SODALITE MINING PROJECT

DRAFT ENVIRONMENTAL MANAGEMENT PLAN

FOR MINING OF BLUE SODALITE DIMENSION STONE AND OTHER MINERALS, NEAR OTJIMUHAKA, WITHIN MINING LICENCE 40 & MINING CLAIMS 68664, 70783, 70784, 70113, 70114, 70119, EPUPA CONSTITUENCY, KUNENE REGION

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Prepared For:

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Title	Draft Environmental Management Plan for mining of blue sodalite dimension stone and other minerals, near Otjimuhaka, within Mining Licence (ML) 40, Epupa Constituency, Kunene Region
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ABREVIATIONS

EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
ERA	Environmental Risk Assessment
HSE	Health Safety Environment Officer
I&AP	Interested and Affected Parties
MEFT	Ministry of Environment Forestry & Tourism
MC	Mining Claims
MSDS	Materials Safety Data Sheet
PBS	Performance Based Standard
PPP	Public Participation Process

1. INTRODUCTION

KNL of Namibia (Pty) Ltd, (hereafter referred to as KNL or the Proponent) is a wholly owned Namibian company, which holds the mineral rights as granted with ML40, issued by the Ministry of Mines and Energy on 24 April 1997. KNL plans to continue mining sodalite dimension stone and also start mining and processing of other minerals within Mining Licence 40 (ML40) and within Mining Claims 68664, 70783, 70784, 70113, 70114, 70119, which are located at the northern border of Namibia, near Otjimuhaka (previously Swartbooisdrif) in the Kunene Region. The mineral rights are situated within communal farming areas which fall under the responsibility of the Kunene Regional Council.

The proponent appointed Philip Hooks, an independent Environmental Assessment Practitioner (EAP), to undertake the assessment and compile this scoping assessment report and Environmental Management Plan (EMP) in support of the application. The curriculum vita of the EAP is provided in **Appendix A** in the EIA report.

Mining will take place within the licences, which cover approximately 640ha and which lies roughly 130 km northwest from Opuwo and about 2.5 km south-west of the Namibian-Angolan border, marked by the river Kunene. The ML40 area and nearby Mining Claims are situated approximately 4 km south-west of the settlement Otjimuhaka (previously Swartbooisdrif) (see Figure 1).

The proposed activity focuses on specific resources of sodalite, iron ore and rare earth mineralisation and mining will take place within the boundaries of known mineralisation within ML40 and the other mineral licences that the Proponent currently has rights to. The activities will be undertaken in phases as follows:

- The construction phase activities
- The operational phase activities
- Decommissioning phase activities

Operation will entail mining, i.e., drilling and blasting of rock outcrops and also open cast mining with diamond cutting equipment to extract industrial size blocks of dimension stone. Mining techniques will make use of modern equipment such as excavators, diamond wire saw, circular diamond cutting machines, compressor driven drill rigs, jack hammers and dump trucks. Open cast mining will be established according to good practice procedure. KNL wants to establish central processing facilities for dimension stone, iron ore and for rare earth mineralisation, all of which occur within the Mining Licence and surrounding Mining Claims belonging to the proponent and to some extend also on other surrounding mineral licences.

Blocks of dimension stone, lumps of ornamental stone or concentrates of base and rare earth metal products are to be transported as bulk cargo as well as in bagged form. The viability of any mining operation, just like most industries, is particularly sensitive to the logistics concerned with getting the product to market. Different options are presently being investigated for the transport of the products to the harbour of Walvis Bay. Bulk bags on low-bed trucks or bulk road transport with loads up to 67 tons are envisaged to take the products on the public road infrastructure from the mine site to the harbour of Walvis Bay. Various studies have been undertaken to support the usage of such trucks including road wear analyses, modelling of a tractor-trailer design, bridge assessments. Product will be transported on a continuous basis. At a maximum monthly production of 5,000 t, a total of 139 truckloads at 36 t payload would be required. That is equivalent to 5 trucks each day. The product would be transported along the gravel road to Ruacana and thereafter along the tar roads to the port of Walvis Bay.

Decommissioning activities will include the removal of infrastructure, preparation of final land forms for closure and to rehabilitate roads where necessary. However, ongoing rehabilitation and

landscaping should be conducted as the mining operations proceed. Shaping of the excavated / mined areas not only to accommodate rehabilitation efforts, but also in terms of safety, should be conducted according to a rehabilitation plan. In accordance with the Environmental Management Act, the proponent is required to make funds accessible which will specifically be available and allocated for rehabilitation efforts. This fund should continually be available during the life of mine yet also be sufficient to cover the decommissioning activities as required.

The potential impacts associated with the envisaged sodalite and base and rare element mining and processing operations are specifically outlined in the environmental impact assessment chapter and include the potential impacts on personnel working at the mine and the general public who might reside near the mine.

If purely looking at the available rock material within the mining licence, the estimated mining lifespan could be more than 50 years. However, for this assignment an estimated mining lifespan of up to 25 years is considered. The life of mine for the operations has been based on the expected demand and the size of the resource. However, this may vary significantly as the demand may fluctuate.

Public consultation was thorough, and the communities were well informed about the project. This was done through newspaper adverts for two consecutive weeks in The Namibian and Die Republikein (21st and 28th of July 2020) as well as face to face meetings with the public and relevant authorities. The stakeholders had an opportunity to ask questions and raise their various concerns. Upon completion of this report and drafting of the environmental management plan the Interested and Affected Parties have had further opportunity to provide input during the public review period.

The mineral rights are situated in a remote rural area. There are obvious signs of degradation by over-grazing and the effects of the current drought exacerbate the difficulty that the communities experience in living off the land.

The mining operations will take place on communal land. Due respect is given to the communities that use the area for subsistence living. The Ovahimba people are semi-nomadic and may come near the mining operations from time to time. Good community relations are imperative for the successful running of the mine. Public safety is of utmost importance.

The assessment of the identified potential impacts was undertaken after due consideration of the physical and biological environment. The programmes below provide the outcome of the mitigated assessment. The chapter on impact assessment in the EIA Report more fully develops the reasons for these outcomes. The outcomes have been incorporated into the environmental management plan and the programmes that will facilitate the implementation of the measures that are required. It is the author's opinion that the environmental clearance be granted on condition that this Environmental Management Plan be implemented. The EIA Report should be used to compliment and supplement the EMP where more understanding is required

This Environmental Management Plan (EMP) documents a series of individual management programmes (MPs) designed to meet legal requirements for the activities related to the Proponents operations. The EMP aims to avoid or minimise potential negative impacts, while optimizing the potential positive impacts associated with the mining operations and decommissioning once the activity has been completed.

2. PROJECT OVERVIEW

A short description of the project and the location is laid out below. The full project description is given with the EIA report.

Project Location

The mining licence 40 and associated Mining Claims are situated near Otjimuhaka approximately 75 kilometres west of Ruacana, within the Epupa Constituency. The licence lies within communal farming areas which fall under the responsibility of the Kunene Regional Council. The people living in the area are led by headmen who in turn grant stewardship and authority to junior headmen. Officially they fall under the authority of the Governor of the Kunene Region of northern Namibia and the constituency councillors through the Governor. **Figure 1** renders a map of the mining licence relative to the nearest communities of Oroutumba and Otjimuhaka.

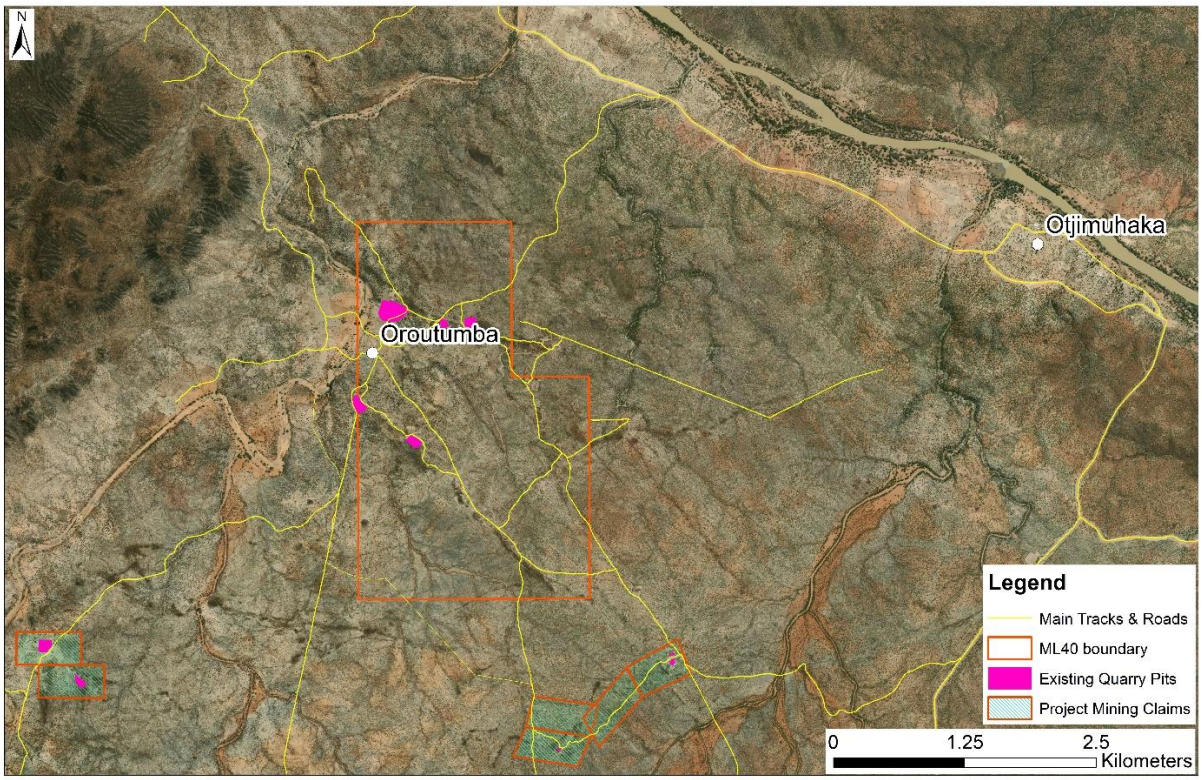

Figure 1. The location of the project's mining licence (ML40) and associated licences showing the nearest permanent communities.

Project Description

The following is the summary of envisaged development with mining and processing activities that are expected to be undertaken by the project proponent during different project development phases.

Construction Phase Activities

This will comprise of the following:

- Construction of a new processing facility (for iron and rare earth ore) and associated Tailing's Storage Facility (TSF) and Waste Rock Dump (WRD) (please refer to the EIA for details).
- Construction of stormwater canals, diversions & contamination containment (see EIA for details).
- Construction of a water pipeline from the Kunene river to the processing plant (see EIA for details).

- Construction of a powerline from Otjimuhaka sub-station to the processing plant.
- Construction of roads (internal within the Mining Licence) and upgrading an access road from the mine to the main road.
- Construction of fuel storage and dispensing facilities, fencing, security and staff accommodation, sewerage, and waste handling facilities.

Solid non-mineral waste will be removed off site and taken to the nearest rubbish dump either in Otjimuhaka or Ruacana depending on the nature of the waste. Ablution facilities will use sealed septic tanks or a wastewater treatment plant or French drains. Sewerage sludge will be taken to the Ruacana sewerage plant periodically if the septic tank option is used.

Prior to the construction of a new power line, the projects' electricity requirements will rely on diesel generators. Construction staff will be accommodated on site at a temporary camp. Security will be supplied on a 24-hour basis at the mine and construction sites. Support services and any facilities established during the construction phase will either be removed at the end of this phase or incorporated into the project's operational phase.

It is anticipated that the proposed construction will commence immediately after receiving the ECC from the MEFT and once the relevant permits and licences have been issued by the different regulatory bodies.

Operational Phase Activities

Current sodalite operations use open cast mining methods. Mining techniques make use of modern equipment such as excavators, diamond wire saw, circular diamond cutting machines, compressor driven drill rigs, jack hammers and dump trucks. Such open cast mining operations will be established according to good practice procedure. The mining operations comprise of consecutive phases including: site clearing, excavations – by means of drilling and blasting, digging, block cutting, removing and haulage of rock to processing plant and storage yard. The diamond cutting equipment enables extraction of industrial size blocks of sodalite dimension stone.

Future planned operations will entail the drilling and blasting of rock outcrops to a depth of 50 metres for rare earth and metal mineralisation. Multiple quarries (i.e. wedge, terrace or trench shaped) will be mined at various places within ML40 and the 6 mining claims. Quarry depth will also be to about 50 m. Approximately 8,000 t of ore is expected to be removed from the ground and processed on a monthly basis. For all types of mineral ore the excavations are planned to a maximum stripping ratio of 1 : 15. Overall the maximum or total estimate of waste rock produced will be up to 1.5 million tons annually. Mineral waste will be deposited in waste rock dumps and in a tailings storage facility.

