SHALKIYA MINE EXPANSION PROJECT

(KYZYLORDA REGION, KAZAKHSTAN)

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

NON-TECHNICAL SUMMARY

Version B

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DISCLAIMER

This Non-Technical Summary is the summary of the Environmental and Social Impact Assessment Report for the Shalkiya Mine Expansion Project and is based on the information available at the time of its preparation. This document is confidential and intended solely for the internal review by Hatch Engineering and Consulting (Hatch) and JSC ShalkiyaZinc LTD. The Ecoline Environmental Assessment Centre accepts no liability for the consequences of any actions taken on the basis of the information provided herein.

LIST OF ABBREVIATIONS

APP	Air pollution potential
EBRD	European Bank for Reconstruction and Development
Ecoline EA Centre	Ecoline Environmental Assessment Centre Non-profit Partnership
ESAP	Environmental and Social Action Plan
ESIA	Environmental and Social Impact Assessment
EU	European Union
GHG	Greenhouse gases
ICWC	Interstate Commission for Water Coordination
IFC	International Finance Corporation
IFI	International Financial Institutions
IPCC	Intergovernmental Panel on Climate Change
LOM	Life-Of-Mine
OVOS	Environmental Impact Assessment per Kazakhstani legislation requirements (Otsenka Vozdeistvia na Okruzhauschuu Sredu in Russian)
PR	Performance Requirements of the EBRD
PS	Performance Standards of the IFC
RK	Republic of Kazakhstan
SanPiN	Sanitary Rules and Norms
SEP	Stakeholder Engagement Plan
SN	Sanitary Norms
SPA	Special Protected Area
SPZ	Sanitary Protection Zone
Syr Darya (RBMA)	Syr Darya River Basin Management Authority
TSF	Tailings Storage Facility
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
UNEP	United Nations Environmental Programme

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1. INTRODUCTION

JSC ShalkiyaZinc LTD is proposing to expand the existing Shalkiya Mine, which is located in Zhanakorgan District, Kyzylorda Region, in the south of Kazakhstan (**Figure 1**). The Project entails an expansion of operations of the Shalkiya Mine and the construction and operation of a new Processing Plant and supporting surface and underground infrastructure. JSC ShalkiyaZinc LTD plans to approach International Financial Institutions (IFIs) to obtain funding for the proposed Project. The IFIs require *inter alia* an Environmental and Social Impact Assessment (ESIA) to support the funding application. Such an ESIA has been completed for the proposed mine expansion and this document serves as Non-Technical Summary (NTS) of the ESIA.

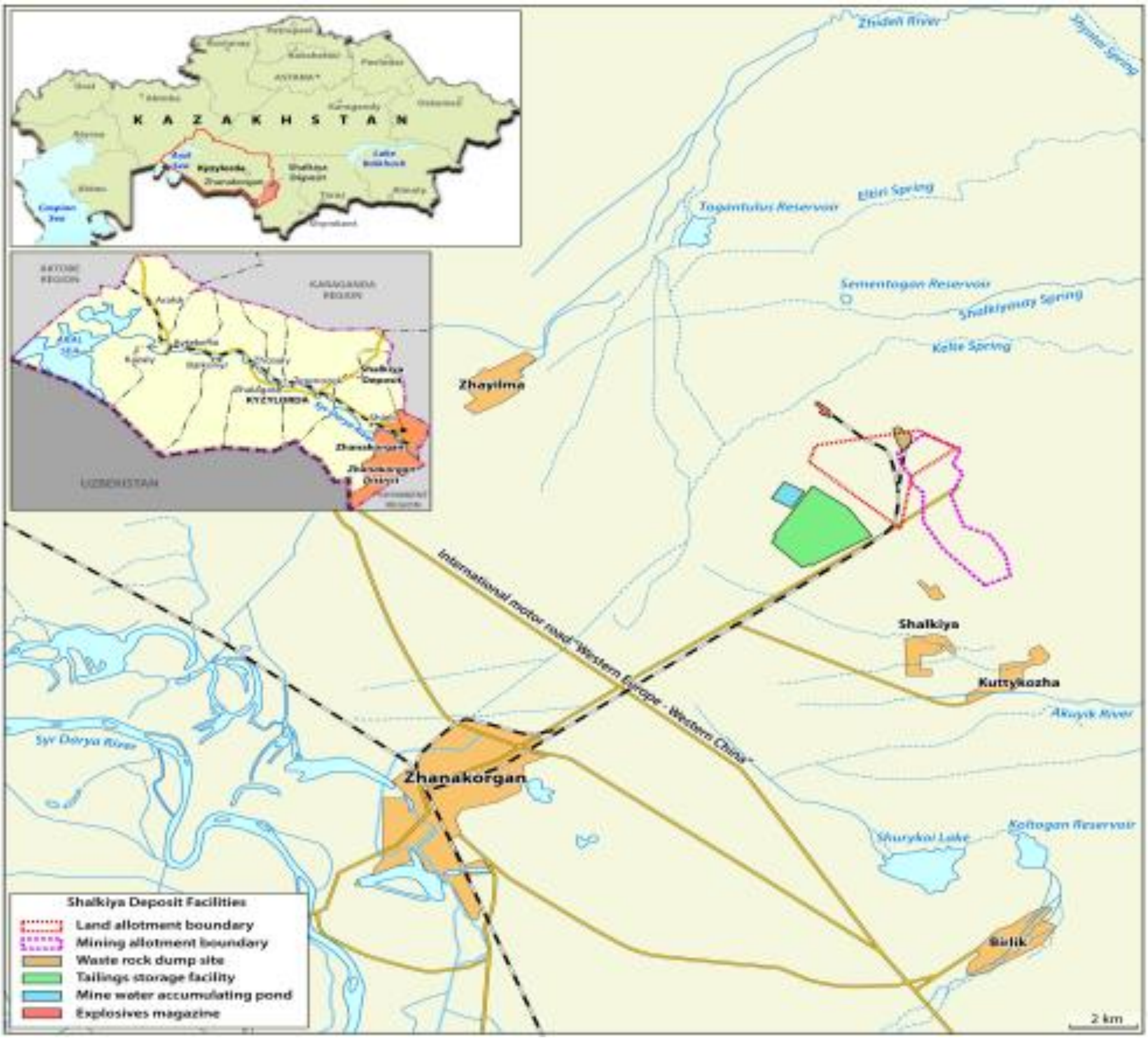

Figure 1: Map showing the position of the mine in southern Kazakhstan and surrounding settlements and other features

Source: Ecoline EA Centre, own map.

