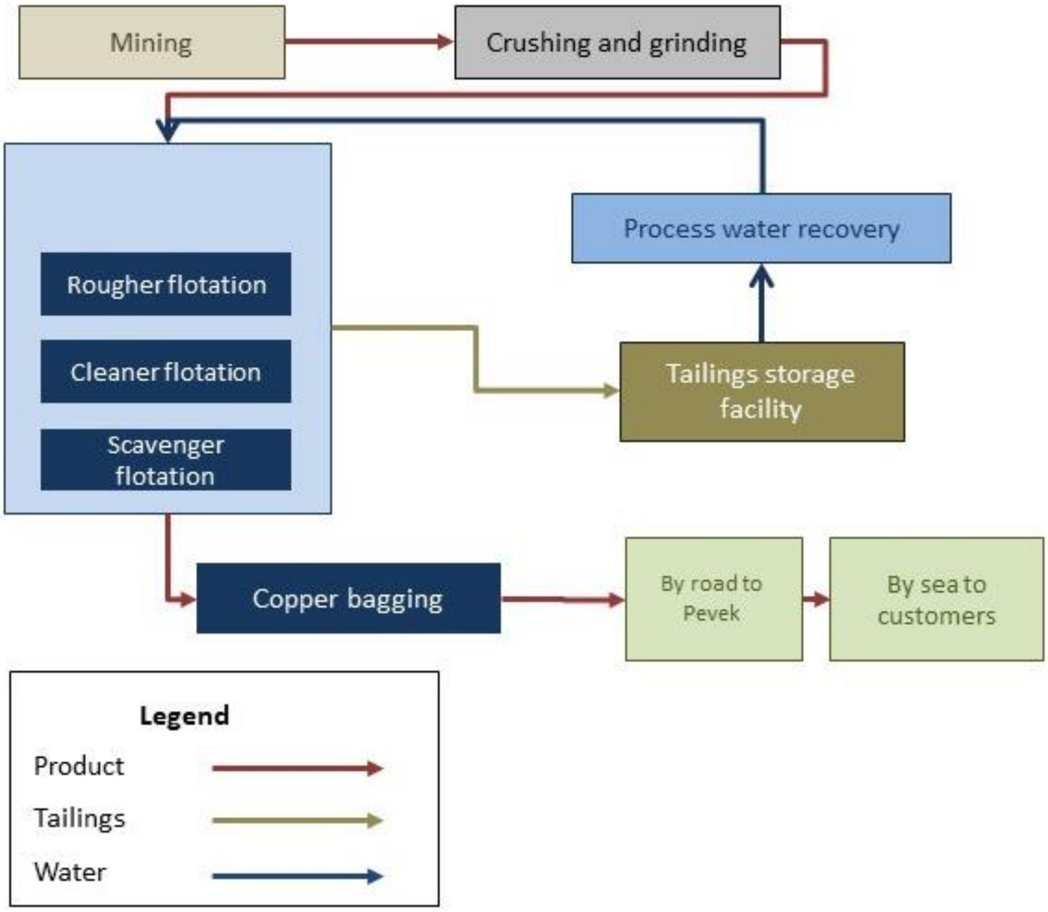

Figure 2. Schematic presentation of the key elements of the mineral extraction and concentration process

3.7.6. Tailings

The remaining gangue or tailings is then dewatered to a ratio of 62% solids in the process water and pumped to the TSF for disposal.

3.7.7. Containment of liquids and slurries

All process liquid and slurry containing vessels would have secondary containment according to regulatory requirements. Surface runoff (precipitation) from the concentrator area would be channelled to the TSF.

3.7.8. Indoor air quality

Process buildings would be heated to maintain a minimum temperature of 5°C with adequate ventilation and emission controls to maintain worker health.

3.7.9. Reagents

Reagents would be mixed and stored in annexes to the main concentrator building. Each processing line would have dedicated reagent systems including separate buildings for the handling of flammable/combustible reagents, dedicated secondary containment and spill collection sumps.

3.8. Potable and process water

Raw water would only be used for potable water and the analytical laboratory. Raw water would be sourced from a reservoir in the Levaya Peschanka River valley that will collect water from spring melt every year, and from taliks (year round unfrozen ground) within the Baimka River valley during construction. Water would be treated to potable standards before being used. Process water (water that is used in the concentrator) would be sourced from the TSF with about 85% going into the concentrator. The remaining water would be used for cleaning, dust suppression, firewater and so forth.

3.9. Domestic Sewage Treatment

Domestic sewage would be treated in sewage treatment plants with treated water going to the TSF and solids incinerated.

3.10. Transport

While there is currently no permanent road connection from the project site there is a state plan to develop a permanent road from Magadan to Anadyr. That road would pass close to the project site and a connecting road from the mine to that new road established. Winter roads would be used during construction. An aerodrome and helicopter pad would also be established at the mine.

3.11. Tailings storage facility (TSF)

Tailings (waste from the concentrator) disposal is a potentially significant source of environmental and social risk for any mining operation. The safe, permanent disposal of the tailings requires a purpose-built storage facility that would contain the tailings for not only the life of the operation, but well into the future after mine operations cease. The Peschanka tailings storage facility (TSF) would take the form of a dam on the downslope side of the valley. Tailings would be deposited on the upslope side and as the tailings flow downhill the solid material settles out of the slurry with the ‘clean’ water (referred to as ‘supernatant’) continuing downhill to where it is contained by the embankment. A large portion of the supernatant is transported back to the concentrator via a water reclaim pumping and pipeline systems.

The embankment is progressively raised over time as the TSF fills always maintaining sufficient dam freeboard (excess storage capacity) to prevent the TSF from overflowing. A secondary containment would also be constructed downslope of the embankment to contain seepage that may flow under the main embankment. Surface runoff from the catchment within which the TSF is situated also flows into the facility, as does precipitation that falls directly over the facility. Water is also lost from the facility as a result of evaporation and sublimation.

The Peschanka TSF would have an embankment approximately 110 m high (elevation 330 m) at the end of the mine life. The embankment would be a rockfill structure with an impervious liner on the upstream face to prevent water from percolating through and thereby weakening the embankment. The foundation of the embankment would be on bedrock for geotechnical stability. Geothermal Modelling indicates permafrost would be retained under the TSF and so seepage into the ground would be minimal if at all. The TSF for the Peschanka Copper Project would be established in the Yegdegkych River valley after several other possible locations were investigated and discarded. The final area of the TSF will be some 45 km^2 within a total catchment area of some 173 km^2.

3.12. Other facilities at Peschanka

In addition Peschanka would have an analytical laboratory, waste rock dumps, electrical power supply and distribution, communications and fuel supply facilities.

3.13. Marshalling Yard at Pevek

Finished products would be exported via the port at Pevek some 550 kms north east of the Peschanka site. To facilitate the export of products a stand-alone marshalling yard will be constructed close to the town, which would include an office, warehouse and segregated storage areas. This facility would be established at an early stage of the construction programme to facilitate import of goods and equipment needed for the Project via the port. During the operations phase the marshalling yard would be used for storage of incoming goods and equipment and finished products delivered from the Peschanka site.

3.14. Mining Rights

In accordance with the license agreement on the license for subsoil use AND No. 14673 (license type TR) GDK Baimskaya LLC undertakes to provide for engineering, construction and commercial mining of copper and associated minerals. A TEO Konditsi and a report with the estimate of resources has been completed and approved. The TEO contains various conditions including mineral resources conservation and subsoil protection, industrial and occupational safety, environmental protection and participation in social and economic development.

3.15. Associated Facilities

Associated facilities are those facilities that appear external to the main Project such as road and electricity supply infrastructure, but which have been established specifically for the Project and would not be established in the absence of the project. For the Peschanka Copper Project two dedicated transmission lines would be constructed to supply electrical power to the Peschanka site (a 200kV primary facility from Magadan and a 100kV secondary facility from Pevek), and access road to the site from the all weather road from Pevek to Magadan.

3.16. Environmental and Social Aspects for the Peschanka Copper Project

For each of the identified activities it is necessary to list the associated environmental and social aspects. Environmental and social aspects are defined as ‘an element of an organisation’s activities, products or services that can interact with the environment’, and it is the identification and quantification of the aspects that provides the key to assessing impacts. The environmental and social aspects of the proposed Peschanka Copper Project are presented in Table 1 and Table 2 below.

Table 1. List of the principal environmental and social aspects associated with construction activities on the Peschanka Copper Project

Category	Aspect	Aspect	Estimated Construction Quantity	Units
Resource use	Water	Industrial	600 to 650	m^3/annum (m^3/a)
		Potable	25 to 470	m^3/a
	Energy	Mining	173,400	MWh/a
		Liquid fuels	36	m^3/a
	Raw materials	Explosives	160,000	tonnes per annum (t/a)
		Lubricants	190	litres per annum (l/a)
	Waste	Sewage	69,000 to 1,272,670	m^3/a
		Non-hazardous	2,267,388	kg/a
		Hazardous	1,221	kg/a
		Medical waste	132	kg/a
		Waste oil	4,571	l/a
Outputs	Energy emitted	Maximum noise	120	maximum dBA
		Maximum noise (from blasting)	105 to 135	1,000m from blast in dBl
Socio-Economic	Jobs	Jobs	up to 5,000 (peak quantity)	
	Spending	Total Capital Expenditure	4,061	million USD

Note: the environmental and social aspects have been estimated as a function of available information and should be viewed as indicative only

Table 2. List of the principal environmental and social aspects associated with operational activities on the Peschanka Copper Project

Category	Aspect		Estimated Operations Quantity	Units
Inputs	Water	Industrial*	57,000,000	m^3/a
		Potable (From River)	25 to 470	m^3/a
	Energy	Mining	191,000	MWh/a
		Concentrator	1,953,000	MWh/a
		Other Infrastructure	256,000	MWh/a
		Tailings storage facility	87,000	MWh/a
		Liquid fuels	140	m^3/a
	Land	Mine pits	497	hectares (ha)
		Stockpile areas	566	ha
		Waste rock dump areas	1,371	ha
		Overall mine area including concentrator	182	ha
		TSF	4,874	ha
		Aerodrome	207	ha

Category	Aspect		Estimated Operations Quantity	Units
	Raw materials	Explosives	46,000	t/a
		Antiscalant	1,542	m^3/a
		Concentrator chemicals	165,038	t/a
		Lubricants	275	1000 l/a
		Coolant	38	1000 l/a
Outputs	Products	Payable copper in concentrate	250,000	t/a
		Gold in concentrate	400,000	koz/a
	Effluent	Mine water	1,035 to 2,235	m^3/day
		Storm water **	28	Mm^3/a
		Sewage (after 2026)	199,000 to 220,000	m^3/a
	Waste	Waste rock	1,164	million tonnes (LOM)
		Tailings	69,000,000	t/a (dry solids)
		Waste oil	813,000	l/a
		Domestic waste	2,555	t/a
		Sewage sludge	2,400	t/a
		Industrial waste	215	t/a
		Hazardous waste	100	t/a
	Energy emitted	Maximum noise (plant)	105	dBA
		Noise (blasting)	105 to 135	1,000m from blast in dBl
		Maximum vibration	<170	kN
	Emissions	Total CO_2 emissions	447,000	t/a
		PM emissions (Mine site)	300	t/a
		NO_x emissions (Mine site)	6,300	t/a
		SO_2 emissions (Mine site)	800	t/a
		PM emissions (Off site)	50	t/a
		NO_x emissions (Off-site)	900	t/a
		SO_2 emissions (Off site)	100	t/a
Socio-Economic	Jobs	Jobs (operations)	200 to 1,000	
	Spending	Total Operating Costs	732.7	million USD

** Reclaim water from TSF to plant at 5,070 m^3/hr*
*** From run-off either diverted as non-contact water or collected in the TSF for process use*
Note: the environmental and social aspects have been estimated as a function of available information and should be viewed as indicative only.