Mineral Processing

KNL has already established a central processing facility for sodalite dimension stone blocks at the Oroutumba settlement. Existing quarries are dotted around the ML40 and mining claims as rendered in **Figure 1**.

Blocks of sodalite dimension stone are trimmed by means of diamond rope machines and cut into slabs. Smaller blocks and boulders are also trimmed and cut into slabs and tiles. Lumps and boulders of sodalite rock are stockpiled and sold as ornamental stones.

The additional iron ore and ore of rare earth mineralisation will be mined from the ML40 and the 6 mining claims and processed at a new processing facility away from the Oroutumbu settlement. For iron and rare earth mineralisation the ore is drilled and blasted and removed from the ground in opencast quarries. To concentrate the valuable mineral content the processes as detailed below are

envisaged. **Figure 2** renders a map showing the location of the new processing plant area showing the water pipeline extension from Oroutumba settlement and the hand-dug well.

The iron ore processing from the Run-of-Mine ore:

I. Run-of-Mine ore crushed to <25 mm

II. screen for size classification

a) fraction 40 to 25 mm: scan / sorting separation
b) fraction less 25: magnetic separation

After mining of the rare earth containing rock processing will occur as follows:

I. Run-of-Mine ore crushed to <25 mm

II. screen for size classification

a) fraction 40 to 25 mm: scan / optical sorting separation
b) fraction 25 to 6 mm: magnetic sorting
c) fraction less 6 mm: gravity separation process using limited amounts of water

III. Milling of concentrate

a) Flotation, using limited amounts of water
b) leaching of gangue carbonate, using limited amounts of water

Up to 90 ha of footprint size is envisaged for the accessory works area to accommodate the processing, tailings disposal, product storage, loading facilities, offices, security and workshop facilities within the mining licence area. **Figure 3** renders a plan of the layout of these structures.

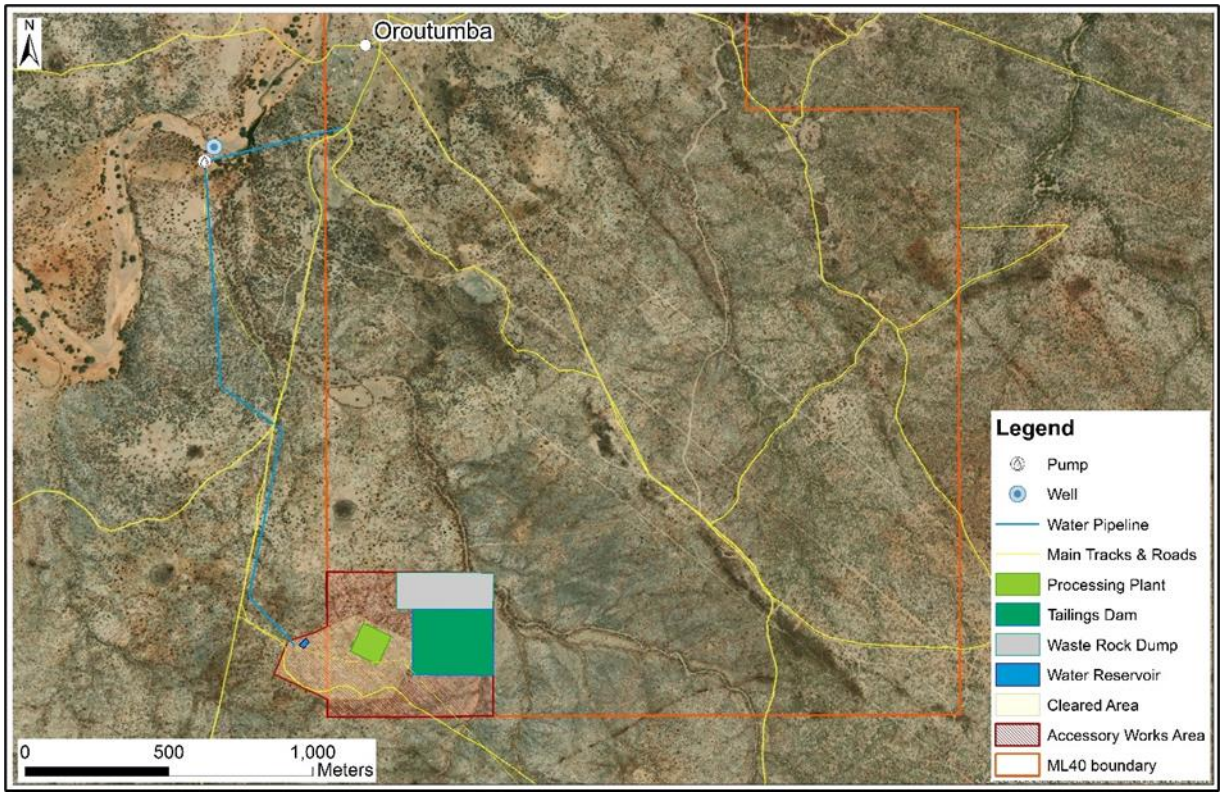

Figure 2. New processing plant area showing water pipeline extension from Oroutumba settlement.

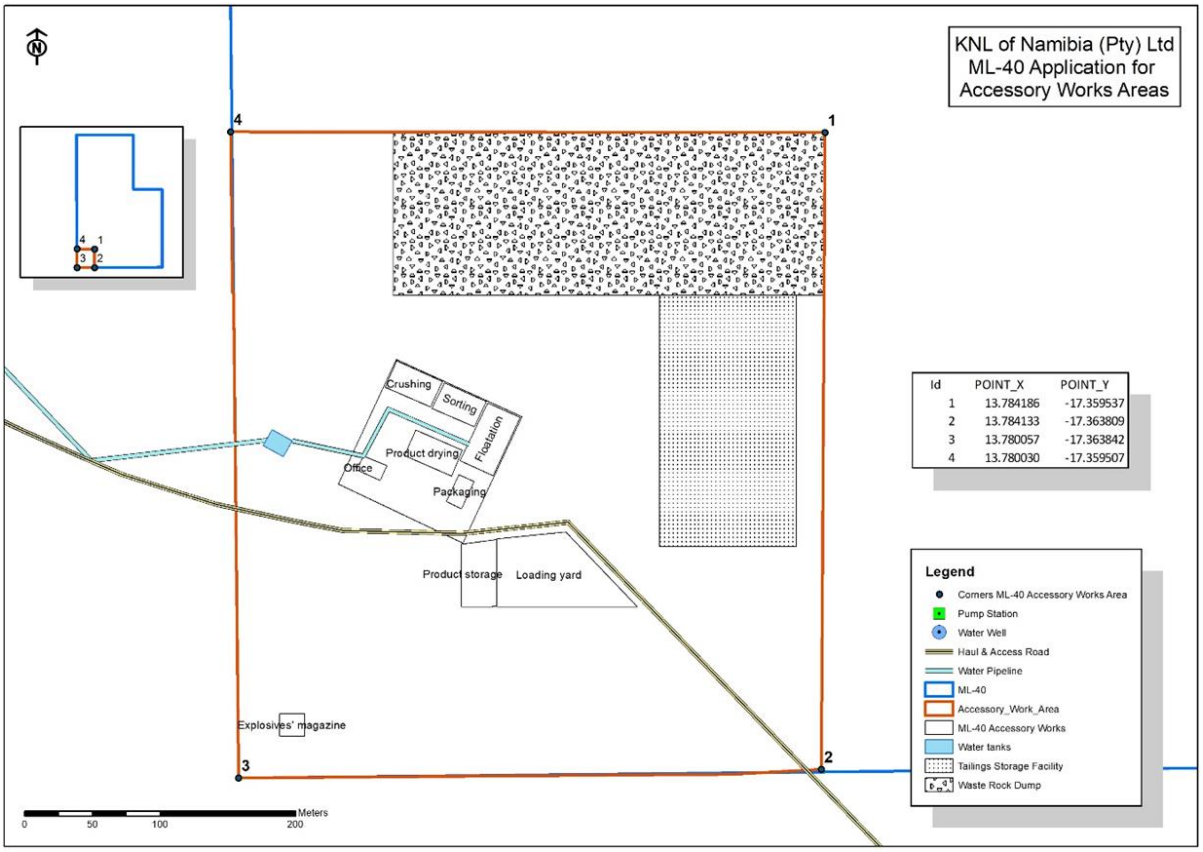

Figure 3. Detailed layout of the accessory works area (initial approved MME application)

Operational Support Services

Transport

Blocks of dimension stone, lumps of ornamental stone or concentrates of base and rare earth element products are to be transported as bulk cargo as well as in bagged form. The viability of any mining operation, just like most industries, is particularly sensitive to the logistics concerned with getting the product to market. Different options are presently being investigated for the transport of the products to the harbour of Walvis Bay.

There are currently two options for the type of truck to be used for the haulage. Either the usual 36 tonne load or a specialised 67 tonne load. At a maximum monthly production of 5,000t a total of 139 truckloads at 36t each (first option) would transport product each month. That is 5 trucks each day. The product would be transported either along the gravel road to Ruacana or via Opuwo and thereafter along the tar and gravel roads to the port of Walvis Bay. The product would either be in bulk bags on low-bed trucks or in bulk trailers with covers.

A reduction in the number of trucks required for the transport could be achieved if a Performance Base Standard (PBS) trucking option is approved by the Roads Authority. The bridge study (Olivier, 2020) was undertaken to support the usage of 67 tonne payload trucks along the gravel road route from Opuwo to Walvis Bay. The bridge assessment along the preferred route was assessed for weight carrying capacity.

Geometrical information of bridges was verified on site, most importantly with respect to deck thicknesses and spans. Concrete strength estimates were established by means of Schmidt Hammer tests. Maximum Safe Yield design was compared to the modelled yield induced by the PBS Smart Truck configuration. From the work undertaken (Olivier, 2020) the bridges can accommodate the load imposed by the proposed high-tonnage vehicle with ample safety margins. The envisaged PBS option aims for an allowable unit load of 67 tons. This would almost half the number of haulage trucks on the road and or reduce the frequency with which the trucks must run. The overall wear and tear on the road infrastructure would also be reduced when using the PBS trucks. See Error! Reference source not found. for the preferred and alternative routes and associated distances for each leg of the routes. The preferred route would be the shortest but includes gravel sections amounting to half the journey. **Figure 4** shows a map of the planned haulage route. The preferred route is shorter by 426 km for the round trip. Although the preferred route includes gravel road sections it is not as congested as some legs of the alternative route.

Table 1 Preferred and alternative road routes for haulage trucks.