2. THE PROPOSED PROJECT

2.1. Historical Context and Current Status of the Project

The Shalkiya Mine commenced mining in 1982 and ceased in 1994 for economic reasons. Mining was re-started in 2004 and operated until 2008 when the mine was put into a care-and-maintenance programme simply to maintain the facilities. The initial mine infrastructure consisted of two vertical shafts, a mine settling pond for retaining and potentially treating pumped mine water, administration buildings and several other buildings that were never completed, such as the sewage treatment plant. The entire run-of-mine ore was transported by rail from the mine to off-site processing facilities with no ore processing on site. As a result, there are currently no tailings facilities, no significant overburden, nor waste rock dumps although there is a small existing waste rock stockpile north east of the site.

2.2. Shalkiya Deposit

The Shalkiya lead-zinc deposit includes North-Western and South-Eastern properties with total commercial reserves of 117,126 thousand tonnes. In the North-Western property, the ore bodies are located between 40-50 m up to 680 m below the surface, whereas the South-Eastern property's mineralization extends deeper and concentrates at a depth of 530-860 m below the surface.

2.3. Proposed Mining Operations and Infrastructure

The mining rate is currently planned at 4.0 Mtpa, with over 70 million tonnes of zinc-lead ore to be mined during the life-of-mine (LOM). The mining would progress in a south-easterly direction becoming progressively deeper following the ore body. Traditional underground mining methods would be used to develop and extract the ore, utilizing the standard drill-blast-haul-hoist cycle. The underground operations would be accessed via the existing ramp and vertical shafts. The existing and proposed facilities are shown in **Figure 2**.

In support of the mining activities it would be necessary to upgrade existing and establish new underground facilities. Underground facilities include:

- primary crushing,
- water management systems,
- power distribution systems,
- ventilation,
- equipment maintenance, storage and support, and
- other underground utilities, such compressed air and communication and process control systems, as necessary.

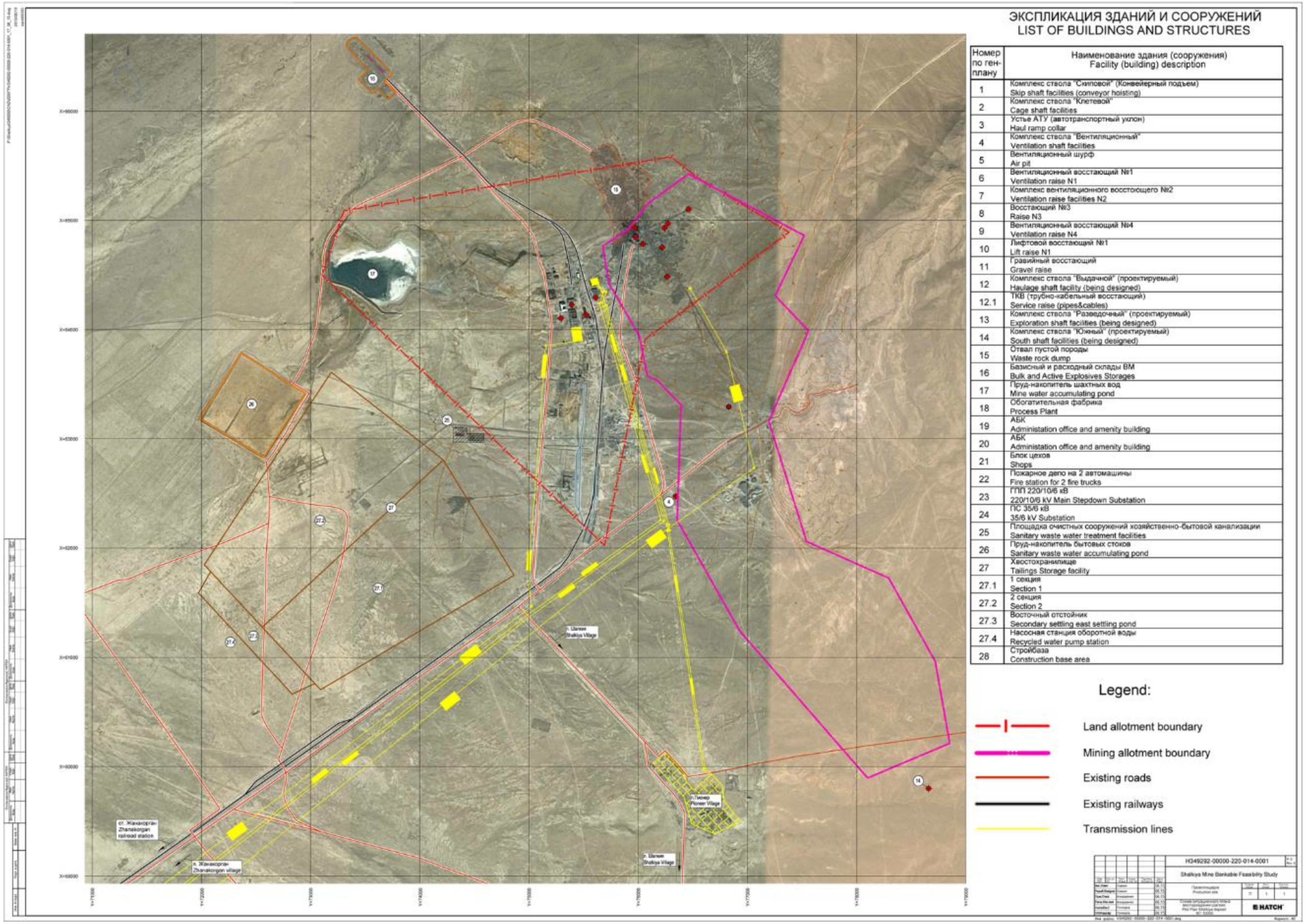

Figure 2: Location of the ore body, the current mine infrastructure, proposed Tailing Storage Facility (TSF) location and the waste rock stockpiles

The required surface infrastructure would include:

- A processing plant that would serve to separate out the zinc and lead concentrates;
- A tailings storage facility;
- A water management system;
- A waste management system; and
- Development of support infrastructure to support the mine and process plant activities (maintenance and repair facilities, equipment and material storages, power distribution, accommodation and administration buildings, mine rescue and fire station, etc.).

2.4. The processing plant

Pb and Zn concentrates will be produced via a conventional flotation process. Ore crushed underground will be conveyed to surface from where it will undergo secondary crushing and then grinding in ball mills followed by flotation where various reagents will be used to recover the concentrate. A Zn upgrade circuit will also be added to produce high quality Zn concentrate. Lead concentrate and high grade Zinc concentrates would then be bagged in covered rail cars to be transported to a smelting facility for further processing

2.5. Construction Activities

Given that the mine already exists much of the construction activities would be upgrading of existing infrastructure but a range of new facilities would be constructed. These new surface facilities include the processing plant, the sewage treatment plant and the tailings dam and underground facilities supporting the mining activities including workshops, explosive magazines, and so forth. The kind of activities that would be required for this construction include bulk earthworks and excavations, concrete batching, structural steel erection and cladding and electrical and mechanical installations. The construction would also see commissioning of the new equipment. The underground facilities would require new areas to be excavated in order to house the support facilities.