Manpower is expected to grow quickly through 2020 to a level of +/- 1,000 by early 2021, rapidly ramping up thereafter at increments of 1,000 -1,500 per annum to peak at ca. 5,000 during the period 2024/ 2025.

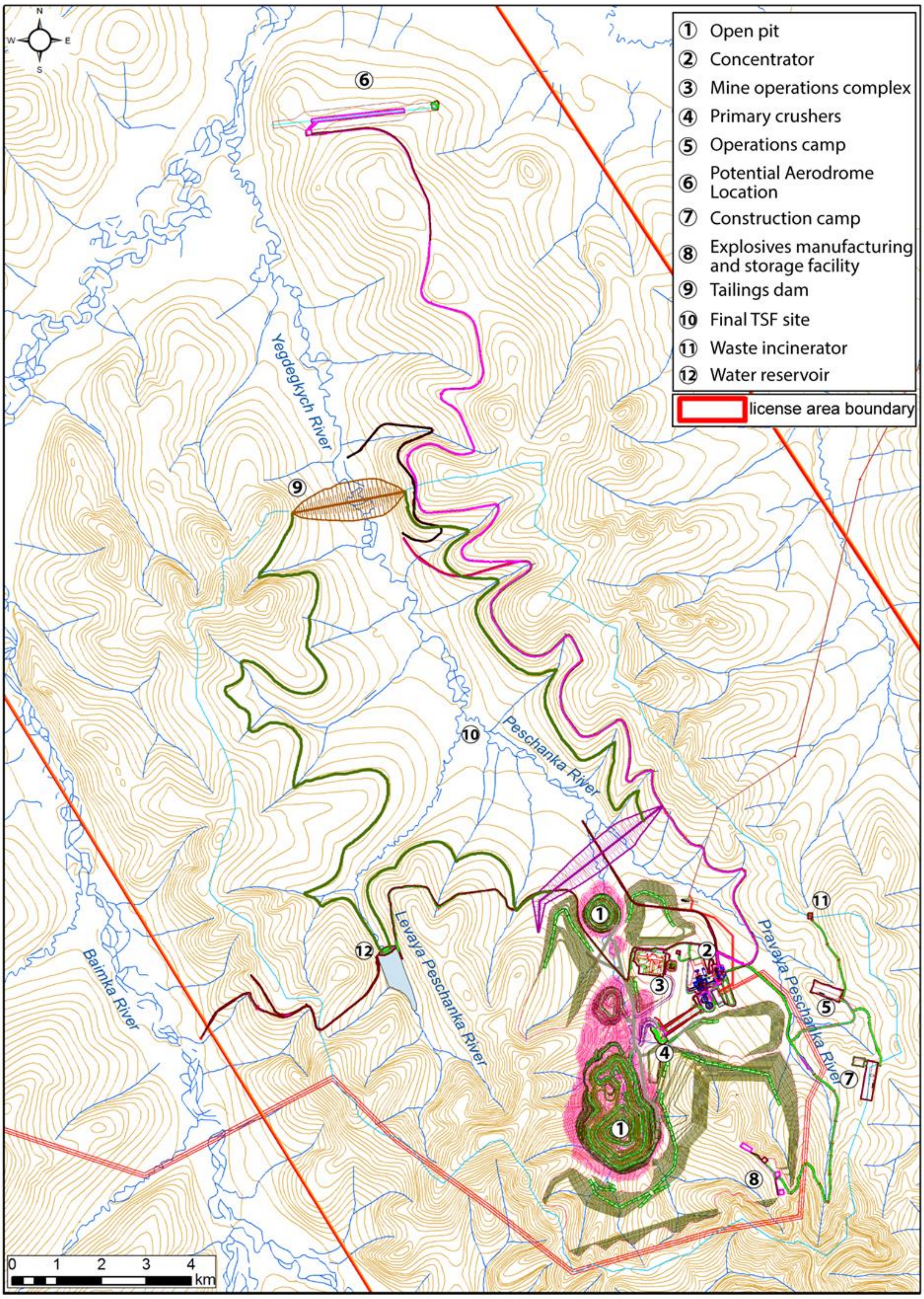

Figure 3. Mine pits, ore stockpiles and waste dump locations for the* Baimsky GOK, *Peschanka Copper Project.

4. THE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) METHOD

4.1. Overview

Environmental and Social Impact Assessment (ESIA) is a process of identifying impacts, both positive and negative, and determining the significance of such impacts for decision-making on the acceptability of the proposed project. Mitigation that could reduce or prevent negative impacts or enhance the benefits is also identified for inclusion in the implementation of the project as is public consultation with a particular focus on people who may be directly affected by the project, especially where such people may be vulnerable to impacts as a result of poor socio-economic circumstances.

4.2. Activities, Aspects and Impacts

Activities refer to the physical activities that would occur during all project phases (construction, operations and decommissioning), while environmental and social aspects are the inputs and outputs of the activities (see Table 1 and Table 2). Impacts are defined as 'changes in the receiving environment that would be brought about by the activities and associated aspects'.

4.3. Environmental and Social Baseline

A key part of any ESIA is a detailed characterisation of the environment and society that would be affected by the proposed project before the project is introduced. Importantly the environment and society can never be understood as a series of discrete, unrelated components but must be viewed as a system rather.

4.4. The Assessment Process

The assessment process is then one of determining which environmental and social aspects would affect components of the receiving environment and society and how those components would change compared to the baseline. Impact significance is then determined by considering the 'consequence' of the changes to the system (impacts).

4.5. Ascribing Significance for Decision-Making

Decision-making is essentially weighing up the environmental and social costs against the project benefits. As such the costs are presented as risks. Inherent risk is an expression of what could happen whereas the residual risk is a reflection of what is likely to happen. The residual risk is expressed as the likelihood of the inherent risk given the nature of the environment in which the project will be implemented together with the controls that would be implemented to reduce the risk (Table 3).

Table 3. Ranking of consequence

Environmental Cost	**Inherent risk**
Human health – morbidity / mortality, loss of species	High
Material reductions in faunal populations, loss of livelihoods, individual economic loss	Moderate – high
Material[1] reductions in environmental quality – air, soil, water. Loss of habitat, loss of heritage, amenity	Moderate
Nuisance – implying that there is a disturbance that may be annoying to people but that will not result in adverse health effects as such.	Moderate – low
Negative change – with no other consequences	Low
Environmental Benefits	**Inherent benefit**
Net improvement in human welfare	Moderate – high
Improved environmental quality – air, soil, water. Improved individual livelihoods	Moderate
Economic Development	Moderate – Low
Positive change – with no other consequences	Low

4.6. <u>Likelihood</u>

A set of likelihood descriptors that can be used to characterise the likelihood of the costs and benefits occurring, is presented in Table 4.

Table 4. Likelihood categories and definitions

Likelihood Descriptors	**Definitions**
Highly unlikely	The possibility of the consequence occurring is negligible
Unlikely but possible	The possibility of the consequence occurring is low but cannot be discounted entirely
Likely	The consequence may not occur but a balance of probability suggests it will
Highly likely	The consequence may still not occur but it is most likely that it will
Definite	The consequence will definitely occur

[1] By 'material' is implied a percentage change of 15% or greater or where the change results in moving from compliance with a standard to not complying. The term is used to recognize that any emissions, wastewater discharge and so forth will bring about some change, but the concern is where there is a major change.

4.7. Residual risk

The residual risk categories are shown in Table 5 where consequence is shown in the rows and likelihood in the columns. The implications for decision-making of the different residual risk categories are shown in Table 6.

Table 5. Residual risk categories

		Residual risk				
Consequence	**High**	Moderate	High	High	Fatally flawed	
	Moderate – high	Low	Moderate	High	High	High
	Moderate	Low	Moderate	Moderate	Moderate	Moderate
	Moderate – low	Low	Low	Low	Low	Moderate
	Low	Low	Low	Low	Low	Low
		Highly unlikely	Unlikely but possible	Likely	Highly likely	Definite
		Likelihood				

Table 6. Implications for decision-making of the different residual risk categories shown in Table 5.

Rating	Nature of implication for Decision – Making
Low	Project can be authorised with low risk of environmental degradation
Moderate	Project can be authorised but with conditions and routine inspections
High	Project can be authorised but with strict conditions and high levels of compliance and enforcement
Fatally Flawed	The project cannot be authorised

5. ASSESSMENT OF ALTERNATIVES .

5.1. 'Zero' Alternative

The 'Zero' alternative means the negative environmental impacts associated with Project implementation would not occur but neither would the benefits. The impacts associated with the exploration that has occurred to date would also not be rehabilitated.

5.2. Alternative Locations of the TSF

Some 18 alternative TFS sites were assessed with seven being within a radius of 15 km from the concentrator. The preferred location was selected given that the overall project impact was then limited to only one river catchment namely the Peschanka-Yegdegkych River catchment.

5.3. Alternative Technology Options

Maximising the possible ore yield whilst minimising the use of resources including water, energy and reagents has largely driven the optimal technology option. As such the optimal technical, economic configuration has been accepted as environmentally optimal too.

5.4. The Marshalling Yard at Pevek

Six potential sites were considered for the Pevek marshalling yard. The preferred site was selected on the basis of agreement from the Pevek authorities together with the site that would result in the least disruption to people in Pevek by project vehicles moving between the harbour and the site.