Preferred route	**Distance**	**Units**	**Road**	**Surface**
Mine Site to Ruacana	80	km	Via D3700	gravel
Ruacana to Kamanjab	287	km	via C35	bitumen
Kamanjab to Fransfontein	84	km	via C35	gravel
Fransfontein to Uis	135	km	via C35	gravel
Uis to Hentiesbay	124	km	via C35	gravel
Hentiesbay to c28 (Swakop)	74	km	via C34	bitumen
Swakop junction to Namport	45	km	Via D1984	bitumen
Total	**829**	**km**		
Full cycle	**1658**	**km**		

Alternative route				
Mine Site to Opuwo	130	km	via D3701	gravel
Opuwo to Kamanjab	262	km	via C35	bitumen
Kamanjab to Outjo	157	km	via C40	bitumen
Outjo to Otjiwarongo	72	km	via B1	bitumen
Otjiwarongo to Omaruru	140	km	via C33	bitumen
Omaruru to Karibib	65	km	via C33	bitumen
Karibib to Usakos	33	km	via B2	bitumen
Usakos to Swakopmund	138	km	via B2	bitumen
Swakopmund to Namport	45	km	via D1984	bitumen
Total	**1042**	**km**		
Full cycle	**2084**	**km**		

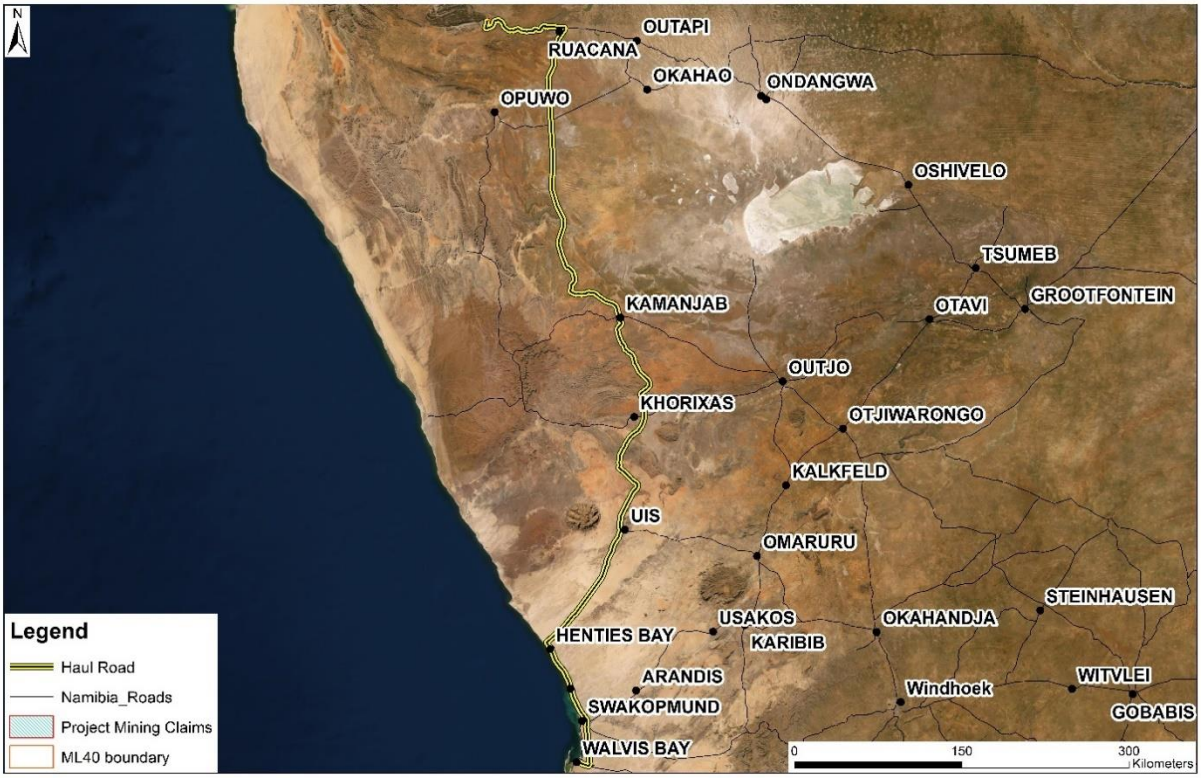

Figure 4. The preferred haulage route for transporting various product to the Walvis Bay port.

Walvis Bay Port Storage & Export

Four bulk storage location options are available for the proponent at the Walvis Bay Harbour. **Figure 5** renders a map of the layout of the storage areas at the Walvis Bay Port. For the options made available there are restrictions on how the material must be stored. Traditionally, the bulk storage area for commodities were allocated opposite berths 5, 6 and 7. Due to the proximity to the Etosha

Fish Factory Bulk Plot 10 would require the product to be contained in bulk bags. This mitigation would potential apply to Bulk Plot 37 as well. Bulk Plot 17 provides for the option of undercover break bulk material and all the precautions about handling exposed product inside a potentially unventilated space must be in place. Bulk Plot 20 may also allow break bulk storage in the open. Due to the heavy nature of the product, only minor barriers may be necessary to prevent any aeolian drift of particulate emissions. Specific requirements of the port will be adhered to A lease application will be submitted for the option that best suits the Proponent.

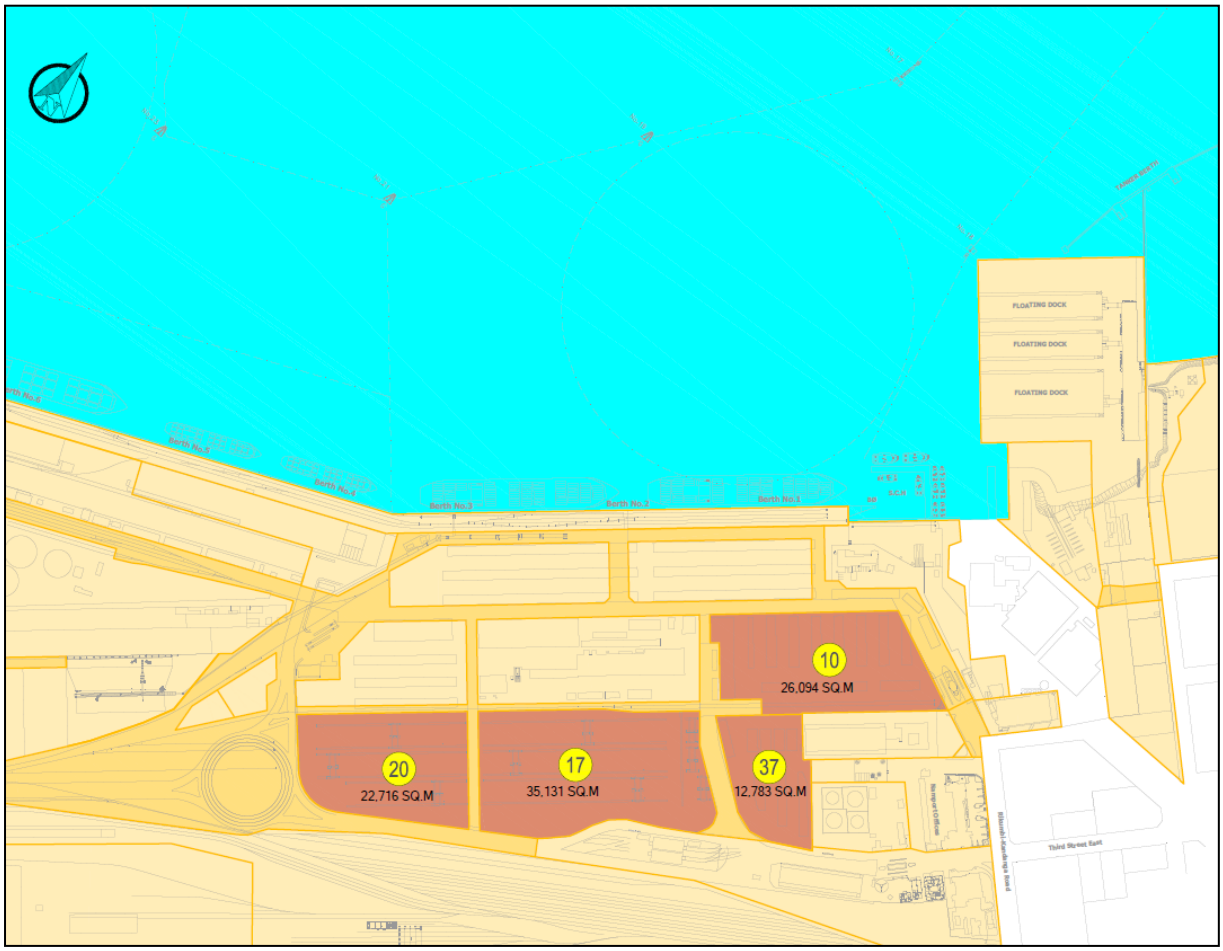

Figure 5. Layout of Walvis Bay Port and Locations of Bulk Storage Options (Bulk Plot No. 10, 17, 20, 37)

Water supply

Water supply to the mine and accessory works is provided by the two sources of water. The one source is from a hand-dug well in the Ondoto river and the other is from a borehole in the Dwyka sediments near the Kunene River. Estimated water demand is 100,000 m^3/year (or 12 m^3/hour over every 24 hours). The water study by Sarma (2021) is summarised in the environment description of chapter **Error! Reference source not found.** of the EIA and impact assessment chapter **Error! Reference source not found.** of the EIA. This same water study provided the specifications for the new water supply infrastructure as discussed above in section **Error! Reference source not found.** of the EIA.

Power Supply

Infrastructure to get electricity from the national grid may be required for the future processing operations. A powerline extending from the Otjimuhaka (Swartboois Drift) sub station to the mine site is planned. The route for the powerline is shown in the EIA.Error! Reference source not found.. U nderground cabling would not be viable for such a venture and so overhead electricity lines would be considered. The design and construction of the powerline will be in such a way that it mitigates for limiting bird collisions.

Currently, electricity for the machinery at the sodalite quarries is supplied by diesel generator equipment. Diesel will be stored at the mine site.

An array of photovoltaic panels will be considered for alternative power generation. Water heating would use solar power as well. The buildings' rooves may be used for the construction of the panels. This will reduce the footprint of the mine and maximise the use of sun light as a renewable form of energy.

On-Site Fuel and Lubricant Storage

Diesel storage at the mine site will consist of a bunded fuel tank system, conveniently placed and accessible for the frequent deliveries. In addition to this it is feasible for a few bunded mobile facilities to be placed conveniently for use by the mining equipment at the various active mining areas. These facilities will be of modern construction, either double-skinned or bunded to ensure spills are prevented.

Delivery systems will use sealed fittings to prevent spillage. The fuel facilities should be actively manned. Lubricants will be stored in a double bunded facility which is designed for this purpose. Lubricants will be transferred to machines via reticulated network within the heavy vehicles workshop or mobile lubrication trucks.

Standardised spill kits and reporting systems will be in place to deal with hydrocarbon spills. Contaminated soils will be transferred to a remediation section on site that is specifically designed for such soil remediation.

Explosives Magazine and Use of Explosives

In terms of the proper use and storage of explosive material on site, the Explosives Act of 1956 states that the proponent can only keep, store or possess explosives in such a manner and in such quantities as have been approved in writing by an inspector and shall only be stored on premises where there is an explosives factory or explosives magazine. The proponent should obtain a permit issued by an inspector of the explosive police unit and the explosives need to be kept in quantities not exceeding 500 kilograms and be stored in an isolated place. Every 120 days the proponent should furnish the Chief Explosive Inspector with information in writing as from the said date regarding the quantity of explosives in the company's possession or custody. The proponent should bear in mind that the inspector may enter any explosives facility or explosives magazine at any hour of the day or night for the purpose of inspection and for making inquiries relative to the compliance with the provisions of this Act and its regulations, or relative to the means used therein for preserving the safety of the public or employees or for purposes of analysis or test, ask for samples of explosives or ingredients of explosives from the proponent.

Security of the Mine and Accessory Works Area

Various locations and infrastructure may need to be fenced in order to control the access to the various hazardous or potentially unsafe facilities so as to prevent unauthorised persons and vehicles from entering these areas, and to keep out animals from the surrounding communal farming area.

Public safety is the guiding principle behind this aspect. Security personnel may be needed from time to time.

Decommissioning Phase

The life of the mine is set at 25 years currently. After this time, if all mineral resources are spent then it will be required to close the mine. This decommissioning phase includes the following activities:

- removal of processing plant infrastructure,
- potential sale of any permanent office and ablution infrastructure for residential use
- Rehabilitation of waste rock dumps and the tailings storage facility to encourage natural revegetation
- Secure the quarry areas and tailing facility for long term public safety (i.e. by fencing, revegetation or physically changing the angle of quarry sides.
- Rehabilitate roads where necessary.
- Re-assign electrical and water infrastructure for use by the residents.

These and other aspects will be comprehensively addressed in a mine closure plan which will be developed during the first cycle of the environmental clearance certificate. This is necessary so that rehabilitation and landscaping can be conducted as the quarries, trenches and pits are created during the life of mine. This saves money in the long term so that the rehabilitation works do not get left to the time of closure when costs might be more. The life of mine for the operations has been based on the expected demand and the size of the resource. However, this may vary significantly as the demand may fluctuate.

In accordance with the EMA, the proponent is required to make funds accessible which will specifically be available and allocated for rehabilitation efforts. This fund should continually be available during the life of mine and yet also be sufficient to cover all decommissioning activities at decommissioning. The rehabilitation of the various mine landforms is to encouraging vegetation growth to reduce the effects of soil erosion and to re-establish normal ecosystem functionality after the mine closes.

3. EMP OBJECTIVES

The main purpose of the Environmental Management Plan ("EMP") is to provide a strategy for the identified socio-economic and biophysical impacts in order to provide measures that mitigate, as far as practicably possible, the effects of significant adverse impacts while providing strategies for maintaining or enhancing positive impact effects.

This mode of environmental protection is implemented in all the activities associated with the Proponent operations, ensuring that time and national resources are not wasted and that problems occurring during all operations are identified and rectified to prevent damage to the environment.