2.6. Mine Closure

A mine closure plan must be prepared to detail the technical requirements together with adequate financial provisions for the closure. The mine closure planning must ensure:

- Future public health and safety are not compromised;
- The post mining use of the site is beneficial and sustainable to the affected communities in the long term;
- Adverse socio-economic impacts are minimized and socioeconomic benefits are maximized.

Closure and post closure plans should include maintenance of the facility and continued monitoring of the site, pollutant emissions, and related potential impacts for a duration commensurate with the risk, but for at least five years.

3. REGULATORY AND INTERNATIONAL LENDER REQUIREMENTS

3.1. Legislative Requirements of the Republic of Kazakhstan

The Environmental Code (2007) is the key environmental legal document of the Republic of Kazakhstan. It prescribes undertaking OVOS for projects which may have a significant impact on the environment, public health and society and it is prohibited to carry out economic activities without the positive ‘conclusion’ of the state environmental review.

The Environmental Code (and relevant bylaws) sets requirements for land conservation and use, soil protection and preservation, and subsoil use, and regulates industrial atmospheric emissions. The Water Code of Kazakhstan regulates water use and protection aspects and dictates the need for a water use permit. The Environmental Code and relevant bylaws regulate waste management requiring waste producers to characterize and monitor the waste they produce and dipsosal. The main occupational health and safety (OHS) and community health requirements are contained in the "People's Health and Health System Code" (2009) and the law "On Civil Protection" (2014)".

3.2. International Lender Requirements

The ESIA has also been prepared within the framework of IFI requirements, namely the Equator Principles the European Bank for Reconstruction and Development (EBRD) and International Finance Corporation (IFC).

3.2.1. Equator Principles

The Equator Principles (EP) (Version III of 2013) establish minimum requirements for environmental and social management and have been adopted by most large-scale financial institutions throughout the world. The EP apply to all new projects with total cost exceeding US$10 million that have potentially significant environmental and social effects. The EP are also based strongly on compliance with the IFC's Performance Standards.

3.2.2. EBRD Requirements

The EBRD requires its clients to meet specific environmental and social performance standards and achieve sustainable outcomes as specified in its Environmental and Social Policy and specific Performance Requirements (PRs) (2014). Supporting environmental and social performance requirements are based on European Union legislation.

3.2.3. IFC's Policies and Performance Standards

The IFC is a part of the World Bank Group; however, it has its own policies and standards pertaining to environmental protection, health and safety, and public disclosure. They are presented in the Environmental and Social Sustainability Policy and eight supporting Performance Standards (PS) (2012) and sector specific environmental, health and safety guidelines.

3.2.4. Key requirements

The requirements at project stage for all three IFI's are detailed below:

Environmental and Social Impact Assessment (ESIA)

The ESIA has the following objectives:

- Identify and assess both adverse and positive potential impacts of the project;
- Prevent or, if prevention is impossible, minimize, mitigate or compensate for adverse project impacts on staff, affected communities, and the environment;
- Ensure appropriate communication with the affected population on issues that may potentially affect living conditions of that population; and,
- Facilitate improved social and environmental performance of companies through implementing effective management systems.

Environmental and social action plan (ESAP)

In order to ensure that findings and recommendations from the ESIA are properly implemented, it is necessary to develop an Environmental and Social Action Plan (ESAP). The ESAP should describe and prioritize all necessary social and environmental management requirements together with a cost and implementation timeline.

Stakeholder Engagement

Stakeholder engagement is the cornerstone of the ESIA and is partly addressed in the Kazakhstani regulations. For projects that might affect local population, the preparation of a Stakeholder Engagement Plan (SEP) is required in accordance with IFI and national requirements. The SEP details public consultation, disclosure of information, methods and timeframes of communicating information about risks of adverse impacts on local population and opportunity provided for engagement with such affected parties.

The ESIA, ESAP and SEP for the Shalkiya Mine Expansion Project have been prepared to comply with the requirements of the IFIs and legislation of Kazakhstan. The ESIA, ESAP and SEP have been completed but the local OVOS requirements, one each for the mine and the processing plant, are expected to be finalized later.

4. METHODOLOGY

Because ESIAs are predictive processes undertaken before a detailed design of the project is available there is always data uncertainty. Information was provided by the mine, and also sourced from 2007 and 2012 EIA reports (excluding the process plant), monitoring conducted by the mine, Internet searches and authorities. Information was also sourced during consultation processes. Impact significance was defined as a function of receptor sensitivity and the magnitude of the impact together with the probability of the impact.

5. ENVIRONMENTAL AND SOCIAL BASELINE

5.1. Climate and Meteorology

The mine project area is located in a sharply continental climatic zone characterized by significant daily and annual temperature fluctuations, moderately cold winters (average -6,8°C), and long, hot summers (average 27,8°C). Average precipitation is 151 mm and prevailing wind directions in mid winter are northeast, north, and east while in mid-summer north and northeasterly winds prevail. Calms are common in winter. Meteorologically, air pollution potential is deemed unfavourable but there are few major emissions sources in the area apart from the mine itself and some quarries in close proximity to the mine. Measured air quality is compliant with the Kazakhstani requirements but is not directly comparable with World Health Organisation (WHO) limits due to different averaging periods. SO_x and NO_x concentrations are not expected to be significant due to the limited emissions sources but there may be localized exceedances of PM standards given the localized stone crushing operations.

5.2. Topography

Kyzylorda Region’s terrain is one of a low-ridge mountain range joining the steeply-sloping ridges concentrated in the western part of the Syr Darya Karatau Ridge. The project area has elevations of up to 400 m in the northeastern section and a gently undulating plain with elevations of up to 250-300 m in the southwest. Localised anthropogenic activities have resulted in changes in topography with about 30% of the sanitary protection zone having been transformed.

5.3. Soils

Soils at the industrial site and in the surrounding areas are poor and of low productivity. There has been partial soil re-deposition as a result of past industrial activities. The disturbed soil layer in the areas that have undergone the profound transformation cannot be restored. Storing the stripped topsoil material is considered to be impractical due to the thinness and poor fertility of the humus layer.