6. ENVIRONMENTAL BASELINE

6.1. Geology and Topography

The Peschanka gold-copper-molybdenum porphyry[2] deposit is one of the twenty largest deposits of that type in the world. A series of lode (minerals contained within rock) and placer deposits (minerals liberated by erosion and deposited in rivers) extends along the Baimka (Yegdegkych) Fault to form the Baimka Metallogenic Zone (BMZ). The Project area comprises the following geological formations:

- Late Jurassic to Early Cretaceous (163 to 100 million years ago) country/host rocks and soils;
- Late Pleistocene to Holocene (126,000 years ago to today) unconsolidated/dispersed rocks and soils.

The Peschanka deposit is located in an area of continuous permafrost, which varies in thickness with relief and exhibits continuous thaw zones under rivers and streams. The permafrost thickness ranges from approximately 150 m to 280 m.

6.1.1. Orographic Setting and Landforms

The area is part of the Anyuysk Plateau within the Northeast Highlands, which comprises fold and block mountain structures of varying size and height. Typical landforms are alpine and ancient glacial features, barren tundra areas and lava plateau formations with young, extinct volcanoes. The area is medium to slightly dissected (rivers and river valleys) with low to moderate altitude mountains.

6.1.2. Ore and Rock Composition

The Peschanka deposit contains porphyry-copper ores[3] with low sulphur content (less than 1%).

6.2. Acid-Base and Metal Leaching Potential of Ore and Rock

Acid rock drainage and metal leaching (ARD/ML) may occur when sulphide bearing minerals in waste rock, tailing waste and cut-off grade ore are exposed to air and water, resulting in acid drainage and subsequent metals leaching[4]. As such it is necessary to determine the ARD/ML potential of both the ore and the host rock. The Neutralization Potential Ratio (NPR) = Acid Neutralisation Potential (ANP) / Acid Generating Potential (AGP) is widely used to assess the acid rock drainage risk. The

---

[2] Porphyry is a variety of igneous rock consisting of large-grained crystals, such as feldspar or quartz, dispersed in a fine-grained matrix (groundmass)

[3] The Conceptual Mining Study of the Peschanka Site within the Baimka Deposit, Bilibino District, Chukotka AO, October 2011.

[4] International Network for Acid Prevention. 2014. The Global Acid Rock Drainage Guide. Available at http://www.gardguide.com/index.php?title=Main_Page.

higher the ratio the lower the ARD risk. Static tests on samples revealed that some 92% of waste rock samples and ore samples were classified as non-acid generating (NAG) suggesting that the tested waste rock samples have limited ARD potential.

Twenty rock samples and two ore samples were selected for 1-day rapid leach tests to assess the quantity of metals that would be released from the host rock and ore were they to be in an acid environment. Metal concentrations were generally small. Based on the static test results, 6 samples were subjected to kinetic testing (longer term exposure to humidity) with the results suggesting that ore is potentially acid generating while waste rock is not.

6.2.1. Evidence of ARD-ML in surface water

Some surface water in the vicinity of the proposed mine is an unnaturally blue colour suggesting dissolved copper and, potentially, molybdenum, at elevated concentrations. Samples are currently being assessed to determine composition and potential origin.

6.3. Radiation

Surveys conducted as part of the geological exploration indicated radioactivity was within normal background levels and therefore not a risk to mine personnel.

6.4. Geological Hazards

6.4.1. Seismic activity

The risk of earthquakes cannot be discounted due to the fact that the mine is in a seismic risk zone and an earthquake did occur in 2009. The design of mine buildings and infrastructure would need accordingly to make provision for earthquake risk.

6.4.2. Erosion

The extreme climate of the area results in a variety of erosive processes including water erosion from surface runoff, thermal erosion such as frost heaving, frost fracturing, solifluction and creep processes (gradual movement of wet soil down a slope, especially where frozen subsoil acts as a barrier to the percolation of water) and bog formation.

6.5. Climate

The Project area is in the subarctic zone of the Siberian region. The climate is distinctly continental with long-term, severe winters lasting for 7 - 8 months, and short cool summers. The spring thaw occurs in late May to early June. Average annual temperature is -11.2°C with an absolute minimum -57.5°C and maximum +33.5°C. Average annual precipitation is 297mm with the largest monthly precipitation being 136mm. On average, snow cover lasts for about 8 months (and typically completely disappears by late May). The predominant wind is south-easterly but more north-westerly during summer. Chukotka is synonymous with severe weather ranging from strong winds, intense rainfall, blizzards, icing of infrastructure, fog and extremely low temperatures in winter to hot days and high fire risk in summer.

6.6. Ambient Air Quality

Ambient air quality of the Project area has not been measured. As there are no human settlements in the Project area, the only existing emissions sources are those from the fledgling mine itself (electricity generating power plants, vehicles and machinery, and dust). Given an almost complete absence of industrial sources of emissions within the Project area the current air quality is considered to be good.

6.7. Soil

Unsurprisingly given the Arctic conditions, the Peschanka site has marginal soil layer not exceeding ten centimetres thickness, thinner on slopes and slightly increasing at the bottoms of the river valleys with very limited top soil.

6.8. Water Resources (Surface Water and Groundwater)

Surface water is principally the Bolshoy Anyuy River with groundwater belonging to the Mesozoic Oloy Artesian Basin System.

6.8.1. Hydrological Conditions

Surface water in the Project area comprises rivers, numerous ephemeral streams, small lakes and temporary watercourses in ravines. The Project area is located within the catchments of the Peschanka, the Levaya Peschanka and the Baimka rivers, which form part of the Bolshoy Anyuy River basin[5].

6.8.2. River Network

The river network from the Peschanka River to the East Siberian Sea is illustrated schematically in Figure 4. Watercourses are classified as typically very small and small (in terms of both catchment area and river flow) mountainous rivers[6] and snowmelt-dominated (65% of annual river flow).

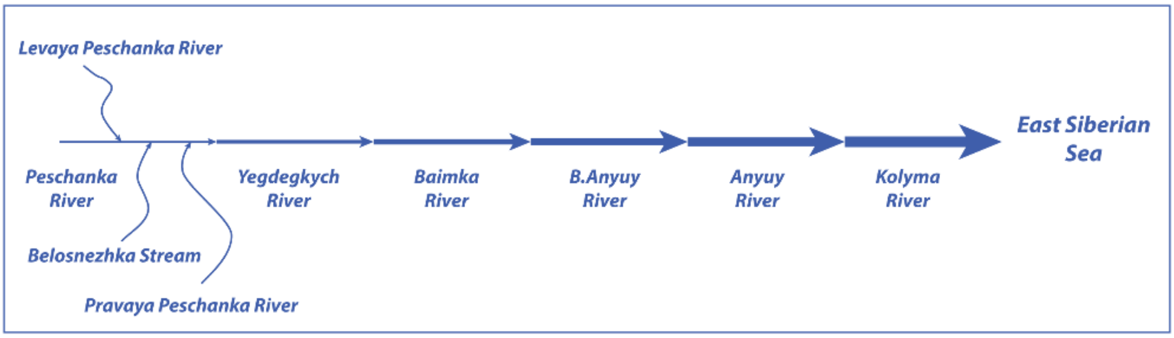

Figure 4. The network of rivers from the Peschanka River to the East Siberian Sea

6.8.3. Surface Water Quality[7]

Water has pH values ranging from 5.7 to 7.1 (slightly acidic to neutral). Mineralisation levels vary from 39 mg/l to 1292 mg/l (mean of 175 mg/l), i.e. from sweet to brackish water. Surface water quality in the Project area does not meet the fisheries and

[5] CSA Global. 2019. Technical Review: Preliminary Hydrological and Hydrogeological Report – Peschanka Copper Project, Russian Federation (CSA/FLU-A9PK-90-K023-002T-A) CSA Global Report Nº R185.2019, 04/07/2019.

[6] GOST 17.1.1.02-77. Environmental Protection. Hydrosphere. Water Body Classification.

[7] HYDEC. 2016a. Investigation of the Hydrogeological Conditions of the Peschanka Deposit, the Baimka License Area in 2015 (Chukotka Autonomous Okrug). Report on Findings of the Study. HYDEC Hydrogeological and Geo-ecological Company (HYDEC) CJSC, Moscow, 2016.

drinking water quality guidelines, especially during flood flow, with naturally occurring ammonium and metals exceeding maximum permissible concentrations (MPC) for fisheries and drinking water together with elevated concentrations of other elements.

6.8.4. Hydrogeology

The hydrogeology is shaped by faults and fractures in aquifers, presence of permafrost and river morphology. Supra(above)-permafrost water occurs widely within seasonally thawed and talik zones of river valleys. The top of the permafrost forms the base of the supra-permafrost water layer and generally follows the shape of the surface topography. Sub-permafrost aquifers underlie the permafrost layer[8] and exhibit no significant seasonal fluctuation in groundwater level.

6.8.5. Groundwater Quality

The water quality of the supra-permafrost aquifer does not comply with the drinking water maximum permissible concentrations (MPC) for several parameters. Water within the sub-permafrost aquifer ranges from fresh to brackish with salinity increasing with depth. Exceedances of the maximum permitted concentrations for ferrous iron and manganese are evident, with boron, bromine, strontium, lithium, beryllium and tungsten exceeding the rated values. Total salt content and hardness are elevated.

6.9. Landscapes

6.9.1. Natural Landscapes

Based on the physical and geographical zoning map provided in the National Atlas of Russia the study area comprises the sub-altiplanation sparse forest and permafrost taiga landscapes of the Kolyma Mountainous Area. The mountain areas in Eastern Siberia have a relatively monotonous landscape structure consisting of tundra and permafrost taiga landscapes. The mid-elevation and low-elevation mountain slopes are covered with sparse larch forests. The fragments of relic meadow and steppe vegetation and poplar-chosenia forests growing along the riverbanks form an important and distinct component of the local landscapes. Recent tectonic movements resulting in a local landscape dominated by mid-altitude and low-altitude mountains have shaped the present-day terrain. Three altitudinal landscape belts can be distinguished in the Project area:

- 500-750 m: Arctic-mountain desert and tundra belt lying on rubble/stone ridge-top with little or no vegetation;
- 400-500 m: Larch forest tundra belt extending over primary slopes; and,
- 200-400 m: River valley bottom belt composed of pebble/stone and sand/pebble alluvial deposits (alluvium is loose, unconsolidated soil or sediment)

Burnt patches in the landscape are widespread in the areas covered with dwarf cedar and larch shrubs. The typology of landscapes in the Project area is determined by local geology, topography, moisture regime and material migration routes. Gentle hillsides and foothills dissected by ravines are periodically waterlogged and permafrost is present at a depth of 0.5-0.6 m. These conditions harshly suppress plant

[8] Kalabin A.I. 1960. Permafrost and Hydrogeology of the Northeast USSR. - Magadan, VNII1, 1960.

growth and result in sparse boreal forest gley soils and alluvial peat-gley soils. Key landscape features dominating the area are the main river valleys (the Baimka and Bolshoy Anyuy rivers) and mountain summits.