The overall environmental objectives have been set for the management of the following main activities:

1. Mining sodalite dimension stone, iron ore and rare earth elements within ML 40 and mining claims.
2. Transporting product along the national road network
3. Storage and export at Walvis Bay port

If any issues were overlooked, the plan must be amended in consultation with the Proponent and regulatory authorities. The EMP objectives are:

- To comply with national legislation and standards for the protection of the environment.
- To limit potential impacts on biodiversity through the minimisation of the footprint and the conservation of residual habitat within the mine area.
- To ensure the Proponents operations are managed efficiently and effectively to reduce or avoid negative impacts and enhance positive impacts of the operations
- To keep surrounding communities informed of the mining activities through the implementation of forums for communication and constructive dialogue between the Proponent and all those affected
- To conserve soil resources by stripping, stockpiling and managing topsoil where practicably possible.
- To minimise the potential for dust emissions through the implementation of dust control measures.
- To minimise the potential for noise and vibration disturbance in surrounding areas.
- To undertake rehabilitation wherever possible during the life of the mine.
- Prevent and minimise all forms of pollution.
- To include all components of the operations of the project.
- To prescribe the best practice control methods to lessen the environmental impacts associated with the operations of the project.
- To monitor and audit the performance of operational personnel in applying such controls.
- To ensure that appropriate environmental training is provided to responsible operational personnel.

The Environmental Management Act and Regulations require that an EMP for the proposed project be developed (see Legal Section of EIA Scoping Report). The Management Programmes within this EMP have therefore been compiled to satisfy requirements based on the regulations for all developmental projects in Namibia.

4. ENVIRONMENTAL MANAGEMENT ROLES AND RESPONSIBILITIES

The main parties that are responsible for specific aspects of the EMP's implementation or to whom the responsibility reports are:

- The **Proponent**- KNL Namibia;
- **Project Manager** (PM);
- The **Environmental Assessment Practitioner** (EAP)
- The **Environmental Control Officer** (ECO)

Proponent

Bears the ultimate responsibility for the mining and processing operations and is thus responsible for environmental performance. Must be informed of environmental issues and impacts of all operations (existing and future) and the resultant effect that such activities have on the environment.

Environmental Assessment Practitioner

Undertakes Environmental Impact Assessment ("EIA") and generates a draft Environmental Management Plan, completes EIA and EMP reports, ensures overall compliance of the EMP and undertakes periodic external environmental audits.

Environmental Control Officer

Monitors the implementation of the EMP as well as identifies potentially detrimental impacts not identified in the EMP so that the EMP can be reviewed and updated. The following list outlines the ECO's responsibilities:

- Responsible for maintaining compliance to the EMP and any other relevant legal requirements e.g. permits and authorisations.
- Implementation of the Environmental Management System ("EMS").
- Coordination, monitoring and consultation with stakeholders and personnel, including the promotion of environmental management competence and providing risk assessment expertise.
- Undertake Environmental Risk Assessments (ERAs).
- Set environmental objectives and targets.
- Monitoring of systems to ensure compliance to legislation and company policies.
- To facilitate updating of the environmental management process and ascertaining the state of environmental risk and performance.
- Compile biannual reports for MEFT.
- Ensuring that all personnel undergo environmental awareness training as per company environmental standards on an ad hoc basis.
- Coordinate internal and external environmental audits.
- Submit required information to relevant authorities such as reporting related to monitoring and with regard to compliance with the EMP, permit and relevant authorisations.
- Liaise with the Proponent's management team and various external stakeholders such as authorities and interested and affected parties on environmental management

5. ENVIRONMENTAL TRAINING AND CAPACITY BUILDING

The Proponent is responsible to ensure all personnel are trained on all the company Health, Safety and Environment (HSE) policies relevant to the site. The plant equipment technical team must be trained to maintain the plant. Equipment manuals and data sheets must be supplied. HSE manuals must be available on site at all times. Material Safety Data Sheets ("MSDS"), where required, are to be available.

Where the capacity of the personnel is insufficient the Proponent must take up the responsibility to build capacity especially where compliance to HSE issues is lacking. For this EMP to be successful, compliance monitoring is essential. Reporting the data from the monitoring to the environmental authority will be necessary in order to show that capacity building and training have been carried out.

6. ENVIRONMENTAL IMPACTS

The key environmental impacts described and discussed in the scoping report for construction and operations were identified by site visits, consultation with the Proponent and an impact assessment.

Key Positive Environmental impacts

The following key issues and potential positive impacts associated with the proposed operations are:

- The operations help to create jobs and long term employment.

- The local economy benefits; through direct contribution to Gross Namibian Income (GNI) of the mine.
- Reducing income inequality, increasing job creation and economic growth.
- Implementation of environmental management measures to mitigate negative impacts.
- Environmental awareness created for all the mine personnel through training.
- Improve the standard of living of the Proponent's employees.

Key Negative Environmental Impacts

- Potential decrease in the road surface integrity due to increased haulage frequency could incur more frequent spending on road repairs.
- Potential air pollution from vehicle fumes and during windy conditions from dust generating activities.
- Potential decrease in aesthetic value of the area earmarked for mining as vegetation and topsoil will be cleared as it is prepared for mining expansion and operations.
- Potential increases in waste and sewerage generation.
- Potential increase of soil erosion because of stripping of topsoil during the mining operations.
- Natural resource depletion, loss of land (habitat), change in land-use potential.
- Potential impact on health and safety (security) of personnel and public.
- Potential water pollution and poor water quality.
- Public safety on National Roads and at the Port of Walvis Bay.

7. EMP IMPLEMENTATION GUIDELINES

The potential impacts resulting from the proposed operations were evaluated in the scoping report with assessment. The suggested mitigations for potentially negative impacts if implemented, will reduce the impacts on the biophysical and socio-economic environment so that their significance is negligible. The mitigation measures are included in the EMP implementation guidelines below. **Table 2** to **Table 17** describe the management programmes for the main potential impacts to mitigate and/or enhance the potentially significant environmental and socio-economic impacts.

This document may need to be periodically reviewed and updated due to new insights or operational changes to ensure that all the environmental impact aspects are included. It categorises aspects into loosely defined phases of planning, construction, operational, and decommissioning phases. These phases are applicable in the following ways:

- elements of the **Planning Phase** apply to the current scoping report preparation, the review process, permit and certificate renewal periods;
- the establishment of new activities on site and the upgrading of infrastructure or equipment is covered under the **Construction Phase**;
- extraction, blasting, crushing, milling and haulage of the resource and supplies and transport of product to port and various accessory components falls under the **Operational Phase**;
- should any of the activities discussed ever end then the **Decommissioning Phase** section will be applicable in particular the application of the fund to the rehabilitation of the mine.

The following programmes are discussed in detail in the tables that follow:

- Air quality Management Programme
- Noise Management Programme
- Health & safety Management Programme (includes Security)

- Visual Management Programme
- Stakeholder Communication Management Programme (include socio-economic and cultural heritage aspects)
- Waste Management Programme
- Ecology Management Programme
- Water Resource Management Programme: a. Water Resource Management (Utilisation) b. Water Quality Management (Contamination)
- Traffic Management Programme
- Port Handling and Storage Management Programme
- Mine Closure & Rehabilitation Management Programme

The Port Handling and Storage Management Programme has a stand-alone EMP that is to be approved by the Port's Authority. It is included at the end of the EMP.

Table 2. Air Quality Management Programme

Impact Event		**Disturbances to soil, rock and ore resulting in excessive dust in the atmosphere**				
Description		Dusty atmospheric conditions do prevail in the arid north west of Namibia particularly during the winter months when dry easterly winds blow and during early summer months when south westerly winds blow. Mining activities will generate dust as follows: ➢ Movement of vehicles along road network hauling ore to the plant on site are likely to lift dust into the air ➢ Trucks transporting product along the dirt roads create dust trails as they travel south to the port along the preferred route as per the EIA and the project description above. ➢ Drilling and blasting will most definitely cause dusty conditions. ➢ Crusher, sizing screens and conveyor functioning will result in dusty conditions. ➢ The TSF and waste rock dump (WRD). ➢ Product handling & storage areas The surrounding habitats receive the dust that emanates from the mining activities and may potentially be affected. Fauna and flora alike could be impacted as ecosystem functioning is possibly affected. Negative effects of dust on personnel working at the quarry site are likely to occur if dust suppression techniques are not employed and personal protection equipment is not used to safeguard the health of personnel. It is not known how many people lived at Oroutumba before the existing sodalite quarry work started decades ago but currently there are at least 50 residences within 500m of the main quarry site. At the planned new processing site there are only 26 people living in 10 residences at 250m to 750m away from the boundary of the new accessory works area. Nearby residents may be affected by these dust sources.				
Nature		Negative				
Phases		Phases during which sources of dust apply are highlighted below; Significance assessment was carried out on the operational phase which presents a long term risk.				
Construction Phase		**Operational Phase**		**Decommissioning Phase**		**Post Closure**
Crushers & screens		Crushers & screens		Dismantling crushers & screens		Background levels will most likely resume soon after closure.
Conveyor construction		Conveyor functioning		Dismantling conveyors		
Road network establishment		Road use and maintenance		Demolishing buildings		
Building construction		Drilling & blasting		Rehabilitation of slopes		
		Ore haulage from quarry pit		Constructing fences		
		Product handling & storage				
Severity		Moderate / measurable deterioration (discomfort). Recommended level will occasionally be violated.				
Duration		Reversible over time. Life of the project. Medium term				
Spatial Scale		Fairly widespread – Beyond the site boundary. Localised at best. Though this does depend on mobility of particles and prevailing weather conditions. Dust trails are also created outside the local area along the gravel road between the mine and Opuwo or Ruacana and then again between Kamanjab and Henties Bay via Khorixas.				
Probability		Definite and continuous				
Mitigation	**Severity**	**Duration**	**Spatial Scale**	**Consequence**	**Probability of Occurrence**	**Significance**
Unmitigated	**M**	**M**	**M**	**M**	**H**	**M**
Significance of Consequence		Unless it is mitigated the generation of dust should have an influence on the decision to carry out the activity or not. Natural weather conditions can create very dusty atmospheric				

	conditions regardless of the existence of the mine. However, mining and processing activities on site will contribute significantly to local atmospheric dust levels and could potentially affect the ecosystem functioning. Company personnel could be affected depending on the content of the atmospheric dust and how great the exposure is.
Prevention	Dust creation cannot be prevented completely. Water is normally used to suppress dust on the roads. However, this scarce resource cannot be applied continuously and indiscriminately without impacting the groundwater resource.
Mitigation Action	Dust suppression techniques will be necessary when dust becomes an issue during the dry winter months. The following can be done to reduce exposure of the environment and personnel to continuous and excessive dust plumes: ➢ Avoid dust generating activities that create excessive dust during windy conditions. ➢ The new and refurbished roads should have a hard surface whose integrity will not be easily compromised. ➢ Personnel are required to wear personal protection equipment if excessive dust should be created. ➢ All vehicles transporting product material off site should be covered with a tarpaulin when travelling on the national road network of tar and gravel roads. ➢ Windbreaks and covers can be used to reduce lifting of dust from crushers, screens and conveyors. ➢ Water spays at the various plant components will effectively keep dust from blowing into the atmosphere (only if water sources are sustainably used) ➢ The road network within the mine site can be sprayed with water and other dust suppressants during dry dusty conditions (only if water sources are sustainably used) ➢ Waste rock dumps (WRDs) and the TSF should be landscaped and compacted where necessary to supress erosion of soil and dust emission on windy days. ➢ Natural revegetation of the WRDs and the TSF side walls would mitigate the amount of dust that these sources could generate. ➢ To mitigate gaseous pollutants released from the combustion of hydrocarbons, use of high-quality fuels will ensure quantities released per unit weight of product are at levels within environmental limits. ➢ In order to know for sure whether the dusty conditions created by mining activities will exceed the limits or standards set for the southern African context it would be necessary to set up a monitoring network of dust fallout buckets. The merits of such monitoring could be motivated by local authorities should complaints be received by nearby residents. The results of any monitoring would confirm the ambient air quality during baseline pre-construction conditions, and this would provide a gauge by which the site-specific conditions compare to the industry standards used.