5.4. Geology

The Shalkiya deposit is located on the southwestern foothills of the Karatau Range and is classified as a stratiform lead-zinc deposit. The structure of the deposit consists of sandstones and siltstones and an upper and a lower ore body. The deposit is up to 5 km long and up to 1,150 m wide. Dimensions of the ore bodies in the North-Western section are 2,200-2,400 m long northwestward, up to 1,150 m wide northeastward, with average vertical thickness of 12-13.5 m. The ore bodies in the South-Eastern section extend for 2,060-3,340 m and are up to 890 m wide; the average thickness of the ore bodies varies from 7.1 to 10.2 m. The ores of the deposit are commercial lead-zinc in carbonaceous-siliceous carbonate rocks, with zinc predominating over lead. The ores typically have a fairly simple mineral composition. The lead to zinc ratio varies from 1:2 to 1:20 with average yields at 1.28% lead and 4.27% zinc.

5.4.1. Assessment of Acid-Base and Metal Leaching Potential of Ore and Rock

Results of static geochemical tests completed to assess the ARD/ML potential and historical observation data on the composition of mine water lead to the conclusion that the tested ore and rock materials generally fall into the category of non-acid generating (NAG). Historical observation data indicate that mine water can be characterized as near neutral and slightly alkaline. Despite generally elevated levels of sulphates and toxic compounds, the RK domestic and drinking water quality guidelines have been exceeded in recent years only for cadmium, barium and – very rarely – for lead. Recorded variations in concentrations of other compounds also do not exceed admissible limits.

5.4.2. Hydrogeology

The main hydrogeological unit (aquifer) at the Shalkiya deposit and surrounding area is a complex of carbonate rocks. The water-bearing zone of the carbonate rocks forms a single fissure-karst water basin that extends more than 30 km in the east-west direction in the form of a belt of 4.1 to 14 km wide bounded by impermeable rocks. The water inflow of water-hosting rocks is non-uniform and well flow rates vary considerably. Kuttykozha, the water intake closest to the deposit, is located 3 km southeast of the margin of the North-Western section and is used to supply industrial and drinking water to the operating mine with proven groundwater reserves of 4,600 m^3/day. The basin is supplied mainly by infiltration of atmospheric precipitation over its entire area and seepage of runoff from the Akyuk River and Shalkiyasai Stream. Based on studies as of February 1, 2007, the proven groundwater reserves of the Upper Cretaceous Senonian sediments in the Shalkiya section were re-approved for supplying process water at a rate of 20,700 m^3/day for 25 years of operation

5.5. <u>Surface water</u>

The Shalkiya Project area lies within the Syr Darya River catchment. The river is the longest in Central Asia flowing for 2,212 km. The total annual flow of the Syr Darya River is over 40 km^3 but unmanaged water offtake resulted in no water reaching the Aral Sea between 1982–1987. Subsequent interventions have freed up additional flow. Water may be sourced for mining operations from the Syr Darya River water at 30,000 m^3/day in future but this possibility has not been assessed in this ESIA.

5.5.1. Water Quality in the Syr Darya River Catchment Area

The water composition of the Syr Darya has changed significantly in recent years due to the water use for agriculture. In the territory of Kyzylorda Region, the total mineralization of its water increases dramatically and the water quality is poor. The potential use of this water will need careful evaluation as to the full cost of transporting and treating the same to the required quality levels.

5.6. <u>Seismicity</u>

Kazakhstan is part of the Eurasian seismic activity bands and is characterized by intensive seismicity with the country having experienced a number of devastating earthquakes. The Shalkiya Mine and surrounding areas occurs in the 7-degree seismicity zone, which implies significant risk of high intensity earthquakes. The design, construction and operation of the mine facilities including underground and surface infrastructure, processing plant, tailings storage facility and so forth will require special provision in the design for such seismicity.

5.7. Radiation

Natural radionuclides and their decay products in the mass of rock that is removed and processed during mining mean potential exposure to radiation for both workers and the natural environment. RK legislation makes provision for different hazard classes as a function of the presence of radioactivity (radioisotope composition). Analysis of overburden samples from Shalkiya indicates the lowest hazard class meaning that overburden material can used for various types of construction works and other activities without radiation restrictions. Groundwater present in the deposit is also characterized by low radioactivity levels considerably lower than relevant health guidelines. Radiation monitoring at the mine (gamma-radiation equivalent dose and radon flux density) show recorded values well within health guidelines and this includes monitoring done at Shalkiya village.

5.8. Biodiversity

The habitat surrounding the mine is one of scarcely populated desert and arid steppe areas that are cold in winter and hot in summer. The Project area has a homogenous local landscape of ephemeral steppe area, attributable to the arid climate, infertile soil and low-productive biota with low resilience against anthropogenic disturbance. Various anthropogenic impacts have reduced the resilience of the landscape pattern and caused ecological destabilization of the natural environment. The topsoil layer is considered to be the most sensitive component of the local landscape. Plant cover is extremely sparse but there is a possibility that Reb Book plant species may occur both in the work site areas assumed for placement of new facilities and in adjacent areas.

Terrestrial vertebrate species occurring in the Project area include 26 mammal species, 48 bird species, 11 reptile species, and 1 amphibian species. Overall, 78 bird species may occur in the area during the migration period, including five rare species listed in the Kazakhstan Red Data Book. The mine site and surrounding areas lie within the zone where venomous insects and snakes, as well as various types of plague carrying animals, occur. Kyzylorda Region has a limited habitat for red data bird species and/or involved in the global-scale migration. Specially Protected Areas in Kazakhstan are far removed from the mine site.

5.9. Noise and vibration

Sources of noise and vibration include the use of equipment, vehicles and mobile plant and blasting operations performed at the mine itself, as well as similar activities at adjacent industrial sites. Roadways are also sources of noise. Detailed monitoring of noise, vibration and EMR will be required to establish a comprehensive baseline.

5.10. Social baseline

5.10.1. Republic of Kazakhstan

The Republic of Kazakhstan (RK) is located in Central Eurasia and occupies an area of 2,725,000 km^2. It is the 9th largest, and the largest landlocked, country in the world. It has a population of 17,439,300, which is growing together with increased urbanization. Kazakhstan includes 14 Oblasts and two Republican significance cities (the ex-capital Almaty and current capital Astana). Mining and resource extraction (oil, gas, uranium, other metals and minerals) is the leading economic sector in Kazakhstan and accounts for some 90% of the country’s exports. Regions are economically, socially and politically dependent upon the central government. The share of local revenues in the budgets of many predominantly agrarian Oblasts including Kyzylordy Region (where the mine is situated) is relatively low. Unemployment is currently at 5%.