6.9.2. Anthropogenically Transformed Landscapes

Landscapes have been transformed principally due to mining and are widespread in the Peschanka River valley. Pioneer ruderal (vegetation growing in disturbed area or waste) species are gradually colonising the lowland areas. About 460 ha show signs of human activity excluding winter and temporary summer roads. Tracks left by heavy-duty vehicles can be seen everywhere. In foothill areas and lower sections of river valleys, water accumulates in the ruts, causing localised waterlogging.

6.9.3. Landscape Resilience[9]

Historical studies on tundra resilience demonstrate that it may vary from high elastic resistance (landscape is able to resist external impacts and restore its initial state) to high plastic resistance (landscape changes due to external impacts while retaining key structural characteristics). Water divides and foothill areas take a very long time to recover (50-100 years and even more). Larch forest tundra could recover in 15-35 years. Floodplains associated with river valleys can be classified as relatively resistant with vegetation cover recovering in 25-30 years.

6.9.4. Fire Resistance of Landscapes

Tundra fires are hazardous events with relatively high likelihood and last from June through October and so the Chukotka AO Government has adopted special procedures to prevent natural fires.

6.10. Vegetation

6.10.1. Plant Species Composition

The Project site and surrounding areas extend into the Mountainous Anyuy-Chukotka Geo-Botanical District of the Arctic Tundra Region and Chaun Floristic District of Arctic Province within the Circumboreal Region of the Holarctic Kingdom. As such there is widespread occurrence of Arctic and typical tundra vegetation with shrubs and mixed grasses. Kayander larch is the main tree species with few or no trees in low-lying and poorly drained areas. Low-productivity and sparse larch trees and dwarf cedar shrubs are key elements in forest areas. No rare and/or protected species listed in the RF and Chukotka Red Data Books were recorded at the Project site and surroundings.

6.10.2. Key Vegetation Communities of the Study Area

Key vegetation communities include boreal forest vegetation (only Kayander larch), sparse boreal forest vegetation, shrub and dwarf cedar vegetation and arctic mountain desert vegetation. Crustaceous lichen associations occur as fragments along the water divide between the Peschanka and Baimka rivers occupying over 50% of stone surfaces. Iceland moss and reindeer moss predominantly cover soil, with crustaceous lichen being the co-dominant species.

---

[9] State Standard GOST 17.8.1.01-86. Nature Protection. Landscapes. Terms and Definitions.

The grass layer is well developed in some areas (covering up to 40% of the surface) and dominated by great willow herb and pine purple grass. Sparse larch woods dominate the area with their type depending upon soil moisture. Dwarf cedar woods play a secondary role. The least commonly occurring are plant communities associated with the bottom sections of river valleys. Areas with no vegetation or those covered by ruderal vegetation and concentrated in the disturbed sections of river valleys account for less than 1.5% of the total mapped area.

6.11. <u>Animal Life</u>

6.11.1. Terrestrial Animal Species

The Project site and surrounding areas are part of the Euro-Siberian Subregion of the Forest Tundra Zone[10]. Birds belong to the Chukotka District of the Bering Sub-Province of the Arctic Tundra Province of the Arctic Subregion of the Holarctic Region[11], and mammals to the Chukotka District of Bering Tundra Province of the Arctic Subregion of the Holarctic Region[12]. Some 40 bird species representing 6 orders (Table 7) and 12 terrestrial mammal species from 4 orders were observed in the study area but other species may also occur.

Table 7. Recorded bird species and their orders in the project area

Species	Order	Species recorded
Greater white-fronted goose, tundra swan or small holarctic swan, bean goose, snow goose, brent goose.	Anseriformes	40%
Snow bunting, common raven, spotted nutcracker, Eurasian jays and marsh tits	Passeriformes	33%
Eastern marsh-harrier	Falconiformes	6.6%
Willow ptarmigan	Galliformes	6.6%
Lesser spotted woodpecker	Piciformes	6.6%

The nearest water bodies with large waterfowl populations are the Figurnoye Lake (15.4 km north of the runway site) and Ulitka Lake (29 km north north-west of the runway site), as well as wetland areas surrounding these lakes and the upper floodplain of the Bolshoy Anyuy River.

Chukotka's fauna comprises 64 mammal species and some 220 bird species. The most widespread species in the area of the proposed mine are polar hare, partridge and wild reindeer. Animal species in the Project area are those whose habitats are associated with forest tundra and sparse forest areas namely: tundra shrew, Arctic ground squirrel, tundra vole, Arctic fox, lemming, glutton, northern red-backed vole and common vole, wolf, fox, ermine, weasel, brown bear and Laxmann's shrew.

[10] National Atlas of the USSR. Moscow, Encyclopedia, 2007.

[11] L.A. Portenko. 1973. Birds of the Chukotka Peninsula and the Wrangel Island. L., Nauka, Vol. 2. 1973.

[12] F.B. Chernyavsky. 1984. Mammals of the Far Northeastern Siberia. Moscow. Nauka, 1984.

6.12. Bird and mammal habitats

Bird habitats are associated with the following particular landscape types:

- River floodplains and first-level terraces (30 species);
- Lower sections of slopes and dry shrub tundra terraces (6 species); and,
- Anthropogenic habitats (abandoned settlements) (4 species).

Habitats of 10 terrestrial mammal species are associated with river floodplains and first-level terraces. These habitats are forests and sparse forest areas, grassland and shrubland areas and arctic mountain desert areas.

6.13. Rare and protected species

Rare and protected species in the Bilibinsky Municipal District include snow sheep, osprey, white-tailed eagle, blue hawk, Gyrfalcon, peregrine falcon, eagle owl and boreal owl. Migration routes used by wild reindeer have been difficult to predict mainly driven by availability of and access to food. Autumn migration starts at the end of August and lasts till mid-December with reindeer returning to their fawning grounds in April. Virtually all migratory bird species routes lie along the Baimka and Bolshoy Anyuy River valleys and do not cross the catchments of the Peschanka and Yegdegkych rivers (the mine site).

6.14. Fish

Fish habitat in the Project area is categorised as Circumpolar Subregion of the Holarctic Region. Fish populations are dominated by Northern Palaearctic species with minor influence of American species. Conditions in the Baimka and Yegdegkych river basins are classified as Category 1 fishery water bodies and part of the Western Chukotka fisheries region. Three salmon species were identified in the Peschanka, Yegdegkych and Baimka river basins: lenok, East Siberian grayling and round whitefish. No rare and/or protected fish species were found in the Yegdegkych and Baimka river basins. The lower sections of the Kolyma River (i.e. downstream of the mine) are home to more than 20 fish species representing at least 10 families.

6.15. Benthos

Benthos (organisms that live on, in, or near river beds) form an important food source for fish, and as such are powerful indicators of the ecological status of water bodies. The absence of Oligochaeta cells and an Oligochaeta index of zero implies that the water in the Baimka River Basin is ‘very clean’.

6.16. Protected Natural Areas

There are no protected natural areas (PNA) of regional or local significance in the Project area area and the area of influence of the mine does not reach any existing PNAs in Chukotka. The closest PNA of federal significance is the Wrangel Island State Nature Reserve, the northernmost World Heritage Site but it is about 1000 km north of the proposed mine site.

6.16.1. Sanitary protection zones

More than 20 watercourses flow across the Project site requiring coastal buffer zones (CBZ) of between 30 and 50 m on either side of the watercourse. Developments such as landfills are precluded from these areas and any developments that do occur must have structures to protect the water bodies from impact. Similarly the reservoir requires a sanitary protection zone of 50 m. The aerodrome would also require sanitary protect zones that differ according to the various activities of which the most important is a 15 kilometre buffer between the aerodrome and features that attract and result in mass aggregation of birds.

6.16.2. Pastural Lands

A small Even community in the Burgakhchan area on the southern side of the Baimka License Area practice traditional reindeer husbandry, fishing and hunting. Other land use in areas used to pasture reindeer is to all intents and purposes prohibited.

6.17. Ecosystem Services

Categorising ecosystem services is a way of 'valueing' services provided to humankind by the natural environment. Services include provisioning (resources) regulating (e.g. climate), cultural services and supporting services (e.g. soil formation and photosynthesis). Provisioning services in the project area include natural pastures, forest fare, game, fish and firewood, with regulating services regulating greenhouse gas fluxes, carbon sequestration, surface water runoff management and soil erosion prevention.

Social and cultural ecosystem services are largely limited to local people (i.e. the Burgakhchan Community). Supporting services derive from the pristine state of ecosystems in the area that provide habitat for wild species of plants and animals. Beneficiaries of these ecosystem services include the Burgakhchan Community, Bilibinsky Municipal District residents, local authorities, the project sponsor and Russian and global citizens.

6.18. Climate Change

Against a body of evidence that climate is changing as a result of humankind's activities, average annual temperature from 1976-2018 increased by 2.5-3.0oC in the Bering Strait area but without significant changes in precipitation. Forecasts for the region indicate a progressive warming for the remainder of the century by up to15oC higher than the start and that the region will get wetter as it gets warmer. Importantly it is also anticipated that there would be increased carbon emissions and reductions of carbon reserves in soils, further enhancing climate change.

7. SOCIO-ECONOMIC BASELINE

7.1. Chukotka Autonomous Okrug

The Chukotka Autonomous Okrug (Chukotka) occupies the most northeastern part of Eurasia. The administrative centre is Anadyr on the Bering Sea. The okrug is divided into six administrative units (in descending order in terms of area): Anadyrsky, Bilibinsky, Chukotsky Municipal Districts, and Pevek, Providensky, and Egvekinot Urban Districts. Chukotka has a violent history with more than a century of conflict in the 16th and 17th centuries between Russians and various tribes that later received a common name 'Chukchi'.

When the wealth of mineral resources was discovered in the 20th century, extensive mining activities began in the area with many placer and lode gold deposits explored and developed. The Russian-American Company (RAC) was established in the early

19th century to colonize the area with activities continuing till 1867 when Alaska was sold to the USA. GULAG prisoners were also used to exploit the mineral wealth during the Soviet era.

There are five urban settlements and a number of rural settlements in Chukotka. The energy system is a technically isolated territorial system consisting of three, independent energy hubs. Electricity supply will be enhanced to meet the energy demands of the Peschanka Copper Project and other mining operations through the Energy Bridge Project connecting two currently isolated energy systems and adding the Bilibinskaya Thermal Power Plant (TPP) (24 MW of electricity and 83.2 MW of heat).