Mitigation	**Severity**	**Duration**	**Spatial Scale**	**Consequence**	**Probability of Occurrence**	**Significance**
Mitigated	**L**	**L**	**M**	**L**	**L**	**L**

Significance of Consequence	The dust suppression techniques if applied diligently and consistently will result in a low significance impact for both the biophysical and social environment.
Confidence Level	High, provided management implements the mitigation action and the company provides the necessary financial support to implement the measures required
Monitoring	A dust bucket network is recommended so that **monthly dust fallout** can be documented. However, the setting up of a monitoring network could be delayed if the conditions are perceived to be excessive and complaints from residents are received. Acceptable limits as proposed by the Ministry of Environment Forestry & Tourism must be complied with. In the absence of such guidelines, typical ambient conditions prior to operations can be compared to guidelines used by RSA and Botswana and limits can be set for this project. Comparisons can be made with baseline conditions recorded by the Celsius Cobalt project should a network be set up later during operations. A **complaints register** must be kept

Table 3. Noise Management Programme

Impact Event		**Disturbance of sense of place and the effect on tranquil ambient noise levels**				
Description		Potential noise sources during the mining and processing activities could originate from vehicles, earthmoving equipment like excavators and graders, generators, drilling and blasting, crushers, screens, and conveyors. The irritation issue of these noise sources will depend on the closeness of the mining activities to various receptors. The nearest residences are between 250m and 2km from any mining activity. It is not known how many people lived at Oroutumba before the existing sodalite quarry work started decades ago but currently there are at least 50 residences within 500m of the main quarry site. At the planned new processing site there are 26 people living in 10 residences from 250m to 750m away from the boundary of the new accessory works area. For rural districts the day-time ambient noise level requirement outlined in SANS 10103 (2008) between 6am and 10pm is 45dBA (**A-weighted decibel**). This is in line with the guidelines published by the World Health Organisation (WHO). The noise levels should not exceed the ambient noise levels for rural settings. The residences mentioned above would fall into the rural category.				
Nature		Negative				
Phases		Phases during which sources of noise will apply are highlighted below; Significance assessment was carried out on the operational phase which presents a long-term risk.				
Construction Phase		**Operational Phase**		**Decommissioning Phase**		**Post Closure**
Crushers & screens		Rock Cutters, crushers & screens		Dismantling crushers & screens		Background or baseline levels will most likely become prevalent again immediately after closure.
Conveyor construction		Conveyor functioning		Dismantling conveyors		
Vehicles on road network		Vehicles on road network		Demolishing buildings		
Building construction		Drilling & blasting		Rehabilitation of slopes		
		Ore and blocks haulage from quarry pit		Constructing fences		
Severity		Moderate / measurable deterioration (discomfort). Recommended level will occasionally be violated. Widespread complaints.				
Duration		Reversible over time. Life of the project. Medium term				
Spatial Scale		Fairly widespread – Beyond the site boundary. Localised at best. Though this does depend on prevailing wind conditions proximity of residents.				
Probability		Definite and continuous				
Mitigation	**Severity**	**Duration**	**Spatial Scale**	**Consequence**	**Probability of Occurrence**	**Significance**
Unmitigated	**M**	**M**	**M**	**M**	**H**	**M**
Significance of Consequence		Mitigations to reduce noise levels measured at receptors will be necessary.				
Prevention		Noise creation cannot be prevented and will occur and should be mitigated. Additional traffic planned on the road for hauling product cannot be avoided.				
Mitigation Action		There are industrial standards to which the noise sources (i.e. machinery) must comply. Regular maintenance of machinery should ensure the acceptable noise levels for operators working with the machines. It is not clear whether this will produce the accepted rural standard at the homesteads. It is recommended that any complaints regarding noise be recorded and included in the environmental reports. Should complaints persist then a survey by a suitably qualified and independent occupational hygienist will be required.				

		Shields which deflect the noise away from receptors may reduce the decibels to within the rural standards. The placement of stockpiles and buildings will also play a role to ensure sources of noise are not directly in line with the farm homestead. Transportation routes should be planned for trucks such that they pass noise sensitive receivers at appropriate times. A restriction of the hours of movement, e.g. not allowing the transport of material during the noise sensitive hours of the night can mitigate noise impacts. The frequency (distance between trucks can also be planned to fall within a limited period.				
Mitigation	**Severity**	**Duration**	**Spatial Scale**	**Consequence**	**Probability of Occurrence**	**Significance**
Mitigated	**L**	**M**	**M**	**L**	**L**	**L**
Significance of Consequence		The normal maintenance may reduce the probability of noise marginally. Should the shielding of noise sources keep the noise measured at the receptors to within the limits then the significance could drop to low.				
Confidence Level		The EAP is confident that the mitigations will result in lowering the impact significance. A good monitoring system will enable the mine to document the facts and respond accordingly by enhancing any noise reduction strategies.				
Monitoring		A mechanism to monitor noise levels, record and respond to complaints and mitigate impacts should be developed. **Monitoring:** ➢ Keep a register of all complaints received and remediation action taken. ➢ Survey noise levels annually **Performance Indicator:** ➢ Number of registered complaints ➢ Noise monitoring plan is on file. ➢ Record all information in a biannual report.				

Table 4. Health & Safety Management Programme – a. Noise and Vibration Effects on Personnel

<table>
<tr><td>Impact Event</td><td colspan="6">The effects of excessive noise and vibration on the health and safety of personnel.</td></tr>
<tr><td>Description</td><td colspan="6">Noise:
➢ Long term exposure to high levels of noise can cause permanent hearing loss. Neither surgery nor a hearing aid can help correct this type of hearing loss.
➢ Short term exposure to loud noise can also cause a temporary change in hearing (your ears may feel stuffed-up) or ringing in your ears (tinnitus). These short-term problems may go away within a few minutes or hours after leaving the noisy area.
Vibration:
Different vibration types are defined as:
➢ Hand-Arm Vibration is defined as mechanical vibration that, when transmitted to the human hand-arm system, entails risks to the health and safety of workers, vascular, bone or joint, neurological or muscular disorders. Whole-Body Vibration is defined as the mechanical vibration that, when transmitted to the whole body, entails risks to the health and safety of workers lower back morbidity and trauma to the spine.</td></tr>
<tr><td>Nature</td><td colspan="6">Negative</td></tr>
<tr><td>Phases</td><td colspan="6">Phases during which sources of noise and vibration could apply are highlighted below; Significance assessment was carried out on the operational phase which presents a long-term risk.</td></tr>
<tr><td>Construction Phase</td><td colspan="2">Operational Phase</td><td colspan="2">Decommissioning Phase</td><td colspan="2">Post Closure</td></tr>
<tr><td>Crushers & screens</td><td colspan="2">Rock Cutters, Crushers & screens</td><td colspan="2">Dismantling crushers & screens</td><td colspan="2" rowspan="5">Background or baseline levels will most likely become prevalent again immediately after closure. Personnel no longer on site.</td></tr>
<tr><td>Conveyor construction</td><td colspan="2">Conveyor functioning</td><td colspan="2">Dismantling conveyors</td></tr>
<tr><td>Vehicles on road network</td><td colspan="2">Vehicles on road network</td><td colspan="2">Demolishing buildings</td></tr>
<tr><td rowspan="2">Building construction</td><td colspan="2">Drilling & blasting</td><td colspan="2">Rehabilitation of slopes</td></tr>
<tr><td colspan="2">Ore haulage from quarry pit</td><td colspan="2">Constructing fences</td></tr>
<tr><td>Severity</td><td colspan="6">Substantial deterioration (permanent damage to spine from vibration or hearing). Recommended level will often be violated. Personnel potentially unable to work any longer.</td></tr>
<tr><td>Duration</td><td colspan="6">Permanent. Beyond closure. Long term.</td></tr>
<tr><td>Spatial Scale</td><td colspan="6">Localised - Within the site boundary.</td></tr>
<tr><td>Probability</td><td colspan="6">Definite and continuous</td></tr>
<tr><td>Mitigation</td><td>Severity</td><td>Duration</td><td>Spatial Scale</td><td>Consequence</td><td>Probability of Occurrence</td><td>Significance</td></tr>
<tr><td>Unmitigated</td><td>M</td><td>M</td><td>L</td><td>M</td><td>M</td><td>M</td></tr>
<tr><td>Significance of Consequence</td><td colspan="6">Mitigations to reduce noise levels and exposure to vibrations for personnel are imperative.</td></tr>
<tr><td>Prevention</td><td colspan="6">Engineering controls that reduce sound exposure levels are available and technologically feasible for most noise sources. Engineering controls involve modifying or replacing equipment or making related physical changes at the noise source or along the transmission path to reduce the noise level at the worker's ear. The same goes for vibration. The following should be considered:
➢ Choose low-noise tools and machinery.
➢ Maintain and lubricate machinery and equipment (e.g. oil bearings).
➢ Enclose or isolate the noise source.</td></tr>
<tr><td>Mitigation Action</td><td colspan="6">Noise:</td></tr>
</table>

	The **Occupational Safety and Health Administration** (OSHA) guidelines set legal limits on noise exposure in the workplace. These limits are based on a worker's time weighted average over an 8 hour day. With noise, OSHA's **permissible exposure limit** (PEL) is 90dBA for all workers for an 8 hour day. The OSHA standard uses a 5dBA exchange rate. This means that when the noise level is increased by 5dBA, the amount of time a person can be exposed to a certain noise level to receive the same dose is cut in half. The WHO guideline on maximum noise levels to prevent hearing impairment set noise level limits at an average of 70 da over a 24-hour period with maximum noise levels not exceeding 110 dBA during the period. These limits would apply if the day-time shift is prolonged beyond the 8-hour day. **Mitigation actions include:** ➢ Limiting the amount of time, a person spends at a noise source. ➢ Providing quiet areas where workers can gain relief from noise sources. ➢ Where possible, restricting worker presence to a suitable distance away from noisy equipment. (Controlling noise exposure through distance is often an effective, yet simple and inexpensive administrative control.) ➢ In open space, the further the distance from the source of noise, the worker may experience a decrease in noise levels to be about 6dBA less for every doubling of the distance (nonlinear relationship). ➢ Hearing protection devices, specifically earmuffs for long periods of exposure near sources and at all times use plugs for all places outside offices within the claims not near noise sources for extended periods ➢ PPE is considered an acceptable mitigation, but a less desirable option to control exposures to noise. ➢ Entrance and exit medicals to test hearing should be carried out as a minimum requirement. **Vibration:** Meet industry vibration regulations; set daily exposure limit values and action values for both hand-arm and whole-body vibration for eight-hour shifts. Personnel can work shorter shifts where excessive vibration conditions exist.

Mitigation	Severity	Duration	Spatial Scale	Consequence	Probability of Occurrence	Significance
Mitigated	**L**	**M**	**L**	**L**	**L**	**L**

Significance of Consequence	If all the mitigations listed are used then the significance of the impact will be maintained at low.
Confidence Level	The EAP is confident that the mitigations will result in low significance. A good monitoring system will enable the mine to document the facts and respond accordingly by enhancing any noise and vibration reduction strategies. Continuous training of personnel is imperative
Monitoring	A mechanism to monitor noise levels, record and respond to health-related complaints of personnel and mitigate impacts appropriately. **Monitoring:** ➢ Record all health-related incidents ➢ Survey noise and vibration levels annually **Performance Indicator:** ➢ Number of registered health complaints/incidences ➢ Occupational health policy is on file ➢ Monitoring plan is on file. Record all information in a biannual report.

Table 5. Health & Safety Management Programme – b. General Hazards and Potential Risk of Injury

Impact Event		**Injury risks due to normal working conditions**				
Description		The potential impacts on human health and safety resulting from activities in any phase could include occupational accidents and injuries, vehicle accidents, exposure to weather extremes, trips and fall on uneven terrain, adverse health effects from dust generation and emissions, and contact with hazardous materials. The potential for these impacts to occur would be low because of the limited range of activities and number of workers required during operations. KNL follows a set of industry-specific safety and health policies in the work place. Typical operational procedures that pose risks to operational personnel are: ➢ Operating heavy machinery such as, front-end loaders, excavators, and stationary processing equipment. ➢ Operating haulage trucks				
Nature		Negative				
Phases		Phases and specific activities or equipment during which personnel are exposed to health and safety risks are highlighted below; Significance assessment was carried out on the operational phase which presents a long term exposure risk.				
Construction Phase		**Operational Phase**		**Decommissioning Phase**	**Post Closure**	
Processing plant construction site		Processing plant operations		Dismantling processing plant	Personnel no longer on site. Public safety ensured through restricted access though quarry pit will remain.	
Rock falls from steep and high cliff faces of quarry pit		Rock falls from steep and high cliff faces of quarry pit		Rehabilitation of slopes		
Large mobile plant equipment		Large mobile plant equipment and product haulage		Demolishing buildings		
Working at heights		Drilling & blasting		Constructing fences		
		Fire and explosion hazards				
Severity		Substantial deterioration. Accidents can happen and injuries to personnel may potentially lead to early retirements.				
Duration		Permanent. Beyond closure. Long term.				
Spatial Scale		Localised - Within the site boundary.				
Probability		Definite and continuous				
Mitigation	**Severity**	**Duration**	**Spatial Scale**	**Consequence**	**Probability of Occurrence**	**Significance**
Unmitigated	**H**	**H**	**L**	**H**	**H**	**H**
Significance of Consequence		Mitigations to reduce exposure to health and safety risks for personnel are imperative.				
Prevention		The removal of hazards or risks will possibly prevent accidents from occurring. However, it is not possible to remove all risks.				
Mitigation Action		It is not possible to prevent all incidents from occurring completely. An accident is an unplanned incident though it could have been foreseen if the necessary precautions had been taken. Not all hazards can be removed but the risk it presents can be lowered. An integrated health and safety management system acts as a monitoring tool and mitigating tool to reduce the risks. Typical mitigating measures within the health and safety management systems are:- ➢ Draw up operational procedure manuals ➢ Provide health and safety awareness training ➢ Establish practical standard housekeeping rules				

<table>
<tr><td colspan="2"></td><td colspan="5">

Colour code certain areas, equipment and substances to thereby classifying the risks.
Provide signage for personal protective equipment (e.g. protective clothing like safety boots and hard hats)
Institute safe working procedures and require permits to work
Devise and implement emergency response plans
Close coordination with the traffic authorities to ensure road safety signs are strategically placed and ensure all employee drivers are well trained
Provide easy access to Material Safety Data Sheets (MSDS)
Provide first aid treatment and training
Devise emergency medical procedures for all eventualities
Undertake daily safety reminders and/or drills
Establish regulations for handling fuel

The MSDS gives health related medical responses for personnel assisting staff who are exposed to the products, i.e. fuels, chemicals, etc.