5.10.2. Kyzylorda Region (Oblast)

Kyzylorda Region is located in the south of the RK and bordered by the Aral Sea and Uzbekistan. Most of the settlements of the region border the Syr Darya River. The population is 758,518 and growing and the region administratively divided into seven districts. Kyzylorda region is rich in mineral resources. The mining industry is the core of the regional economy that otherwise includes agriculture, forestry and fishing but the economy is modest at 12th in the list of regional economies. Two power plants generate electricity in the region but the technical condition of the regional power networks is poor. In general housing and community amenities are in disrepair. There is a state network of healthcare facilities but the morbidity rate slightly exceeds the national average. There is a broad spread of educational facilities and various cultural facilities including libraries, museums and theatres. The region has low crime rates and low unemployment, with many small and medium enterprises. Some 8.69% of the regional population has incomes below the subsistence minimum.

5.10.3. Zhanakorgan District

Zhanakorgan District is located in the southeastern part of Kyzylorda Region and comprises 2 settlement-type and 24 Aul-type communities ('okrugs'). Apart from relatively high infant mortality rates, the demographic situation in the district appears good. Key industrial sectors are electricity and thermal power generation and sulphuric monohydrate production and the district is the region's leading meat and poultry producer. The development of a centralized gas supply network is a key priority for the regional government. The unemployment rate is 4.9%, which is the lowest level in the region. The district has schools and hospitals but low medical staff availability.

5.10.4. Shalkiya Aul Okrug (Aul District)

Shalkiya Aul Okrug (aul district) is located in Zhanakorgan District, Kyzylorda Region, Kazakhstan, in the Karatau foothills, 40 km north-west of the administrative centre of the district, Zhanakorgan, The administrative centre is Shalkiya settlement that now includes the former Pioneer settlement. Shalkiya aul district was founded with the implementation of mine and now has a population of 3,056 including 2,035 people in Shalkiya with a low unemployment rate. Many of the residential buildings are in a state of acute disrepair. There is a clinic in Shalkiya, a secondary school and kindergarten. Shalkiya aul district is located near the Western Europe-Western China highway. There is centralized water supply to 63 buildings but many of the population use open pit wells and boreholes where the water quality is poor.

5.10.5. Cultural Heritage

The Project area is rich in tangible cultural heritage and includes remnants of ancient nomadic people and heritage items associated with the Silk Road. Specific heritage items on the mine site include a burial site. Intangible heritage is maintained through community keeps the national Kazakh traditions in their everyday life.

6. PROJECT ALTERNATIVES AND ASSESSMENT

6.1. Project Need

Zinc has multiple uses with construction the main driver of zinc consumption (46% share). At a global level, zinc markets are likely to move to a period of a deficit of supply of zinc concentrates because of mine closures and reduced volumes. The zinc industry may have to deliver an additional 10.4 Mt of zinc between 2020-2030 to meet forecast demand. Lead Acid Batteries (LAB) accounts for 75-80% of lead demand. Despite an anticipated increase in lead recycling there could be concentrate shortages as result of big mine closures. The project will be a significant economic stimulus in the area.

6.2. Alternatives

The location of the ore deposit and existing mine infrastructure prevents alternative siting for the project but a range of technical and process, power supply, ore transport, tailings disposal alternatives have been assessed to ensure that the options chosen are environmentally and socially optimal. The 'no project' option has also been considered which would mean that negative environmental and social impacts would not occur, but none of the economic benefits that are required in the area for social upliftment would be realized either.

7. ENVIRONMENTAL IMPACT ASSESSMENT

7.1. The Hazard Properties of Lead

As described variously in this document, lead will be one of the two primary products produced by the mine. Lead has gained notoriety for its potential health effects and lead poisoning is one of the most common occupational diseases. The lead produced at the mine will be lead sulphide (some 85%) and lead carbonate (some 15%) with the latter being deemed the more hazardous of the two. Strict control swill be needed to prevent windblown dust and workers potentially exposed to the lead concentrate will need to be equipped with suitable personal protective equipment (PPE) including:

- Respirators;
- Eye protection; and,
- Skin protection.

Dispersion modelling indicates that little off-site risk and as such the risk posed by lead carbonate is seen to be primarily an occupational exposure risk. Both forms of lead are insoluble in water and thus of limited potential health risk. Product spillage in the event of an accident could result in off-site exposure to communities and the mine will need to develop an emergency response that is equal to the risks posed of community exposure and effectively countering the same.

7.2. Climate Change

Climate change is a hugely important global environmental threat and as such the receptor sensitivity must be viewed as very high, however, the overall contribution of greenhouse gases emissions from the proposed expanded mine operation is relatively small. The contribution of the mine would be a small fraction of the total greenhouse gas emissions for Kazakhstan and below the typical reporting thresholds of international lenders. As such, the impact magnitude is considered to be negligible and impact magnitude would be considered slight. During the transition to full-scale operation, the Company will be required to acquire greenhouse gas emission quotas from the RK government.

7.3. Air Quality

The air quality impact assessment has been based on calculating expected emissions from across the mine operation and then using an atmospheric dispersion model to predict the likely ground level (ambient) concentrations of the pollutants. Only dust (particulate matter (PM)) was considered as a significant emission source. The overall assessment is one where receptor sensitivity must be seen as ‘very high’ because degraded air quality can result in human morbidity. However the impact magnitude is considered to be no more than ‘minor’ given the relative localised extent of the receptors, which have exceedances of the limit values predicted. This implies an overall impact significance of ‘moderate or large’. The impact significance is however driven more by the receptor sensitivity than by the impact magnitude. It is also considered that modern dust control techniques in the production areas would reduce the risk of adverse health effects due to dust exposure. In addition the exposure is principally worker exposure in the production area where steps can be taken through the use of PPE should the predicted dust concentrations manifest in reality. There seems little risk of any off site impacts most notably in respect of lead dust.

7.4. Topography

Changes in topography is not believed to be a significant impact for the mine as the general terrain is massively homogenous and extends for hundreds of square kilometres. Receptor sensitivity to the changes in landscape is considered to be low. At the same time, the visual impact on the topography has already happened to a large extent as a result of the previous and existing mine operation, for example the large dam that has been created for the pumped mine water pond is a substantial change to the area. The topography of the area will be further changed by the waste rock stockpile but more importantly by the tailings dam that will be created and which will occupy an area of some 4 km^2. The impact magnitude in this case is deemed to be negligible because the new topographic features will occur in an area where there is already a visual impact from the existing mine infrastructure. This implies an impact significance of neutral or slight.