7.1.1. Transport

Chukotka's transport system comprises air, maritime, and road transport but no railroads. In addition road transport is not reliable with only 544.6 km of all-season roads with basic paving. There are 8 airports and 5 seaports in Chukotka. Access roads to Bilibino, Komsomolsky and Egvekinot are currently being constructed which will provide a reliable road connection between the Baimka License Area and human settlement and logistic centres.

7.1.2. Demography

The population of Chukotka was 49,663 people in 2019 with men outnumbering women and Russians (49.6%) and Chukchi (25.3%) dominating ethnicity. Following the large outmigration during the first post-Soviet decade, Chukotka has since sustained population growth, which is atypical for Russia. Tuberculosis rates are very high while HIV and syphilis rates appear to the relatively low thought to be as a result of strict control of migrant workers. Employment rates are higher than Russia's average rate but there is a shortage of qualified staff. State budget-funded enterprises and mining industries are key employers in the region.

7.1.3. Gross regional product and key sectors of regional economy

Mining is a core sector of the regional economy (Chukotka has about 10% of Russia's gold reserves) while indigenous people are engaged in traditional crafts and activities. The okrug has amongst the highest gross regional product (GRP) per capita after the oil-producing Tyumen and Sakhalin regions. Highest wages are paid to state employees even exceeding the mining sector. Incomes and expenditure have grown relatively steadily, with average disposable income across all households. There are some 249 historical and cultural monuments (including 144 archaeological heritage sites).

7.2. Bilibinsky Municipal District

The Bilibinsky Municipal District, is the second largest district in Chukotka, occupying 23.7% of the region with a population density of 0.043 people per km2. Bilibino is the administrative centre (Figure 5). The Municipal District is rich in mineral resources including lode and placer gold, silver, and platinum group metals. Key industrial sectors are mining (gold mining) and electricity generation (Bilibino NPP), while the agricultural sector is made up of reindeer hunting, fisheries, and greenhouse farming.

7.2.1. Demography

The permanent population in the Bilibinsky Municipal District was 5,292 in urban areas, and 2,077 people in rural areas (2018) and growing. There are 43 ethnic groups with Russians accounting for 60% of the total population and indigenous Chukotka people (Chukchi, Evens, Yukaghirs and so forth) accounting for 20%. Indigenous minorities live and maintain traditional lifestyles and account for 24.6% of the population of the District. The District has low unemployment. Key economic activities include upgrading energy and transport infrastructure with mining, electrical power, food processing; and agriculture (reindeer husbandry and crop farming) making up the balance.

7.2.2. Economic activities

All economic activities have grown in recent years. There are several hospitals including a district hospital that is well maintained, equipped, and staffed with trained medical specialists. Housing is generally in a state of disrepair. There are 11 educational institutions in the District, as well as a library and a museum and some 47 identified archaeological sites of federal significance including ancient encampments and burial sites.

7.2.3. Reindeer husbandry

Reindeer husbandry benefits from the forest tundra landscapes and well-developed river systems. There are four municipal reindeer farms supported by the district administration and regional government. This support has stabilised the reindeer sector in the district. The Bilibinsky Municipal District is the first district of Chukotka where zones of traditional nature use may be registered for special protection. The permanent settlements located near the license area are Anyuysk (some 400 inhabitants of which ethnic majority are Evens), Illirney (some 252 inhabitants of which the ethnic majority are Chukchi) and Omolon village (some 785 inhabitants of which the ethnic majority are Evens).

7.3. Pevek Urban District

The Pevek Urban District (previously Chaunsky Municipal District before 2016) is the most industrialised district in the region. The district is one of the major transport hubs in Chukotka and houses the largest seaport and one of the few ports on the Northern Sea Route receiving all types of vessels. Other large-scale economic activities include Kupol, Dvoynoye and Mayskoye mines and, in time, Peschanka. The permanent population was 4,329 in urban areas and 998 people in rural areas (2018).

7.3.1. Demography

There are 44 ethnic groups with Russians constituting 61.9% of the total population. Indigenous people (the Chukchi, Eskimos, Chuvans, Evens, Koryaks, and Yukagirs) account for 18.3%. Unemployment is < 1% and the district is the most industrialised in Chukotka. The Chaun-Bilibinsky Power Hub is being implemented including the world's first floating nuclear power plant and the construction of new power lines. Government policy also promotes agriculture with various incentives to reindeer breeders, hunters, fishermen and others. Public healthcare services are provided by the Chaun District Hospital based in Pevek, which is in good condition, properly equipped and staffed. There are 2 comprehensive secondary schools, 2 comprehensive pre-school and primary school establishments, 2 pre-school establishments, and 2 extended education establishments.

Figure 5. Bilibinsky Municipal District

7.3.2. Traditional Nature Use

Reindeer breeding has existed in the area since ancient times. Pastures are situated close to the coast with different types of pastures for all seasons. The Chaunskoye Municipal Agricultural Enterprise comprises five reindeer brigades, employs 130 people and produces 52 tonnes of meat annually. The Chaunskaya Bay and the Kolyma River Basin are included into the East Siberian sea fishing area with a hunting reserve, Tyjukul, in the low Ichuveyem River basin.

7.4. Baimka License Area and Neighbouring Communities

The Baimka License Area is located in an unpopulated area near the abandoned Vesenniy Settlement with the nearest populated settlement being Anyuysk Village. The Burgakhchan community is located on the boundary of the license area with Luch Mining Cooperative based in Vesenniy. Luch Mining Cooperative LLC (Luch LLC) conducts placer gold mining in an area bordering the license area and employs about 80 people including 4 Evens.

7.4.1. Burgakhchan Community

A small Even community resides in Burgakhchan on the southern side of the Baimka License Area. Currently 16 adult members of the community live in the settlement which was technically closed in 1990. In 2010, the community was legally registered as Burgakhchan Territorial Neighborhood Community allowing the community to operate as a non-profit organization. Economically, the community consists of Brigades No. 7 and 8 of Ozernoye Municipal Agricultural Enterprise with all reindeer being owned by the enterprise. The Burgakhchan Community has not been able to acquire ownership of the reindeer herd nor register for traditional pasture use. From 2010 to 2015 the community sold agricultural products worth 16,144 Russian Roubles (RUR) whilst maintaining other traditional activities such as plant and berry harvesting, hunting, and fishing. The project license area partly overlaps land used by the Burgakhchan but the mining and ore-processing infrastructure is some distance away.

8. ASSESSMENT OF BIOPHYSICAL IMPACTS

8.1. Impact on Air Quality

Ambient air pollution concentrations were modeled using atmospheric emissions (sources) and the atmospheric dispersion characteristics of the area (wind velocity, mixing height and turbulence). The predicted concentrations were then compared to various limit values to determine the likely human health and environmental risks and impacts. The mine would have multiple sources of both gaseous and particulate (dust) emissions but the concentrator as a physical (rather than chemical or thermal) and wet process would have very limited emissions.

Emissions from blasting were deemed potentially significant and therefore assessed in more detail, as was dust loading from the tailings storage facility for different stages of development of the mine (viz. different depths of the pits and the progressive enlargement of the TSF surface area). It should also be noted that the TSF is frozen for a large part of the year preventing dust.

Limit values (concentrations that serve to define (as a function of typically human health based responses) tolerable ambient concentrations) were sourced from the WHO, the US EPA and Russia itself. The WBG EHS Guidelines, as the lenders assessment benchmark, are based on WHO limits. For blasting dust, limits were obtained for different size fractions. The configuration of the dispersion model is described in detail in the main body of the report.

8.1.1. Ambient dust concentrations

Predicted average annual ambient concentrations for the four dust size distribution categories are predicted to be less than 8% of the respective limit value for PM_{30} and less than 1% of the limit value for the remaining size classes. For daily average concentrations non-compliance with the limit values is evident for TSP (albeit marginally), PM_{10} and $PM_{2.5}$ both on and off site. These events would be episodic, a function of dust created by blasting (very short duration) and would not result in 3rd party human exposure given the remoteness of the mine site. Finally predicted hourly average dust concentrations do not comply with the limit value for TSP and PM_{10} but only in the area of the mine pit and only for the early years of the mine life as a function of blasting.

8.1.2. Ambient nitrogen oxide concentrations

Predicted annual average NO_2 and NO concentrations are negligible at no more than 0.03 % of the limit values with the relatively largest predicted concentrations in the vicinity of the mine pit, which is the source. No daily average reference concentrations are available for nitrogen oxides. Predicted hourly average NO_2 and NO concentrations are dramatic with both some nine or ten times the limit value in the mine pit area (the source). There are also significant off-site exceedances of the limits predicted (up to five times the limit value for NO), although there is no community exposure. The very low annual average concentrations, together with the nature of the source (blasting) implies that elevated nitrogen oxide concentrations are intense but short duration events.

8.1.3. Spatially resolved ambient $PM_{2.5}$ concentrations

The TSF will have its greatest spatial extent at the end of the mine life (2059). Predicted off-site annual average $PM_{2.5}$ concentrations do not exceed the limit value and the movement from the TSF is towards the south-east. The spatial distribution of daily average concentrations extends south-west to north-east, with a large area in which predicted concentrations exceed the limit value off-site, south-west of the TSF. As previously described there are no human receptors in the area that would be affected by the exceedances of the limit values. Predicted hourly average $PM_{2.5}$ concentrations are seen to exceed the limit values off site (south west of the TSF) but over a much smaller area than the daily averages.

8.1.4. Spatially resolved ambient NO_2 concentrations

The spatial distribution of predicted annual average NO_2 concentrations when maximum emissions would occur (2030) is negligible and limited spatially to the main pit with almost no effect beyond the exclusion zone of the pit. Predicted maximum hourly average NO_2 concentrations show widespread exceedances of the relevant limit value on all sides of the pit. Again it is argued that the elevated NO_2 concentrations are short, episodic events that mirror the blasting pattern. Adverse human health effects as a result of these predicted concentrations are improbable due to the remoteness of the mine.

8.1.5. Air quality impact assessment

The air quality impacts assessment is summarized in Table 8 and Table 9.