Procedures for dealing with injuries or accidents must be in place and all contact details for emergency personnel must be available.

This list is not comprehensive and could be supplemented substantially by the Health & Safety Manager
</td></tr>
<tr><td>Mitigation</td><td>Severity</td><td>Duration</td><td>Spatial Scale</td><td>Consequence</td><td>Probability of Occurrence</td><td>Significance</td></tr>
<tr><td>Mitigated</td><td>L</td><td>L</td><td>L</td><td>L</td><td>L</td><td>L</td></tr>
<tr><td colspan="2">Significance of Consequence</td><td colspan="5">If all the mitigations listed are implemented, then the significance will be maintained at low.</td></tr>
<tr><td colspan="2">Confidence Level</td><td colspan="5">The EAP is quite confident that the mitigations will result in low significance. Continuous training of personnel is imperative.</td></tr>
<tr><td colspan="2">Monitoring</td><td colspan="5">
Planning:

A register of all incidents must be maintained on a daily basis. This should include measures taken to ensure that incidents do not repeat themselves.
An Emergency Response Plan should be developed.

Construction and Operations:

Monitoring reports on file
Non-compliances reported and on file
Operators certificates on file
Schedule of road maintenance on file
A register must be maintained of all training provided to staff.
A register must be maintained for all safety equipment and medical supplies kept on site. This should include date of purchase and date of service/replacement for items that can expire or deteriorate with age.
A register of all incidents must be maintained on a daily basis. This should include measures taken to ensure that incidents do not repeat themselves.
File any incident reports.
Include all monitoring information in the biannual environmental report.

Mine Closure:
At the time of mine closure and abandonment the contractor must rehabilitate the mine site to the state agreed upon at the start of the agreement. Comparisons with the baseline report drafted at the start of the relationship must be made.

Removal of contractor's movable assets i.e., plant equipment
Demolishment of contractor's fixed immovable assets
Removal of this demolished plant and building rubble by contractor

</td></tr>
</table>

	➢ **contractor** to fence off dangerously deep pits or holes in the ground that poses a threat to the public safety ➢ In accordance with the rehabilitation plan the steep side slopes may need to be blasted to change angle of repose. The **proponent** is to fulfil the same rehabilitation tasks as above for all the accessory works area, including infrastructure, pits and holes etc.

Table 6. Health Environmental Programme: c. impact due to exposure to radioactive particulates and normal working conditions.

<table>
<tr><th>Impact Event</th><th colspan="3">Disease or normal health risk due to normal working conditions and in particular to exposure to radioactive particulates</th></tr>
<tr><td>Description</td><td colspan="3">The potential impacts on human health and safety resulting from activities in any phase could include occupational accidents and injuries, vehicle accidents, exposure to weather extremes, trips and fall on uneven terrain, adverse health effects from dust generation and emissions, and contact with hazardous materials. The potential for these impacts to occur would be low because of the limited range of activities and number of workers required during operations. The proponent and his operational mining company follows a set of industry-specific safety and health policies in the workplace.

Typical operational procedures that pose risks to operational personnel are:
➢ Operating heavy machinery such as, front-end loaders, excavators, conveyors, crushers and sieves
➢ Operating haulage trucks
➢ Prolonged proximity to and exposure to manganese particulates

The REE ore and REE product concentrate is potentially hazardous because of the radioactive nature of the element thorium which is concentrated together with the ore minerals. Through the processing of the REE ore the thorium element is expected to concentrate and as a result increase the risk of radioactive emissions. Working at the mine’s quarries and processing plant could increase the exposure to this risk. The risks associated with exposure to radioactive materials is increased by three factors. Namely, the proximity to the source, the period of time spent on any one occasion near to the source and thirdly the frequency with which you are exposed over a long period of time. These factors affect the potential with which the radiation can cause sickness and or death. Radioactive exposure can be through inhalation, oral, dermal contact or close to the source without contact. The effects can be carcinogenic in nature and can eventually lead to death.</td></tr>
<tr><td>Nature</td><td colspan="3">Negative</td></tr>
<tr><td>Phases</td><td colspan="3">Phases and specific activities or equipment during which personnel are exposed to health and safety risks will apply are highlighted below; Significance assessment was carried out on the operational phase which represents the period personnel are exposed to the hazard.</td></tr>
<tr><td>Construction Phase</td><td>Operational Phase</td><td>Decommissioning Phase</td><td>Post Closure</td></tr>
<tr><td>Processing plant construction site</td><td>Processing plant operations, product storage and handling, and transport of concentrate</td><td>Dismantling processing plant and handling ‘radioactive contaminated materials’</td><td rowspan="5">Personnel no longer on site. Public safety ensured through restricted access though quarry pit will remain.</td></tr>
<tr><td>Rock falls from steep and high cliff faces of quarry pit</td><td>Rock falls from steep and high cliff faces of quarry pit</td><td>Rehabilitation of slopes</td></tr>
<tr><td>Large mobile plant equipment</td><td>Large mobile plant equipment and product haulage</td><td>Demolishing buildings</td></tr>
<tr><td rowspan="2">Working at heights</td><td>Drilling & blasting</td><td rowspan="2">Constructing fences</td></tr>
<tr><td>Fire and explosion hazards</td></tr>
<tr><td>Severity</td><td colspan="3">Substantial deterioration. Recommended level will often be violated. Personnel potentially unable to work because the maximum exposures for the month or year have been met. Some personnel may need to work at less risky sites at the mine for the remainder of the period (a month or a year)</td></tr>
<tr><td>Duration</td><td colspan="3">Permanent. Beyond closure. Long term.</td></tr>
<tr><td>Spatial Scale</td><td colspan="3">Localised - Within the site boundary. During transportation (lowest risk to public) and</td></tr>
</table>

		temporary storage at Walvis Bay Harbour				
Probability		Definite and continuous				
Mitigation	**Severity**	**Duration**	**Spatial Scale**	**Consequence**	**Probability of Occurrence**	**Significance**
Unmitigated	**H**	**H**	**L**	**H**	**H**	**H**
Significance of Consequence		Mitigations to reduce exposure to health and safety risks for personnel are imperative.				
Prevention		The removal of all hazards or risks will not be possible.				
Mitigation Action		It is not possible to prevent all incidents from occurring completely. An accident is an unplanned incident though it could have been foreseen if the necessary precautions had been taken. Not all hazards can be removed but the risk it presents can be lowered. An integrated health and safety management system, including best practice guidelines and for handling radioactive materials, acts as a monitoring tool and mitigating tool to reduce the risks. Typical mitigating measures within the health and safety management systems are:- ➢ Draw up operational procedure manuals ➢ Provide health and safety awareness and radiation training ➢ Establish practical standard housekeeping rules ➢ Colour code certain areas, equipment and substances to thereby classifying the risks. ➢ Provide signage for personal protective equipment (e.g. protective clothing like safety boots and hard hats) ➢ Institute safe working procedures and require permits to work ➢ Devise and implement emergency response plans ➢ Close coordination with the traffic authorities to ensure road safety signs are strategically placed and ensure all employee drivers are well trained ➢ Provide easy access to Material Safety Data Sheets (MSDS) ➢ Provide first aid treatment and training ➢ Devise emergency medical procedures for all eventualities ➢ Undertake daily safety reminders and/or drills ➢ Establish regulations for handling radioactive material or substances.				
Mitigation	**Severity**	**Duration**	**Spatial Scale**	**Consequence**	**Probability of Occurrence**	**Significance**
Mitigated	**L**	**L**	**L**	**L**	**L**	**L**
Significance of Consequence		If all the mitigations listed are implemented, then the significance will be maintained at low.				
Confidence Level		The EAP is quite confident that the mitigations will result in low significance. It is imperative that continuous training and medical monitoring of personnel at the regionally (SADC region) recommended frequency. The regionally (SADC region) accepted levels of radiation exposure must be monitored and maintained. The only point where mitigation may be insufficient is with dust suppression due to the measures in place for limiting water use				
Monitoring		With respect to radiation exposure the following monitoring are either mandatory by law or recommended: ➢ Annual medical assessment – apart from the normal checks, employees' white blood cell count could be tested to assess the potential effect of radiation exposure. ➢ Personnel working in the higher risk area should wear a passive sensor that can be analysed at the laboratory to provide monthly records of radiation exposure; ➢ PPE – dust masks are worn by all employees exposed to dust. The type used is FFP3;				

	➢ Ideally the higher risk ground surfaces should be watered or chemically bound to supress dust billowing; ➢ Ideally at transfer points on conveyor belts and at crusher bins mist sprays should be installed; ➢ The networks of dust fall-out sampling points should be in place and monitoring results direct further decisions for planning mitigation depending on the spatial extent of any high levels of atmospheric radioactive particulates. ➢ Devices for monitoring the radiation emitted from all potential sources must be purchased and a regular monitoring programme be carried out and records kept for reporting purposes. A procedure manual must be drafted that is based on the industry standards and laws and regulations that are implemented by the MME and Ministry of Labour.

Table 7. Visual Impact Management Programme

<table>
<tr><td colspan="2">Impact Event</td><td colspan="5">Changes to the aesthetic appeal of the area due to presence of people, vehicles and machinery. Visible changes to habitats due to human activities.</td></tr>
<tr><td colspan="2">Description</td><td colspan="5">The experience of enjoying the landscape free of human activities is considered highly desirable. Intrusions into the current scenery may be unwelcomed. The mine site is remote and no main tourism routes pass through this valley. Residents within a 5 km radius are few.

Impact on visual resources would be considered unfavourable if the landscape was significantly degraded or modified. The presence of mine personnel, vehicles and other equipment may reduce the aesthetic appeal of the area.

The position of WRDs and a processing plant are key issues with regards this impact. The initial location and extent of the accessory works area has been amended so that the new site is not visible to the people staying in Oroutumba.

The new quarries will not be visible to residents or tourists.</td></tr>
<tr><td colspan="2">Nature</td><td colspan="5">Negative</td></tr>
<tr><td colspan="2">Phases</td><td colspan="5">Phases during which traffic, infrastructure and dust plumes which potentially play a role in visual nuisances are highlighted below; Significance assessment was carried out on the operational phase which presents the long-term risk.</td></tr>
<tr><td colspan="2">Construction Phase</td><td colspan="2">Operational Phase</td><td colspan="2">Decommissioning Phase</td><td>Post Closure</td></tr>
<tr><td colspan="2">Cranes used to build mine infrastructure</td><td colspan="2">Processing plant infrastructure and Traffic</td><td colspan="2">Dismantling infrastructure with cranes</td><td rowspan="3">Barren mountain slopes and quarry scarring</td></tr>
<tr><td colspan="2">Additional traffic on the district road and mine access roads</td><td colspan="2">Processing plant, ore haulage and blasting creating dust plumes</td><td colspan="2">Denuded mountain slopes and open quarry not revegetated</td></tr>
<tr><td colspan="2">Dust plumes caused by mobile equipment operating at the mine</td><td colspan="2">Bare slopes, waste rock dumps, topsoil stockpiles</td><td colspan="2">Demolishing buildings causing dust plumes</td></tr>
<tr><td colspan="2">Severity</td><td colspan="5">Moderate / measurable deterioration. Recommended level will occasionally be violated. Widespread complaints. Noticeable loss of resources.