7.5. Impact on Soil

High-risk environmental aspects that pose a risk to soil in and around the mine complex are land transformation and spillages. By land transformation is meant that the land no longer retains its original use or function and from that point of view is 'lost' as a resource. Spillage risk derives from the use and handling of hazardous materials that are used during the mining operation, hydrocarbons (fuels, oils and grease) and the lead and zinc product of the mine resulting in contamination of the soil where these materials might be spilled. A large-scale spill could also potentially result in a potential threat to underground water. A similar threat exists from the tailings facility and the possible uncontrolled release of tailings. Soil conditions in and around the mine have a very thin layer of topsoil and low fertility and storage is impractical. Immediate use of the removed topsoil for planting the mine site is seen as a preferred option.

The land areas that will be affected by the mining activities are unlikely to be reversible (except over the very long term). Because of the nature of the soil and the massive homogeneity across the area of the mine, the receptor sensitivity is considered to be low. Impact magnitude would have to be considered to be moderate because of the long period of time that would be needed for the soil to recover, but the relative scale of the disturbance given the expanse of the area would be relatively small and as such the impact magnitude is considered to be negligible.

Modern good practice measures typically ensure that potentially hazardous materials required for mining and processing operations are safely managed during transport, storage, handling, use and final disposal and so the risk of (especially a large scale) spillage is considered unlikely. Nevertheless small-scale spills are always a likelihood and it will be necessary to ensure that there are adequate countermeasures in place for recovering and remediating a spill and ensuring that any contaminated soil is either treated or safely disposed. Given the quantities of materials involved and the assumed implementation of control measures the impacts magnitude of potential spills is considered minor and this would imply an impact magnitude of neutral or slight.

7.6. Ground stability

The development of the Shalkiya Mine and mining operations are expected to cause a large-scale impact on ground stability. The mining methods to be used depend upon the spatial geometric configuration of ore bodies, estimated ore losses, and occupational health and safety requirements to be met during mining operations. Mining the Shalkiya deposit will result in discontinuity of the rock mass due to extraction and drainage of the ore field, which will have an adverse effect on ground stability. Receptor sensitivity is therefore considered to be very high as loss of life and serious injury could result. The impact magnitude can be assessed as ‘moderate’ with impact significance being accordingly ‘large’. This issue is fundamentally one of mine health and safety and every effort must be taken to reduce the risk of rock falls, flooding or other hazards that could result in loss of life or serious injury among the mine staff. Mitigation would serve to render fatality or serious injury unlikely and reduce the residual impact significance to slight.

7.7. Radioactivity

Based on available information and taking into account two radiation parameters (Aeff. and gamma-radiation exposure dose), rocks and ores present in the Shalkiya deposit can be classified as those that are assumed to be safe but requiring a prior additional radiation survey for judging whether they are hazardous or not. As a function of the argument presented above the impact magnitude is estimated to be negligible. The impact significance is considered to be 'slight' given implementation of control measures, even though the possible presence of radioactivity presents a risk of human morbidity and as such the receptors sensitivity is considered to be 'high'.

7.8. Groundwater

Given that water is an extremely precious resource in the arid climate where the site is situated the receptor sensitivity is considered to be 'high'. At the same time, the potential impact magnitude is considered negligible because a northeastward expansion of the cone of depression is not predicted due to the presence of the impermeable Tulkubash block of the Eastern thrust fault. Stated differently the Tulkubash block will prevent pumping groundwater from having an effect on the Kuttkhoza wells. This prediction is premised on effective sealing of the 27 exploration wells in the area. If the sealing is not achieved, there is a danger of breakthrough of groundwater to the underground mine workings from the top of wellbores that have penetrated the water-bearing zone of the Famennian-Tournaisian rocks of the Akyuk syncline (which has a high transmissivity of 470 m2/day).

7.9. Impact on Surface Waters

There are no permanent watercourses near the mine, and therefore, surface water quality should not be impacted by mine operations other than during flood conditions due to surface runoff from contaminated or disturbed areas. It should be noted that the reference to the possible use of water from the Syr Daria river is in the interests of disclosure only. Should a decision be made to use water from the river this would have to be the subject of another ESIA as the impact has not been comprehensively assessed here.

7.10. Ore and waste rock dumps

Given the scarcity of water in the area the receptor sensitivity is considered to be 'high'. In this case, though there are controls that can be utilized and which are included in the mine design that can be used to prevent both exposure to precipitation and the prevention of infiltration of the potentially contaminated water at the base of the wall rock dump. Good practice control measures would serve to reduce the impact magnitude to 'minor' with an associated impact significance of 'slight or moderate'.

7.11. Biodiversity

The proposed expansion of the mine can impact on biodiversity in the Project and adjacent areas in a variety of ways. For decision-making the concern is whether any rare or sensitive (threatened) fauna and flora will see material reductions in populations and in extreme cases, possible loss of habitats and species. Given that Shalkiya is an underground mine the surface (habitat) disturbance is far less than would be associated with an open cast mine for example. The major changes to the current mine configuration will be the establishment of the tailings facility at some 4 km^2 and the waste rock stockpiles. There will of course be other infrastructure, most especially the minerals processing plant but this infrastructure will be established within the long-standing production areas of the mine, which has already been disturbed, and thus any remnants of habitat in these areas would be highly transformed already.

The key questions that need to be answered are whether the tailings facility and waste rock stockpiles will impact on critical natural habitats, critically endangered or endangered species or impacts on formally protected conservation areas. The proposed tailings facility area and waste rock stockpiles will affect no such areas other than the possibility of some red data (threatened) plant species. No such species have yet been identified but in the absence of a recent detailed survey the precautionary principle must apply and that is to assume that there may be such species until proven otherwise. It should be noted, however, that Kyzylorda Region has limited habitat for bird species listed in the Red Data Book and/or involved in global-scale migration.

As such, the receptor sensitivity is argued to be 'medium' but an impact magnitude that is 'negligible'. The resultant impact significance is accordingly assessed to be 'neutral or slight'. This significance rating is based on the assumption that the areas affected by the proposed tailings facility and waste rock stockpiles will be carefully surveyed to confirm that there is no flora or fauna that has any conservation status. Even should these areas not have flora or fauna species of such status, it is recommended that search and study exercise be conducted to retrieve and relocate any fauna and flora species that inhabit/grow on the areas that will be affected by the tailings facilities and the waste rock stockpiles, as well as to study possibilities for their restoration and relocation.