Table 8. Impact significance for possible adverse human health risks as a result of atmospheric emissions from the Project

Potential Environmental Cost	Adverse human health effects
Inherent risk	**High**
Causes of risk	**Likelihood of causes**
Predicted ambient NO_x concentrations	Short term averages exceed limits but short duration Highly unlikely for Pevek
Predicted ambient PM (TSP,	Exceed limits on and off-site (short term averages) but

Potential Environmental Cost	Adverse human health effects
PM_{30}, PM_{10}, $PM_{2.5}$) concentrations	limited to TSF and mine pit for longer term averages Highly unlikely for Pevek
Community exposure	No communities exposed to ambient concentrations that exceed health based limits. Highly unlikely for Pevek.
Residual risk	**Low**

Table 9. Impact significance for possible damage to vegetation and reduced habitat risks as a result of atmospheric emissions from the Project

Potential Environmental Cost	Damage to vegetation and reduced habitat
Inherent risk	**Moderate – high**
Causes of risk	**Likelihood of causes**
Predicted ambient NO_x concentrations	Long term averages negligible Highly unlikely for Pevek given the nature of the activities there.
Predicted ambient PM (TSP, PM_{30}, PM_{10}, $PM_{2.5}$) concentrations	
Habitat exposure	
Residual risk	**Low**

8.2. <u>Waste</u>

Waste presents the risk of potential impacts on water resources and soils and worker health and safety, especially exposure to hazardous waste. Waste disposal would ultimately be decided for the project by the authorities as a function of the Russian regulatory requirements for both construction and operational wastes and hazardous and non-hazardous waste classes.

8.2.1. Operational Wastes

Tailings constitute the largest volume of waste (68 000 000 mtpa) followed by waste rock (1 164 mt over the life of mine), with the remaining waste types being significantly lesser quantities. Tailings would be disposed as a slurry in a dedicated TSF. Waste rock will be disposed as an open stockpile with wastewater runoff from that facility being pumped to the TSF. The remaining waste types namely domestic waste, sewage sludge, industrial and hazardous waste (waste oils, hydraulic fluid, lubricants and so forth) would all be incinerated at a rate of 14.5 tonnes per day. Bottom ash from the incinerator would be disposed in the TSF.

8.2.2. Waste rock stockpiles

Overburden rock dumps would be established in the vicinity of the mine pits on unoccupied land. Although acid rock drainage (ARD) is not anticipated it is nonetheless prudent to discharge runoff from the waste rock dumps to the TSF.

8.2.3. Impact Assessment

Table 10. Impact significance for Project-related waste management impacts

Potential Environmental Cost	Risk of material reductions in environmental quality
Inherent risk	**Moderate**
Risk source	**Likelihood of causes**
Transfer of contaminants from waste into surface and/or groundwater	Unlikely but possible with the integrity of the TSF being key to managing this risk. Waste generated at Pevek would be minimal and principally municipal solid waste (MSW) which could be disposed at an existing landfill
Transfer of contaminants from waste into soil	Definite for the waste rock stockpile and for the TSF. Waste generated at Pevek would be minimal and principally municipal solid waste (MSW) which could be disposed at an existing landfill
Transfer of contaminants from waste into atmosphere	Definite (incineration) but immaterial as emissions comply with defined emissions performance criteria for incinerators (IFC EHS Guidelines). Not applicable to Pevek
Residual risk	**Moderate**

8.2.4. Mitigation[13]

Waste rock dumps

Minimize erosion, reduce safety risks and design for deterioration over time of geotechnical properties.

Tailings

Design based on geotechnical stability, seepage management, flood events and seismic risk.

Hazardous Waste

Segregation from non-hazardous wastes, define risks through complete life cycle, prevent accidental releases to air, soil, and water resources, develop spill countermeasures and ensure chemical compatibility.

Incinerator Operations

Avoid incineration of wastes containing metals and metalloids (e.g., mercury and arsenic), comply with national and internationally recognized standards for incinerator

[13] These proposed mitigations derive directly from the IFC's EHS Guidelines for Mining (2007) (available at . https://www.ifc.org/wps/wcm/connect/595149ed-8bef-4241-8d7c-50e91d8e459d/Final%2B-%2BMining.pdf?MOD=AJPERES&CVID=jqezAit&id=1323153264157 https://www.ifc.org/wps/wcm/connect/595149ed-8bef-4241-8d7c-50e91d8e459d/Final%2B-%2BMining.pdf?MOD=AJPERES&CVID=jqezAit&id=1323153264157 https://www.ifc.org/wps/wcm/connect/595149ed-8bef-4241-8d7c-50e91d8e459d/Final%2B-%2BMining.pdf?MOD=AJPERES&CVID=jqezAit&id=1323153264157

design and operating conditions and implement maintenance and other procedures to minimize planned and unplanned shutdowns.

8.3. Impact on Surface Water and Groundwater

Risks of impacts on surface and groundwater derive from pumping of water from the mine pits, possible infiltration of supernatant from the TSF and, spillage of hazardous materials on site. Static and kinetic tests indicate acid rock generation risk is low.

8.3.1. Hydrogeological Conditions

Geological substrate

The upper part of the geological profile comprises relatively thin alluvial deposits associated with small local rivers and streams (gravel, sand and loam) and diluvial deposits (debris and sandy loam) forming a thin blanket on the river valley slopes in the Peschanka River basin.

'Extension zones', which facilitate the upward movement of ore-bearing fluids and solutions include exposed fractures and are highly permeable. These are the weakest zones in the Earth's crust where the river valleys and, possibly, linear fracture systems have developed in their current shape and form.

Cryological stratification

Supra-permafrost water occurs as a seasonally thawed layer having a thickness of 0.5 to 3.5 m. Inter-permafrost groundwater or non-frozen water under rivers and streams ('through taliks') is concentrated under the river channels and lower terraces of larger rivers. Sub-permafrost groundwater occurs at depths exceeding 150 m in slightly fractured or even completely impermeable plutonic rocks.

Fracturing

The rock profile comprises three intensively fractured layers with the upper layer including the weathering zone and seasonally thawed layer and talik zones underneath the river channels and frost-cleft rock formations in exposed areas. The middle includes the contact zones of dikes and other intrusions. The lower layer has a thickness of up to 100 m and encompasses the bottom section of permafrost layer developed as a result of cryogenic (freeze thaw) disintegration.

8.3.2. Water Quality

Surface water quality

Water mineralisation in rivers and streams in the license area is very low, resulting in fresh, sweet water and fed by melt water. Water is slightly acidic to neutral with pH ranging from 5.6 to 6 but containing iron and manganese exceeding respective MPC limits by more than 3 times. High permanganate oxidability values imply the presence of phenols and other organic compounds. Surface water quality in the Project area does not meet the fisheries and drinking water quality guidelines, especially during floods.

Groundwater quality

Supra-permafrost water is very similar to surface water in composition and quality with pH levels ranging from 5.8 to 7.3 and iron and manganese at elevated concentrations of up to 18 times the MPC. Sub-permafrost water has a mineralisation of up to 1.8 g/l, and as such is classified as brackish water. Mineralisation increases with depth and may reach 5 g/l. Elevated concentrations of iron and manganese exceed the MPC limit 150 times for iron and manganese by more than tenfold. In addition, this water contains boron, beryllium, lithium, strontium and tungsten at unacceptably high concentrations.

8.3.3. Surface water impact assessment

The surface water impact assessment is summarised in Table 11.

Table 11. Summary rationale for impact significance in respect of risk of deterioration of surface water quality as a result of Project activities

Potential Environmental Cost	Deterioration of surface water quality
Inherent risk	**Moderate**
Causes of risk	**Likelihood of causes**
Water pumped from the pits will contain elevated concentrations of iron, manganese, copper and other heavy metals.	Unlikely but possible that this water will enter the surface water environment This risk does not exist at Pevek.
Discharge of supernatant from the TSF into the downstream environment either directly or via infiltration	Unlikely (but possible) as the TSF will have an impermeable base and retention dam. This risk does not exist at Pevek.
Residual risk	**Moderate**

8.3.4. Geohydrology Impact Assessment

Pit dewatering

Total water inflow to the deepest section of the pit is expected to be some 650 m3/day at the end of the mine life. Water pumped from the pits and runoff from ore stockpiles would be discharged into the TSF. Project-related impact on groundwater resources is expected to be limited in scale and, given a relatively small pit dewatering requirement during mining operations, considered to be of minor significance for groundwater.

8.3.5. Tailings Storage Facility

The proposed TSF design will benefit from the underlying permafrost layer acting as a regional confining bed in the study area. Thermal conductivity estimates show that permafrost thawing under the TSF site is not expected. Additionally, a drainage system would be installed to collect and recycle seepage water to the TSF.

Groundwater contamination risk

The use of permafrost to create an impermeable layer at the base of the TSF is deemed acceptable. The risk of spillage of hazardous materials is mitigated by a two-pronged approach, namely an effective hazards materials management regime to prevent spillages and effective spill recovery and countermeasures in the event of a spill.

Table 12. Summary rationale for impact significance in respect of risk of deterioration of groundwater quality related to the Project

Potential Environmental Cost	Deterioration of groundwater quality
Inherent risk	**Moderate**
Causes of risk	**Likelihood of causes**
Infiltration of supernatant through the base of the TSF	Unlikely but possible given the use of permafrost as an impermeable barrier. There is no TSF at Pevek.
Spillage of hazardous materials	Unlikely but possible as hazardous materials would be managed to prevent spills. In the event of a spill, spill recovery and countermeasures would be deployed. Such contingencies would also apply to Pevek.
Residual risk	**Moderate**

8.3.6. Proposed Mitigation

Develop a detailed water balance for the project, implement an advanced monitoring system and use on geo-cryological investigations to inform TSF design.

8.4. Biodiversity impacts

Chukotka's fauna comprises 64 mammal species and 220 bird species with species of conservation value inhabiting Chukotka snow sheep, osprey, white-tailed eagle, blue hawk, gyrfalcon, peregrine falcon, eagle owl and boreal owl. Seasonal (spring/autumn) migration routes used by larger birds (goose and duck) are some 20 km away from the mine site and the aerodrome in particular, and follow the floodplain valleys of the Bolshoy Anyuy, Angarka and Baimka rivers.

Species recorded during field surveys were predominantly predators and small rodents with no rare/protected species recorded. Birds and animals in the Project area have a much larger geographic distribution with habitats concentrated in the floodplains of rivers and streams in the area. The tundra is extremely vulnerable to impact as indicated by mining activities resulting in significant environmental degradation. Such degradation is, however, largely limited to the areas directly affected by the mining. Potential impacts on biodiversity from the proposed project would result from habitat destruction, reduced habitat quality, noise and light pollution and poaching by mine personnel.

8.4.1. Impacts on fish

Although fish populations would be lost from the rivers directly affected by the TSF, the lost population would not constitute a significant loss of species and would not imply in any way the potential loss of a species.