It is a remote area off the main tourism route. Only 26 residents stay within 500m of the new processing area.</td></tr>
<tr><td colspan="2">Duration</td><td colspan="5">Reversible over time. Life of the project. Medium term

(Except for the quarries which will remain visible for the long term.</td></tr>
<tr><td colspan="2">Spatial Scale</td><td colspan="5">Fairly widespread – Beyond the site boundary. Localised at best. Though this does depend on mobility of particles and prevailing weather conditions. The setting is rural, and the only receptors currently are a few residents (26 at the time of the social survey).</td></tr>
<tr><td colspan="2">Probability</td><td colspan="5">Definite (in terms of dust plume creation from blasting) and continuous (in terms of the barren mountain slopes until revegetated during post closure)</td></tr>
<tr><td>Mitigation</td><td>Severity</td><td>Duration</td><td>Spatial Scale</td><td>Consequence</td><td>Probability of Occurrence</td><td>Significance</td></tr>
<tr><td>Unmitigated</td><td>M</td><td>M</td><td>M</td><td>M</td><td>M</td><td>M</td></tr>
<tr><td colspan="2">Significance of Consequence</td><td colspan="5">The two aspects for visual impact are under consideration:
➢ Unless it is mitigated the generation of dust should have a moderate influence on the decision to carry out the activity or not. However, natural weather conditions can also create very dusty atmospheric conditions. The mining and processing activities on site will contribute to local atmospheric dust levels and will potentially affect the visual experience of the people staying nearby. Those communities staying along the transport route are affected by other road users too, so this aspect is a cumulative impact. This latter aspect is considered a minor aspect and temporary in nature. The nearby residents (26) could be relocated to a more favourable location.
➢ The aesthetic changes to the landscape can be mitigated for all phases of the mining project. Alternatives have been considered which will reduce the visual impact of the</td></tr>
</table>

	mine on any who pass through the area.					
Prevention	➢ Dust creation cannot be prevented completely. Water is normally used to suppress dust on the roads. Blasting will be intermittent, and the plume will dissipate fairly rapidly. ➢ The bare slopes cannot be avoided in the medium term and the quarries will be a permanent feature of the mining area. For operations to continue, personnel, vehicles and machinery will operate within the area for the duration of the project. It is not possible to operate and have no visual presence.					
Mitigation Action	Best practice methodologies for operations will be employed. These may include the following: ➢ Existing roads and tracks are used to access the mine site. ➢ Dust suppression using water will most likely not be practical due to the non-sustainability of ground water usage. ➢ Product transport should either be containerised or at least installed with covers. ➢ Careful planning to avoid disturbing significant floral and faunal habitats when accessing the mining site ➢ Training personnel regarding the visible signs of faunal and floral biodiversity and the avoidance of habitat disturbance. ➢ Minimise the footprint of personnel, vehicles and machinery ➢ Rehabilitate habitats through the removal of obvious signs of human presence. ➢ Regular removal of waste on a daily basis and disposal of waste in the appropriate manner. ➢ Removal of machinery from the mining sites if periods of inactivity are prolonged. ➢ If lighting is required at night, lights need to be strictly controlled and fixtures should be low-glare lighting with downward facing directed beams (except for quarry walls) ➢ Constructed structures should have natural colours so that they can blend in with the surrounding environment. Often, the sites that are disturbed and rehabilitated at least from an aesthetic perspective will in time be recolonized by both plants and animals. The aim is to minimise the footprint so as to achieve the least impact due to anthropogenic influence. With respect to this the following has been considered: ➢ A reduction in the size or number of the WRDs. ➢ Location and design of WRDs to make them inobtrusive. ➢ Landscaping of quarry sites to reduce visual impact.					
Mitigation	**Severity**	**Duration**	**Spatial Scale**	**Consequence**	**Probability of Occurrence**	**Significance**
Mitigated	**L**	**M**	**L**	**L**	**L**	**L**
Significance of Consequence	The dust suppression techniques if applied diligently and consistently will result in a medium significance visual impact for the residents in the immediate vicinity because dust from heavy traffic on the main dirt road will not be mitigated except by reducing travelling speeds. Additionally, the visual alteration of the mountain slopes cannot be mitigated until mine closure when at that time the quarry will remain a visual reminder of the once active mine.					
Confidence Level	High, provided management implements the mitigation action and the company provides the necessary financial support to implement the changes required. A commitment to rehabilitating the denuded slopes and waste rock dump with the stockpiled topsoil will need to be done where practical and necessary.					
Monitoring	**Planning:** Visual baseline in the form of a photo survey should be undertaken. **Construction:** ➢ Carry out audits and report findings. ➢ Keep a visitors' log.					

	➢ Maintain existing access road. **Operation:** ➢ Visual baseline (2nd) in the form of a photo survey should be undertaken. ➢ Enforce strict rules on the use of lighting by personnel on site. **Decommissioning:** ➢ Requirements for restricting or prohibiting access to the abandoned mine are implemented and records on file. ➢ Final visual baseline (3rd) in the form of a photo survey should be undertaken. A visual audit can be done prior to closure so that a landscaping plan can be drawn up for incorporation into the closure plan.

Table 8. Stakeholder Communication Management Programme: a. land use conflicts

Impact Event	**Herders could potentially experience restrictions to their grazing areas**					
Description	The mining area is situated on land belonging to the government of Namibia granted to rural people in the form of communal land. The mining areas fall within the Kunene River Conservancy. The mining area falls within the Epupa Constituency but falls under the stewardship of Okangwati's rural constituency councillor. The community has grazing rights to the area. The leaders of the community request that the area is kept safe for shepherd boys and their livestock. The TSF may need to be fenced off to insure, the public safety. The community has many needs and request was made that the proponent consider social responsibility projects to uplift the community. Initially, the well in the Ondoto river will be shared as it has been since the sodalite mining began decades ago.					
Nature	Negative					
Phases	Phases during which potential conflicts may apply are highlighted below; Significance assessment was carried out on the operational phase. However, the long-term presence of quarries pose a safety risk. This is included in the assessment.					
Construction Phase	**Operational Phase**		**Decommissioning Phase**		**Post Closure**	
Access to site	Access to site		Access to site		Access to site	
Access to groundwater resources / boreholes	Access to groundwater resources / boreholes		Access to groundwater resources / boreholes		Public safety	
Public safety	Public safety		Public safety		Alternative uses for pit	
Asset security	Asset security		Asset security			
Waste management	Waste management		Waste management			
Severity	Moderate / measurable deterioration (discomfort). Recommended level will occasionally be violated. Widespread complaints. Noticeable loss of resources. Herders' area for grazing will be reduced marginally. Public safety must prevail, and access must be temporarily prohibited during blasting.					
Duration	Reversible over time. Life of the project. Medium term (except quarry which is long term)					
Spatial Scale	Localised. Within accessory works area and 500m boundaries around the quarries.					
Probability	Definite / continuous					
Mitigation	**Severity**	**Duration**	**Spatial Scale**	**Consequence**	**Probability of Occurrence**	**Significance**
Unmitigated	**M**	**M**	**L**	**M**	**H**	**M**
Significance of Consequence	Mitigations to ensure no conflicts with landowners occur will be necessary.					
Prevention	It is not possible to prevent all conflicts. Any unforeseen issues will be mitigated through the various mechanisms stipulated in the EMP					
Mitigation Action	The EMA requires that permission be provided by the competent authorities for the listed activity. The EIA has facilitated a transparent process by which concerns were raised. The PPP has ensured that all stakeholders have been informed. The proponent is subservient to the conditions laid down by the guidelines / conditions and the law that upholds it. The implementation of the mining programme will be in accordance with the approved Environmental Management Plan (EMP). . The following mechanisms should be included in the environmental management system: ➢ Correspondence and agreements - document filing system ➢ Review memoranda of understanding annually ➢ Keep complaints register up to date ➢ Update stakeholder register regularly					

		➢ Engage land users regularly to maintain open channels of communication ➢ Fence off mining areas to increase public safety where necessary The Life of Mine is predicted to be 25 years. This represents a medium period compared to other larger mining operations at other mine sites. Depending on the management approach and decisions to allow access to grazing during no blasting periods and land markers or fences restricting access for safety and security the footprint and impact on normal usage of the area could be kept to a minimum thereby keeping the spatial extent localised. The merits of relocating the nearby 26 residents to ensure no residents live within 1km of the new processing plant.				
Mitigation	**Severity**	**Duration**	**Spatial Scale**	**Consequence**	**Probability of Occurrence**	**Significance**
Mitigated	**L**	**M**	**L**	**L**	**L**	**L**
Significance of Consequence		Maintaining good relationships with landowners is imperative so that the severity and duration of disputes can be kept low. This will ensure the probability is low.				
Confidence Level		I am confident that a well-designed and well implemented stakeholder engagement programme will cover the land use conflicts that could potentially arise.				
Monitoring		The following mechanisms should be included in the environmental management system as monitoring tools and performance indicators: ➢ Correspondence and agreements - document filing system ➢ Review any memoranda of understanding annually ➢ Keep complaints register up to date ➢ Update stakeholders register regularly ➢ Fence off mining areas to increase public safety				

Table 9. Stakeholder Communication Management Programme: b. socio economic impact

Impact Event	**Positive aspect of sustaining employment in the sector.**					
Description	The operations to be carried out at ML40 Sodalite Mine will employ about 50 (including haulage truck drivers) personnel of the contractor to manage the excavation, crushing, milling, screening and transportation processes. A security team of 3 personnel will also be employed. The baseline survey showed that in the immediate (radius of 1km) surrounding area only 26 persons reside. Herders use the area for grazing their livestock. The negative social impact is deemed negligible and the positive aspects of the mine on the economic benefits outweigh any negative aspects.					
Nature	Positive					
Phases	Phases during which mining activities may contribute to the local economy are highlighted below; The significance assessment was carried out on the operational phase which represents the longest term when benefits are greater.					
Construction Phase	**Operational Phase**		**Decommissioning Phase**		**Post Closure**	
Construction personnel	Operational personnel		Demolition personnel		No employment	
Security personnel	Security personnel		Security personnel			
Support services	Support services		Support services			
Severity	Substantial improvement. Will be within or better than the recommended level. Favourable publicity.					
Duration	Reversible over time. Life of the project. Medium term					
Spatial Scale	Fairly widespread – Beyond the site boundary. Local					
Probability	Possible/ frequent					
Mitigation	**Severity**	**Duration**	**Spatial Scale**	**Consequence**	**Probability of Occurrence**	**Significance**
Unmitigated	**M+**	**M+**	**M+**	**M+**	**M+**	**M+**
Significance of Consequence	A medium positive significance is expected.					
Prevention	Economic benefits could be prevented locally if no residents are employed and all materials and equipment is imported from other towns in the region and beyond. Actions that will prevent the positive impact of employment creation for this project would be the no go alternative due to either a fatal flaw from socio-economic or biodiversity impacts being of high significance. Retrenchment of permanently employed can be avoided by diversifying the business options in the construction industry.					
Mitigation Action	Where possible personnel should be hired from the local resident pool. At least this should apply to the unskilled vacancies. The company could start social responsibility projects to uplift the areas health and educational needs. Possible need to relocate the nearby 26 residents would be a negative impact but this depends on the opportunities afforded the people after their relocation.					
Mitigation	**Severity**	**Duration**	**Spatial Scale**	**Consequence**	**Probability of Occurrence**	**Significance**
Mitigated	**M+**	**M+**	**M+**	**M+**	**H+**	**M+**
Significance of	A medium positive significance is expected.					

Consequence	
Confidence Level	Provided local residents are hired then one can be more confident in achieving the medium significance. Through meaningful permanent employment economic development can be secured for all concerned.
Monitoring	Provided local residents are hired then one can be more confident in achieving the medium significance. Through meaningful permanent employment economic development can be secured for all concerned. Include the employee statistics in the annual audit showing long term trends. Company annual production report. Ensure upgraded skills of employees during employment at mine is documented and accredited where possible so that skills are recognised with future employers.