7.11.1. Pollution, Noise and Light Disturbance

In respect of offsite pollution primary air emissions of concern are the different dust size fractions. Although there will be other pollutants including SO_2, NO_x and CO, these are not considered significant. The air quality assessment indicated that there would potentially be exceedances of the strictest, health based ambient air quality limits most notably for PM_{10} but these exceedances were seen to be highly localized and largely contained to the production and tailings receptor areas. The effect of the addition of the dust emissions would simply be to extend this area of transformed habitat to a larger footprint area but the difference would be that the habitat would be degraded rather than lost completely. Again the assessment is one where the relative size of the area affected is a small fraction of the size of the area of similar habitat. Receptor sensitivity would remain 'medium' but the magnitude of the impact would also be considered to be 'negligible' because of the extent of the impact relative to the size of the habitat. The overall impact significance is thus considered to be 'slight'. In respect of noise and light disturbance there can be no doubt that the expanded mine operation will result in a greater intensity of noise and light but this would be against a background of the fact that both these impacts already occur, albeit at a more limited scale. The receptor sensitivity would remain medium, but the magnitude of the impact would also be considered to be 'negligible' as a function of both the low intensity of the change and the relative size of the affected area compared to the overall spatial extent of the habitat.

7.11.2. Epizootic Risk

As described in the environmental baseline the area around the mine is inhabited by animals that serve as carriers for plague causing bacteria such as *cutaneous leishmaniasis*, black fever and so forth. The activities at the mine itself are highly unlikely to compound this problem but it is worth investigating whether the mine could play a supporting role as part of the community to assist in preventing epizootic outbreaks by for example preparing in association with the Zhanakorgan District Medical and Veterinary Services annual situational forecasts of the risk of outbreak of a plague.

7.11.3. Risks to water birds using the mine water storage dam

It is known that water birds sometimes make use of the mine water tailings dam for roosting and potentially also foraging. What is not currently clear is the risk potentially posed to these birds as a result of possible degraded water quality or sediments. To this end it be necessary for the mine to assess the risk of water bird mortality as a result of water quality in the mine water dam and to implement control measures such as bird hazing or similar.

7.12. Seismicity

The Shalkiya Mine is located within the boundaries of the Turan Platform between the South Tianshan and Talas Fergana axes which high seismicity potential. A seismic event has severe potential consequences including risk of death, serious injury, and economic and environmental impacts. Managing seismic risk lies ensuring that all mine facilities and residential buildings are designed taking account of earthquake risk and to ensure that there is an effective emergency response should a seismic event occur. As such the serious potential consequences described above could be prevented which would imply an impact magnitude of moderate or even minor, and impact significance of moderate.

7.13. Noise and vibration

Key noise and vibration sources at the mine site. Assuming that the worst combined noise condition at the mine is 110 dB(A) the distance to Shalkiya North and the Shalkiya village would see effective attenuation of the noise, including noise generated by traffic. Noise would manifest as a nuisance effect at worst implying moderate receptor sensitivity, impact magnitude as minor an impact significance of slight.

7.14. Mine Health and Safety

Mining is a generally hazardous activity requiring all potential hazards to be identified and planned for. These include hazardous substances, explosives, live circuits, extreme temperatures, ionising radiation, noise and vibration, fire, explosion, working at heights, confined spaces and oxygen deficient air. At the same time the hazard properties of especially lead carbonate as a finished product need to be considered. The primary method for reducing potential worker exposure is to ensure that there are control measures in place to limit the formation of lead dust. Over and above the controls to prevent lead dust workers potentially exposed to lead dust must be equipped with personal protective equipment including respirators, eye and skin protection.

The hazards would result in potential serious injury or loss of life and as such the receptor sensitivity is considered to be very high. The potential magnitude of the impact is also considered to be major and this would imply an impact significance of very large. The likelihood of serious injury or death is considered probable rather than definite which would serve to reduce the significance rating to large. Mitigation can reduce the likelihood of the impact further still to an impact magnitude of minor and a resultant impact significance of moderate.

7.15. Community health and safety

Community health and safety may be threatened by mine activities in the following ways: catastrophic dam failure, off site pollution, vehicle movement; and land subsidence. The distance from the mine to Shalkiya means that catastrophic dam failure, off site pollution and subsidence would not result in community health or safety risk but could result in mine closure (albeit temporarily) with associated economic effects should any of these events manifest. Receptor sensitivity is thus considered to be low, impact magnitude moderate, which would result in an impact significance of slight. The low probability of these events as a result of modern designs to ensure dam safety would further reduce the impact significance to slight. Receptor sensitivity in the case of vehicle accidents would be very high because of the risk of injury or death and the impact magnitude at least moderate resulting in an impact significance of large and probable.

7.16. Post closure impacts

Perhaps the key environmental risk post closure relate to public health and safety. Safety risks can arise from post closure failures of infrastructure and also through people accessing hazardous parts of the mine. Receptor sensitivity would be very high but the scale of the impact would be no more than moderate and unlikely with an impact significance of no more than slight with implementation of mitigation. Biodiversity is unlikely to recover rapidly where the mine is rehabilitated but the size of similar habitat beyond the mine renders receptor sensitivity to be low and impact significance no more than slight.

8. SOCIAL IMPACT ASSESSMENT AND MITIGATION

8.1. Overall economic impact

The mine's significant social aspects include the creation of new jobs, career development, improved human resource capacity, procurement of goods and services, development of infrastructure, tax revenues, land acquisition and social partnerships. These aspects are expected to have benefits for Kazakhstan as a whole and the project area in particular as well as adverse effects. The Shalkiya deposit is the largest zinc deposit in Kazakhstan (accounting for approximately 30% of the country's zinc reserves), which would be developed as a metallurgical cluster along with Tau-Ken Samruk, SPK Baikonur, KazAvtoProm and others resulting in benefit for Kazakhstan of moderate significance. Shalkiya is considered among the top priority regional projects for the country where the benefit significance is also rated as moderate with a large benefit to the regional economy.

At Zhanakorgan district level the project will significantly enhance the development of the mining sector, generate revenues for the local budget, and help boost business activity in the area. Receptor sensitivity is considered high, impact magnitude moderate and impact significance large. As the only major taxpayer in the Shalkiya Aul District the mine will be a major tax contributor with the life and well-being of two local settlements dependent on the tax revenues and large impact significance.

8.2. Job creation

The creation of 1,000 jobs during construction and 1,488 jobs during operation may have a significant impact on the demographic situation in Shalkiya and Kuttykozha with a high proportion of residents becoming economically active. Shalkiya village was established specifically in support of the mine and has few other economic activities. It seems unlikely that the village will be able to supply the required work force because of skill shortages so training will be needed to maximise the potential benefit to the village. The effect will be largely the same in Kuttykozha village but may residents there work in agriculture. The receptor sensitivity is high with a major impact magnitude and large impact significance. The impact significance is therefore assessed as being large and positive and will also result in increased incomes and an improvement in the welfare of the village.