Table 13. Summary rationale for impact significance in respect of aquatic ecosystems as a result of Project activities

Potential Environmental Cost	Risk of reduced fish populations
Inherent risk	**Moderate-high**
Causes of risk	**Likelihood of causes**
Sedimentation of surface water	Definite in the areas of the TSF and water reservoir and highly likely downstream during construction of the dam walls. Unlikely but possible during operations. Not applicable to Pevek.
Reduced water quality due to wastewater discharges	Highly likely during the construction phase but restricted to the immediate vicinity of the mine site. Unlikely, but possible, due to discharge of all wastewater into the TSF. Not applicable to Pevek.
Impeded fish migration	Definite in the upper reaches of the Yegdegkych River. Highly unlikely elsewhere and does not apply to Pevek.
Changes in water level	Definite downstream of the TSF but limited extent
Degradation of riparian habitats and spawning areas	Highly unlikely outside the realm of the TSF and does not apply at Pevek.
Impacts associated with physical fields	Highly unlikely outside of the realm of the TSF and does not apply at Pevek.
Illegal fishing activities	Highly likely without strict controls and does not apply at Pevek
Residual risk	**Moderate**

8.4.2. Impact on land-based ecosystems

Impacts on land-based ecosystems are primarily a function of the direct physical transformation of land due to exploration and mining and how that transforms habitat. In addition, noise, especially from blasting, but also from vehicle movement and operations of the processing plant, light and atmospheric emissions would also serve to reduce habitat suitability but limited to no more than a radius of 10 km around the mine site. The consequences of such changes would be potential reductions in animal populations and that is how the impact assessment is framed. Impact significance is summarized in Table 14.

Table 14. Summary rationale for impact significance in respect of terrestrial ecosystems as a result of activities at the Peschanka Copper Project

Potential Environmental Cost	Risk of reduced terrestrial fauna populations
Inherent risk	**Moderate-high**
Causes of risk	**Likelihood of causes**
Loss of vegetation cover	Definite over the entire mine site, access roads to the aerodrome and the main road and the marshalling facilities at Pevek. Materiality of this loss is very low, however, within the context of the surrounding expanse of wilderness area.
Dust deposition	Considered likely but limited in spatial extent. Also likely at Pevek during construction of negligible impact due to scale.

Potential Environmental Cost	Risk of reduced terrestrial fauna populations
Distortion of plant communities and associations	Definite across the entire project footprint including Pevek but relatively small area.
Fires started by people	Impact is considered likely and to potentially affect much larger areas of vegetation than would be affected by the direct impact of the mine. Extremely important for the mine to maintain effective fire control and the same would apply to the facilities at Pevek.
Barriers to migration	Highly unlikely given existing migration patterns and the relatively small footprint of the mine. More important for power lines and the new road and not applicable to Pevek.
Fragmentation of natural ecosystems gullies, holes, pits and so forth on animal migration routes	Highly unlikely due to the relative size of the natural areas outside of the project foorptint. TSF will fragment Yegdegkych tributaries upstream of the TSF but relatively small scale. The new road likely to pose a more severe risk of fragmentation. Not applicable to Pevek.
Night time activities	Definite but largely limited to the mine area and a radius of up to some 10 kms from the mine footprint. Fauna density is generally low too with large ranges. Unlikely at Pevek due to proximity of town.
Unregulated wild plant harvesting and poaching	Likely unless very strict controls implemented. Poaching would exact a much larger toll on faunal populations than the mine's construction and operational activities.
Irreversible loss of directly affected habitats	Definite but limited to small fraction of a much larger area of similar habitat. This risk would not apply at Pevek.
Birds and large predators could be attracted to MSW	Highly unlikely given that an incinerator will be used for waste destruction. Risk does not apply directly at marshalling yard but likely to apply to municipal landfill at Pevek.
Residual risk	**Moderate**

8.4.3. Proposed Mitigation

Surface water

Establish/maintain special protection regime for water, no uncontrolled discharge, re-use of water, construction during low or no flow periods, erosion control and bank strengthening and surface water quality monitoring.

Habitat

Earthworks within the delineated construction site boundaries and no unauthorised off-site roads or tracks.

Biodiversity

Strict compliance with emissions and discharge standards, prevent vehicle access to adjacent areas of barren tundra, enforce strict anti-poaching and fire prevention regime.

Soil

No soil to be removed which may result in permafrost loss.

8.5. Ecosystem Services Assessment

Ecosystem services (services provided by the environment that underpin human welfare) may be impaired in the project area through destruction or damage of specific components of the environmental system that provides the services. It should be noted that for ESS to be considered impaired, the project would have to reduce the availability of the service to other users.

Table 15. Summary rationale for impact significance in respect of impaired ecosystem services as a result of activities at the Peschanka Copper Project

Potential Environmental Cost	Risk of impaired ecosystem services
Inherent risk	**High**
Causes of risk	**Likelihood of causes**
Natural pastures	Highly unlikely as the closest pasture is some 12 km beyond the watershed in which the mine would operate. The same principle applies to Pevek.
Forest fare	Highly unlikely as forest fare is not harvested due to the remoteness and accessibility of the area. Pevek is too small for such impairment to be material.
Game	Highly unlikely due to the very limited game in the immediate mine or Pevek Marshalling yard area BUT essential that poaching by mine personnel is outlawed and strictly enforced.
Fish	Highly unlikely due to the limited fish populations that would potentially be affected by the mine BUT essential that poaching by mine personnel is outlawed and strictly enforced. Not applicable at Pevek.
Firewood	Highly unlikely as no firewood is sourced in the project area. Pevek is spatially too limited for material impact.
Greenhouse gases flux regulation	Unlikely as current estimates show that flux for tundra is about zero. Transformed land would not absorb CO2 but continuity emitting and the mine will be a source of greenhouse gas emissions (both directly and indirectly). Pevek
Carbon sequestration	Highly unlikely due to the relatively small spatial areas of the mine and marshalling yard sites.
Water runoff management	High unlikely as the project is relatively negligible component of the overall surface water availability and immaterial for Pevek.
Soil erosion prevention	Highly unlikely due to the relatively small area that would be transformed at both the mine site and Pevek.
Social and cultural services	Highly unlikely at both sites due to no tourism at the mine site and very limited at Pevek.
Supporting services	High unlikely due to the relatively small areas affected.
Supporting biodiversity and genetic resources	Highly unlikely as rare/protected species have been recorded in the area.
Residual risk	**Low**

8.5.1. Proposed Mitigation

Implement an ecosystem services management programme, with an effective monitoring regime and strictly outlaw poaching.

8.6. Climate Change Assessment

Continued global greenhouse gas emissions will cause further warming and long-lasting changes in all components of the climate system, increasing the likelihood of severe, pervasive and irreversible impacts for people and ecosystems.

8.6.1. Natural and Anthropogenic Greenhouse Gas Emissions in the Far North

Tundra soils are extremely sensitive to human driven transformations especially degradation of permafrost, because permafrost and associated soils are considered the most significant terrestrial carbon pools (reserves) on the planet. The concern is that as temperature increases so the soils may move from carbon sinks to carbon sources.

8.6.2. Assessment of Greenhouse Gas Emissions from the Peschanka Copper Project

GHG emissions derive from earthworks, vehicles, construction machinery and other fuel burning appliances, thawing permafrost, electricity generated from fossil fuels methane emissions from the reservoir and the TSF and soil drying due to fires.

Table 16. Summary rationale for impact significance in respect of climate change and its consequences as a result of Project activities

Potential Environmental Cost	**Contribution to climate change and its consequences**
Inherent risk	**High**
Causes of risk	**Likelihood of causes**
All earthworks Methane emissions from water reservoir and TSF Thermal envelopes from buildings	Definite but the relative scale of emissions is negligible relative to the incomparably larger scale effects of regional and national emissions.
Vehicles, construction machinery and other fuel burning appliances Electricity generated through fossil fuels	Definite and a material addition to the GHG emissions budget of the region. Relative to emissions from the country as whole (estimated at 2.7 billion tonnes CO2eq.) and the world, the risk sources are very small. The challenge is one of reducing GHG emissions across all sources. While the emissions contribution would be relatively small, every effort must be made to reduce GHG emissions across the entire mine and processing plant operation.
Soil drying effect of runaway fires	Likely but immaterial on a comparative scale. Entirely preventable, however. and as such should be prevented. Fire control requirements for Pevek would be as important.
Residual risk	**Moderate**

8.6.3. Proposed Mitigation

International lenders and the Russian environmental legislation oblige businesses to quantify and reduce GHG emissions as much as practicable. Mitigation includes quantifying GHG sources and setting reduction targets, prevent permafrost thawing and flooding/waterlogging of the Project site, adopt BAT for energy efficiency, limiting idling on vehicles, prevent off site access by vehicles and maintain strict fire control regime.

8.7. Climate Risk Adaptation

The proposed mine would operate against a backdrop of continued changes in climate, a progressive warming and increased precipitation. Such changes could invoke new environmental and social risks, or could exacerbate risks that are not considered significant now. The mine may also face changes in other risk profiles as the climate changes and needs to prepare for those risks.

Climate change risks for the Project

Dam failure as a result of unanticipated inflows

Increases in precipitation may trigger unanticipated inflows and resultant dam collapse. Constructing the TSF in stages provides some flexibility for adaptation where the latest hydrology can be used in designing the raising of the dam wall. The wall of the water reservoir will be built in one go for the duration of the Project. Emergency discharge can be included in the design of the reservoir dam wall but not for the TSF as there cannot be downstream discharge of supernatant.

Dam failure as a result of solifluction

Thawing of permafrost under the TSF and water reservoir would increase infiltration of water and stimulate solifluction processes, active ice formation and bulging of soils potentially destabilizing the dam walls.

Polluted water entering natural water bodies

A failure of the TSF dam wall would result in a catastrophic discharge of supernatant and tailings but a more insidious risk would be the progressive thawing of the permafrost layer under the TSF and infiltration of the supernatant into the underlying groundwater. The stability of the post closure TSF in a warmer wetter climate is uncertain.

Unanticipated increases of flow into the pits

Increased precipitation entering the pit directly and increased surface runoff and thawing of permafrost providing larger inflows into the pits from groundwater would require pumping increased water volumes. Additional volumes imply additional capacity in the TSF.

Increased rodent populations

Increased rodent populations could be brought about by several factors including warmer conditions and out migration of predators. This risk would also apply potentially for the Pevek facility.

Proposed adaptation measures

Comprehensive environmental monitoring and continued refinement, as a function of that environmental monitoring data, of forecast changes in rainfall and temperature. Develop a hydrological model that provides accurate forecasts of the water volumes that would need to be managed.

9. SOCIO-ECONOMIC IMPACT ASSESSMENT

9.1. Introduction

The economic development consequences of the Project are significant and positive in their own right with resultant knock on economic and tax revenue benefits. There are also some potentially negative social impacts including work seeker influx, potential social disruption and the vulnerability of especially Indigenous People to the allure of jobs (and salaries) offered by the Project. Individuals taking jobs at the mine may undermine the critical mass of people needed to maintain their traditional way of life and livelihoods.