8.3. Wealth disparity

While an increase in income for residents is positive, there is a risk of price inflation for goods and services. People who do not get work at the mine will be negatively effected by the price disparity especially the vulnerable (the elderly, single parent families and families with many children). The effect is likely to be more pronounced at local level than at district level and mitigation will be required to keep the impact at no more than moderate.

8.4. Human resource benefits

An opportunity exists to target young people for work at the mine so as to reduce out migration by the youth provided that there is adequate training and career development. Impact magnitude is considered slight but could be enhanced through additional interventions especially a progressive human resources policy.

8.5. Impacts Associated with the Purchase of Goods and Services

The increased spending brought about the mine expansion will see increased sales, improved profitability, potentially improved quality of goods and services, and other economic benefits. These benefits would serve to further improve indirect business activities as well but the impact significance is still considered no more than slight.

8.6. Labour Migration

The demand for skilled personnel is likely to result in in-migration to the area by work-seekers. A balance will need to be found between drawing in workers from outside the area and capitalising on the existing labour pool though education and training. Workers will be accommodated in a temporary on-site settlement during the construction phase but there will be a permanent dormitory established for the operations phase. Houses are also available in the village and new houses will also be built.

8.7. Increased burden on social infrastructure

Labour migration will increase the demand for social infrastructure including:

- Hospitals;
- Drinking water – there is an acute shortage currently in Shalkiya village being addressed through a municipal project to bring water in from Talap that will also see a potential improvement in drinking water quality for Shalkiya residents;
- Preschool and schools are currently operating at about 30% of their capacity; and,
- Existing leisure centres, libraries, sports and other facilities.

It is in Shalkiya's interest to provide whatever support it can to the continued development of such facilities so that they are adequate for the influx of people to the village. A good working relationship with the Akimat is essential and well though through interventions could even result in positive impacts.

8.8. Local conflicts

In-migration of labour may result in conflicts between the local residents and employees from outside the region. Such conflict can be brought about by alcohol and/or substance abuse, economic stratification and competition for jobs. The impact significance is expected to be moderate. A well-managed labour force as well as recreational facilities at the mine should serve to reduce this risk.

8.9. Communicable diseases

The risk of communicable diseases (including tuberculosis, sexually transmitted diseases, HIV/AIDS, etc.) is associated with demographic changes and labour migration. HIV/AIDS incidence in Zhanakorgan district is low. Impact significance is considered moderate and it will be incumbent on Shalkiya to run programmes that reduce the risk of communicable diseases.

8.10. Land Use Impacts

The proposed mine development will require additional land (60% extra) resulting in both land use change (agriculture to mining) and potential degradation of new surrounding areas. The new land allotment for Shalkiya affects both industrial and agricultural land with the latter constituting about 0.2% of the total area of agricultural land in Zhanakorgan district. Receptor sensitivity is considered to be moderate, impact magnitude minor because of large areas of agricultural land remaining, and the significance of the impact slight. Dust contamination may affect vegetation cover and grazing area quality but because of the large areas of grazing land around the site and the dust concentrations predicted by the dispersion modelling, impact magnitude is considered to be low, with slight impact significance. It seems unlikely that the Project would lead to economic displacement of neighbouring land users and no physical resettlement is required. The availability of unoccupied land and the remoteness of the mine enterprise from human settlements, receptor sensitivity is considered moderate, impact magnitude low and impact significance negligible.

8.11. Transport Operations (Raw Materials and Products)

Cargo traffic will not affect the Shalkiya and Kuttykozha settlements directly and with the distance to the settlements, the receptor sensitivity can be assessed as low; with magnitude and significance minor and slight, respectively.

8.12. Impacts Associated with the Mine Closure

Mine closure is always accompanied by serious social impacts and requires special and early arrangements, so that these impacts can be mitigated. Shalkiya village is directly dependent on the mine and so the closure of the mine would dramatically reduce the economic base of Shalkiya, with very high receptor sensitivity and an impact magnitude of major resulting in an impact significance of very large but reduce to moderate with adequate socio-economic planning for the close, specifically economic diversification to reduce dependence on the mine. Mine closure planning needs to start as soon as operations recommence. Such planning must also consider new infrastructure in the village and how to provide such infrastructure a life beyond that of the mine so as to avoid the urban decay that now characterises Shalkiya.

8.13. Cultural Heritage

The archaeological survey has discovered two burial mounds that have historical and cultural value. While the Project is not likely to have any direct impact on these sites, the current national legislation requires that appropriate measures be taken to protect these sites from any potential adverse impact.

9. STAKEHOLDER ENGAGEMENT

9.1. Company Experience in Stakeholder Engagement

JSC ShalkiyaZinc Ltd is building its stakeholder relationships in line with the legislation of the Republic of Kazakhstan. Several public hearings have been held over the last several years identifying concerns such as efficacy of environmental protection actions, staff recruitment and qualifications, mine water discharges and process emissions. Drinking water quality and scarcity was an issue of particular interest for the members of local communities as was the possible use of the Syr Darya. Generally, the Company's stakeholder engagement experience is positive with company management directly involved in the consultation. The company needs to implement a series of recommendations to ensure compliance with the IFI requirements including systematic records and responses, meetings in Shalkiya, develop a grievance mechanism, broader and more effective disclosure.

9.2. Stakeholders

The Shalkiya and Kuttykozha residents generally have positive expectations relating to benefits but concerns about drinking water quality (not related to the mine). Neighbouring Land Users still require some form of engagement and households grazing livestock near the Mine Site need to be informed that their livestock cannot access the mine. The local authorities (the Zhanakorgan District and Shalkiya Aul District Akimats) are enthusiastic about the Project but are concerned about the effects after mine closure. The interest and potential concerns of NGOs have not yet come to the fore.

10. ENVIRONMENTAL MONITORING PROGRAMME

10.1. Project Monitoring

Monitoring is a key requirement for effective environmental and social impact management and so a monitoring programme has been developed in the ESIA for the operational mine. The monitoring programme includes both the integrity of structures such as the tailings facility and the waste rock dumps, as well as environmental quality. Provision is made in the monitoring programme for:

- Local climate
- Ambient air quality
- Surface water quality and flow
- Waste
- Noise, vibration and electromagnetic radiation

10.2. Monitoring Locations

In addition to the monitoring done by the mine currently, the following additional recommendations are made:

- Local climate monitoring using automatic weather station
- Mine water pond condition
- Domestic sewage pond
- The Shalkiya-sai Stream and its tributary Kelte
- Water intake location of the Syr Darya River (as an immediate priority)
- Environmental aspects (emissions, discharges, waste, disposal, noise, vibration and so forth), lighting regime of construction sites and access roads during the day and night during construction, operations and mine closure.