9.2. Economic Growth

The headline economic growth benefits are up to 5,000 jobs created during the construction phase (at peak) and up to 2,000 jobs during operations of more than 20 years, USD 5.5 billion expenditure, 15 to 20% increase in copper production, more than doubling of the regional gross product for Chukotka and significant increases in tax revenues from the project and the knock-on growth effects in other economic activities. Direct and indirect spending, job creation and tax revenues could be used to achieve elements of the UN's Sustainable Development Goals (SDGs) in the district and region.

It is not possible to state definitely how the additional revenues would be used by the public sector but it is important to detail what could be achieved in respect of the SDGs. It is presented in the ESIA that SDG 1 – No poverty, SDG 2 – Zero hunger, SDG 3 – Good health and wellbeing, SDG 4 – Quality education, SDG 5 – Gender equality, SDG 7 – Affordable and clean energy, SDG 8 – Decent work and economic growth and SDG 9 – Industry, innovation and infrastructure, could all potentially be advanced in the area through the additional revenues received by the municipality.

9.3. Other Benefits

The other potential benefits that could be attributed to the economic growth and employment benefits of the Project include: General improvements in living standards, new job creation, greater business confidence, greater spending on public goods and services, greater efficiencies in the provision of public services, diversification of economic activities for greater resilience and a wider range of choices for residents.

Table 17. Assessment of social impact significance in this case the expected benefits to occur as a result of the proposed Project

Potential Social Benefit	**Net improvements in human welfare**
Inherent benefit	**Moderate-High**
Risk source	**Likelihood of causes**
Overall economic growth	Net improvements in human welfare are considered highly likely over an extended area of the Okrug given the almost doubling of the GRP that is expected to result from the Project and the multiple potential public benefits that could accordingly be realised including job creation.
Construction and operational spending	
Job creation	
Residual benefit	**High**

9.4. Employment Related Impacts

9.4.1. The Bilibinsky Municipal District

Employment is an important benefit. During the construction peak some 5,000 workers would be required with rotational employees being accommodated in the construction camp at the site. It is surmised that the bulk of the construction force sourced from the Bilibinsky Municipal District would be unskilled implying the need for import of skilled labour. The maximum number of permanent employees would be reached in 2028 at which point up to 2,000 people would be employed.

Table 18. Assessment of social impact significance in case the potential negative impacts to occur as a result of the proposed Project

Potential social risk	**Net reductions in human welfare**
Inherent risk	**Moderate-High**
Risk source	**Likelihood of causes**
Unemployment reduction	The high level of existing employment (97.3%) and lack of qualified workforce will likely exacerbate labour influx and associated potentially negative effects.
Inflationary effects	Inflation would reduce purchasing power for those who do not experience income growth, especially problematic for economically vulnerable people (such as pensioners).
Labour influx	The project has the potential to add an additional 5,000 residents during the construction stage and an additional 1,000 permanent residents during mine operations.
Pressure on social infrastructure	Labour influx may increase pressure on social infrastructure. Vulnerable groups may be directly and negative affected.

Potential social risk	Net reductions in human welfare
Social conflicts	Labour influx may cause conflicts between new and existing residents especially with single male labourers
Increase in communicable disease	It is highly likely that such effects would occur but a net reduction in human welfare seems highly unlikely.
Residual risk	**Low**

9.5. Impact on Indigenous Peoples

Neither the Peschanka mining and processing plant nor the proposed Pevek marshalling yard facilities would directly affect the indigenous communities and traditional nature use. The proposed federal motor road may affect wild reindeer migration pathways but not those of domestic reindeer herds. The access road from the proposed federal motor road to the Peschanka Copper Project site will cross the Burgakhchan Community's pastures.

Table 19. Assessment of social impact significance in this case the negative impacts expected to occur amongst IP as a result of the proposed Project

Potential Social Cost	Risk of reduced livelihoods
Inherent risk	**Moderate-High**
Causes of risk	**Likelihood of causes**
Access road through Burgakhchan lands	Definite fragmentation of TNU land but also more effective access to the district capital, Bilibino and regional capital, Anadyr. Reduced livelihoods unlikely.
Declining IP communities' capacity to maintain traditional nature use	Likely and for the Burgakhchan at least this would make the impact of moderate to high significance. Free choice of the Burgakhchan cannot be impaired
Competition for forest fare (berries/mushrooms)	Labour influx is definite with possible competition for forest fare but loss of livelihoods highly unlikely.
Residual risk	**Low**

9.6. Proposed Mitigation

Close cooperation with neighboring IP communities (the Burgakhchan specifically) strongly advised while enforcing strict anti-poaching policy amongst mine personnel.

10. STAKEHOLDER ENGAGEMENT

Stakeholder engagement was initiated early on in the project although this was fairly limited at first. May 2019 consultation was effected with representatives of the Bilibinsky Municipal District Administration, Ozernoye Municipal Agricultural

Enterprise, Burgakhchan Community, Bilibino landfill representatives, Pevek Urban District Administration, and IP association representatives in Pevekand Anadyr.

10.1. Interested and affected parties

The Burgakhchan (considered vulnerable), Luch Mining Cooperative and two people living in Vesenniy, the entire Pevek and Bilibino community and IP communities whose pasture lands or migration routes are crossed by the roads. Local self-governing bodies and environmental and social NGOs, federal authorities and the Chukotka regional administration The Administrations of the Bilibinsky Municipal District and the Pevek Urban District, the IP associations and any other interested parties.

10.2. Consultation Programme

The Consultation Programme includes ESIA consultation according to IFC requirements and OVOS consultations according to the Russian legal requirements.

11. SUMMARY AND CONCLUSIONS

Environmental assessment fulfils two important project requirements namely:

- Allowing lenders to satisfy their own internal sustainability policies on where they chose to lend or invest.
- The local regulatory requirements for assessment of a project before it can proceed; and,

The first requirement is addressed in this ESIA while the second would be completed as the an OVOS (the Russian equivalent of an ESIA) together with the required design documentation, to be completed during 2020.

The Project

The Project is the establishment of a large-scale open pit operation to extract and process copper and gold in the Baimka Ore Field of the Chukotka Autonomous Okrug. The mine infrastructure would include ore processing line to crush and grind the ore and then use flotation technology to concentrate the copper to commercial recovery. Tailings would be discharged into a dedicated tailings storage facility (TSF) to be built in the Peschanka-Yegdegkych River Valley. The mine will also include facilities for accommodation of mine personnel, offices and administration, maintenance workshops, stores, an explosives magazine, waste rock dumps and an aerodrome. A marshalling yard would also be established close to the port town of Pevek to facilitate materials transport between the mine and the port. The mine would be developed in an extremely harsh climate and will require provision for such in the design and implementation of the project.

Natural environment

Chukotka is sparsely inhabited with few rural settlements due to the extremely harsh climate and the lack of access to much of the area. The rural/wilderness areas of the Okrug are almost pristine and natural. The tundra environment is one of extreme fragility despite the harsh conditions in which it occurs. Cryogenic processes are a key determinant of the nature of the soils, associated vegetation and habitat and the fauna that is to be found there. The area is not especially diverse in terms of vegetation or fauna (fish, birds and mammals) but there are important species that occur in the area, the sustainability of which cannot be threatened by activities at the mine. There are no red-data species in the immediate project area but the flora and fauna in the area is nevertheless deserving of protection and on-going conservation.

Social environment

There is evidence of human activities in the placer mining of Luch Free and other historical mining operations together with the exploration activities especially those for the Peschanka Copper Project. An important grouping of people is the Even that live to the south of the project area and who practice the traditional nature use that categorises them as 'Indigenous People'. This is the Burgakhchan community and although its is highly unlikely that the mine would impact on their traditional lifestyle directly, the importance of ensuring that there are no such impacts cannot be over-emphasised.

Potential environmental and social risks

The impacts identified for the construction and operation of the mine and processing plant and the marshalling yard at Pevek are summarized in Table 20. The impacts have been identified as a function of the cause-effect relationships that exist in the natural and social environments, which can only be effectively understood as a system. The mine activities would result in environmental and social aspects (such as resource use, waste and pollution and social aspects) with the aspects bringing about potential changes in the receiving environment or society. The impacts are expressed as consequences of the changes and are assessed firstly in terms of inherent risk (viz. what could happen). Then, as a function of the specific circumstances of the mine and the environment in which it would be established, together with the mitigation that could be brought to bear to reduce the extent of the change, the likelihood of the inherent risk. The likelihood of the inherent risk provides a residual risk (viz. what is likely to happen). It is the residual risks that need to be accepted by the authorities and lenders to realize the benefits that would be associated with the mine. Those residual risks than also highlight which aspects require the most careful management attention during the implementation and operation of the mine.

Mostly due to the very small area that would be affected by the mine relative to the much larger wilderness area of Chukotka, none of the residual risks are considered significant and no suggestion of a potential fatal flaw. At the same time the job creation, spending and resultant economic growth would likely result in net improvements in human welfare at least in Bilibino and to a lesser extent but still importantly within the Okrug as a whole.

Table 20. Summary listing of impacts as assessed in this ESIA

Risk/Benefit		Inherent Risk/Benefit	Residual Risk/Benefit
Risk	Adverse human health effects	High	Low
Risk	Damage to vegetation and reduced habitat	Moderate – high	Low
Risk	Risk of material reductions in environmental quality	Moderate	Moderate

Risk/Benefit		Inherent Risk/Benefit	Residual Risk/Benefit
Risk	Deterioration of surface water quality	Moderate	Moderate
Risk	Deterioration of groundwater quality	Moderate	Moderate
Risk	Risk of reduced fish populations	Moderate – high	Moderate
Risk	Risk of reduced terrestrial fauna populations	Moderate – high	Moderate
Risk	Risk of impaired ecosystem services	High	Low
Risk	Contribution to climate change and its consequences	High	Moderate
Benefit	Net improvements in human welfare	Moderate – high	High
Risk	Net reductions in human welfare	Moderate – high	Low
Risk	Risk of reduced livelihoods	Moderate – high	Low

Environmental and social management

That assessment does not say that the impacts would take care of themselves. The impact risks require a broad range of mitigation to ensure that the residual risks are no worse that what has been predicted in the ESIA. Not only would that mitigation be required but there would need to be highly effective environmental and social management during the lifetime of the mine to ensure that it stays that way. An Environmental and Social Management Programme (ESMP) has been developed for implementation with the Project as the foundation of a fully-fledged operational Environmental and Social Management System (ESMS). The development of the ESMS would be premised on ensuring that none of the risks identified in the ESIA are ever allowed to get worse than they are predicted to be here and that over time there would be a process of continual improvement in the environmental and social management performance of the mine. The overall environmental and social sustainability objective of the project must be to maximise the social benefit of the project while minimising the environmental cost.