Table 10. Stakeholder Communication Management Programme: c. heritage related impact

Impact Event	**Heritage related impacts.**					
Description	Kaokoland is a special place and it is recognised for its world heritage and for the people who continue to live off the land there. It is expected that the area has important sites of national importance from a historical and pre-historic perspective. The siting of graves, ritual sites, middens and other such important heritage aspects within the mining area could mean that specific areas within ML40 need to be kept pristine for further study If these sites were damaged in any way it would be considered a heritage impact and depending on the importance of the site result in a great loss were it damaged by mining.					
Nature	Negative					
Phases	Phases during which the significance assessment was carried out is highlighted in green. It is the various personnel who could potential come across as yet to be documented find.					
Construction Phase	**Operational Phase**		**Decommissioning Phase**		**Post Closure**	
Construction personnel	Operational personnel					
Security personnel	Security personnel					
Residents	Residents					
Severity	undetermined as yet					
Duration	Not reversible over time. long term					
Spatial Scale	Localised to within the mining licences.					
Probability	Possible because no records known to proponent					
Mitigation	**Severity**	**Duration**	**Spatial Scale**	**Consequence**	**Probability of Occurrence**	**Significance**
Unmitigated	**H**	**H**	**L**	**H**	**L**	**M**
Significance of Consequence	A medium significance is expected.					
Prevention	Well trained staff who know what to look for during the construction and operational phases could prevent any destruction of important sites.					
Mitigation Action	Undertake a survey of the area with the help of local leaders to identify any place of importance before any construction starts. The completed report is found in **Appendix N.** Submit the survey report and apply for the necessary clearance from the Heritage Council to be able to start construction on the planned site. Should anything come up during construction or operations then work should stop and the police should be informed. A member of the heritage council would need to assess the importance of the find and provide the necessary permission to continue with works at that specific site.					
Mitigation	**Severity**	**Duration**	**Spatial Scale**	**Consequence**	**Probability of Occurrence**	**Significance**
Mitigated	**L**	**H**	**L**	**M**	**L**	**L**
Significance of Consequence	A low significance is expected.					
Confidence Level	Provided all personnel are trained in the procedure of chance finds the destruction of anything important could be prevented.					
Monitoring	Clearance from the heritage council is on file. Include any chance findings in the bi-annual report.					

Table 11. Waste Management Programme

Impact Event	**Waste Production**					
Description	Waste is generated during the construction, operational and decommissioning phases of the mine's life. Waste can be classified into mineralised and non-mineralised waste. Non-mineralised waste can be classified as non-hazardous and hazardous waste. Medical waste is an additional category. 1. **Non-Hazardous non-Mineralised includes:** Metal cut offs, rubber, wood, product packaging, organic materials, glass, plastics, food scraps, cardboard/paper, used PPE, etc. 2. **Hazardous non-mineralised:** Printer cartridges, sewerage, batteries, hydrocarbons (oils, grease), fluorescent, etc. 3. **Medical waste:** Syringes, material with blood stains, bandages, etc. 4. **Mineral waste includes:** waste rock, tailings from mineral processing, rejects from beneficiation or concentration of other minerals, refinery or processing discards and sludges, smelter and other furnace slags, ashes, etc. (not all apply to this site but provided as examples)					
Nature	Negative					
Phases	Phases during which waste will be produced are highlighted below; Significance assessment was carried out on the operational phase which presents a long-term risk. Receptors potentially affected by waste are listed.					
Construction Phase	**Operational Phase**		**Decommissioning Phase**		**Post Closure**	
Company personnel health	Company personnel health		Company personnel health		General public health	
General public health	General public health		General public health		Groundwater	
Groundwater	Groundwater		Groundwater		Biodiversity	
Biodiversity	Biodiversity		Biodiversity		Soil	
Soil	Soil		Soil		Atmosphere - dust and other volatiles emitted from waste are covered under air quality impacts but there is some overlap with waste management risks	
Atmosphere	Atmosphere		Atmosphere			
Severity	Moderate / measurable deterioration (discomfort). Recommended level will occasionally be violated. Widespread complaints. Noticeable loss of resources.					
Duration	Reversible over time. Life of the project. Medium term					
Spatial Scale	Fairly widespread – Beyond the site boundary. Localised at best.					
Probability	Definite / continuous					
Mitigation	**Severity**	**Duration**	**Spatial Scale**	**Consequence**	**Probability of Occurrence**	**Significance**
Unmitigated	**M**	**M**	**M**	**M**	**H**	**M**
Significance of Consequence	The mining activities will generate waste. Preventative and Mitigating mechanisms are imperative.					
Prevention	Some waste products of categories 1-3 that can potentially impact the listed receptors can be managed to prevent impacts. Actions and company commitments that can prevent the impacts include the following: ➢ A waste management procedure should cover recycling, re-use, storage, handling, transportation, and disposal ➢ Collection and disposal of waste must be effective enough to not impact any of the receptors ➢ If waste must be stored and separated on site then the activities must take place on sealed surfaces, within bunds and fenced areas, and made ready for transport off-site by packaging the waste in sealed containers					

Mitigation Action	Where waste product impacts on the receptors cannot be prevented the preventative measures above should still be employed to mitigate or reduce the impacts. Mitigations for the various receptors include the following: ➢ Personal protection equipment (PPE) can protect personnel from exposure to disease or toxic chemicals ➢ Awareness training for company personnel and the general public will inform them of those wastes that may cause harm, pollute the soil, groundwater or air (if particulate) ➢ Some wastes are dangerous to fauna and flora; Animals should not be able to access the waste management area; waste must be contained so that it cannot enter the naturally vegetated areas beyond the accessory works area. ➢ Containerisation of highly volatile wastes should be actioned to reduce emissions but not so effectively that creates explosive risks if pressures build up. The latter may occur if the containers are stored outside in the heat of the sun. A waste management programme as outlined in the EMP should keep records in the form of an inventory of waste products collected, sorted, stored, recycled, reused or disposed. Certificates for disposal of hazardous waste should be filed. The mineral waste (category 4 above) will most likely only be waste rock and process tailings that cannot be processed for product. This waste rock will be dumped or stockpiled on site or alongside the new processing plant and could be used in the rehabilitation during decommissioning phase. The health risks associated with the process tailings is discussed under the health impacts above. Sewerage created at the camp or management offices either needs to be deposited directly into approved and permitted French drains or removed offsite. If the latter is to be done then sealed sewerage tanks are required. The regulations under the Water Resource Management Act need to be consulted with regards to the erection of French drains near water courses. They cannot to be constructed within 100m of the banks of a water course. Storage of hazardous liquid waste must by law follow industry standards. These standards will be communicated in fuller details by the fuel supplier. Ideally, self bunded containers should be brought to site and placed upon sealed surfaces with waste collection sumps. Fuel collection should be carried out upon the same sealed surface with slopes for runoff into the sumps. At the mining claim itself a similar bunded surface must be constructed where fuel from a bowser can be transferred to the mobile plant. An oil water separator and wash bay could be constructed in conjunction with fuel dispensing to reduce costs and the concretised footprint. Regardless of this the oil water separator is a requirement to ensure hydrocarbons do not enter the environment indiscriminately. The mobile plant workshop also needs to be constructed on a sealed surface and have liquid waste sumps so that spills can be collected and removed from site on a regular basis. A sealed waste oil contain should be constructed at the vehicle workshop. Regular removal of oil to recyclers is advised. All hazardous liquid waste should be stored on sealed surfaces.
Rehabilitation	If the mitigation hierarchy is followed, rehabilitation may or may not be required. Should an accident occur during the process of collection, storage or disposal of waste and no mitigation be actioned then one of the receptors may be impacted. Consequently, the following examples of rehabilitation may be required: ➢ A person who is exposed to disease (bacteria from organic waste) or toxic waste (mineral or non-mineral), which results in harm, will need medical attention ➢ Soil which is contaminated by used hydrocarbons needs to be relocated to a remediation cell where the material after treatment, i.e. the addition of fertiliser, air and water will within a year be suitable for re-use. ➢ In the event of groundwater contamination by chemicals or hydrocarbons, the sinking of a borehole or the excavation of a pit in the vicinity of the contaminate source will allow the pumping of the groundwater into a holding dam. Through the continued pumping a cone of depression will draw the contaminated water towards the pump. The collected contaminated water can be discarded at a registered hazardous waste site or if separable the contaminant can be removed from the water before disposal. The reclaimed water could be pumped back in the pit or borehole.

Mitigation	Severity	Duration	Spatial Scale	Consequence	Probability of Occurrence	Significance

Mitigated	**L**	**M**	**L**	**L**	**L**	**L**
Significance of Consequence		If the mitigation hierarchy is followed through to rehabilitation, then the resultant consequence could be insignificant.				
Confidence Level		A well designed and well implemented waste management programme will provide the necessary confidence that the risks to receptors will be of low significance.				
Monitoring		**Planning:** ➢ Waste Management Plan on file. ➢ Accessory works application submitted and receipt kept on file. ➢ Accessory works plan on file. ➢ Application for effluent discharge submitted to competent authority and receipt on file. ➢ Maintenance plan on file. **Construction:** ➢ Monitor compliance and file report. ➢ Hazardous waste certificate from hazardous waste dump on file. **Operations:** **Monitoring:** ➢ **Regular** inspection of waste collection and disposal areas. ➢ Check and file waste disposal slips. ➢ Compile all monitoring information in an **annual** report and audit this report against the waste management plan. ➢ Emergency Response Plan on file. ➢ Hazardous waste disposal certificate on file. ➢ Monitor maintenance workshop and wash bays for compliance and file reports. **Performance Indicators:** ➢ Availability of plan ➢ Extent to which plan is complied with ➢ Presence of litter within the area and surrounding land ➢ Availability of rubbish bins and skips ➢ Total volume of general and hazardous waste storage capacity ➢ Total volume of general and hazardous waste stored on site ➢ Degree to which different waste is separated ➢ Frequency of waste collection **Decommissioning:** Monitor compliancy and report on file.				

Table 12. Ecological Management Programme

Impact Event	Mining activities may affect biodiversity of fauna and flora directly or through habitat alteration.
Description	Through mining in general there is potential for impacting the diversity of species within the various habitats by reducing population numbers of certain species. Pressures on the population numbers can potentially lead to a reduction of a population within an area causing the species to no longer exist within that area. Should a species be endemic to that same area then the risk of extinction is high. Habitats can be severely altered potentially changing the type of habitat or leading to the removal of micro habitats. Specialist fauna and flora studies were commissioned for the mining claim, accessory works area and the activities therein. Site visits, species lists for the area and reference to other studies carried out nearby and elsewhere reveal that the habitats, fauna and flora present in the area are not endemic to claim and accessory works area specifically but are either common or potentially rare throughout the Kunene Region. Refer to the chapter on the fauna and flora above and to the specialist study reports in the Appendices. Three habitat types were identified in the vegetation and vertebrate studies for this project and were integrated in one combined floral and faunal classification: Mopane scrub, rocky outcrops and river/drainages. The habitats were rated as to their sensitivity, with the caveat that all habitats are sensitive to disturbance and deserving of conservation measures. A sensitivity rating was assigned based on properties of the habitat itself, including: ➢ nationally or regionally scarce habitats ➢ size of habitat, in the context of the total availability of comparable habitats in Namibia and/or the region. ➢ exceptionally high diversity and/or abundance of species ➢ high level of endemism ➢ support to species of conservation concern ➢ key ecological processes ➢ contribution to ecological functions (nutrient and energy flows) ➢ provision of critical resources ➢ restorability after disturbance Human habitation, grazing and mining activities have resulted in modified areas, some of them get severely degraded such as the rocky ridge south of ML40 and the quarry/mine sites. The village Oroutumba, located in Mopane scrub habitat adjacent to the Ondoto River, also constitutes an anthropologically modified area. The assessment considered all project activities and how these could potentially impact the various habitats. **Fauna:** A key habitat in the larger woodland mosaic is the rocky outcrops habitat. The physical diversity of the hills and rocky ridges leads to a higher and more specialised biodiversity than the surrounding Mopane woodland, and it supports many species that would otherwise not be present. Seeing as mineral-bearing ore is located almost exclusively in the rocky ridges, restoration of this habitat after mining operations will not be possible to any meaningful extent. Riverine habitat has a high ecological value for all taxa, it plays a keystone role in nutrient transport, and serves as important source areas for recolonisation after operations cease. In this project footprint, the Ondoto River is considered very sensitive and apart from the proposed linear infrastructure, no development should take place there. In addition, the natural flow patterns in washes and drainages should be maintained, particularly important when designing and constructing a road network and any other linear development. Destruction of organisms and habitats and alteration of topography both have high unmitigated significance, but potentially decrease to medium significance through the application of management measures if those are carried out effectively. The cumulative nature of mining activities in the Kunene Region and in the Kaokoveld Centre of Endemism, the irreversible damage to the rocky outcrops (as the most sensitive, ecologically valuable

habitat) and the persistence of the excavations after the lifespan of the mine, are three factors that decrease the likelihood of these impacts being mitigated to low significance. However, the strict implementation of mitigation measures and restoration plan can improve the situation significantly for other habitats and aspects such as the accessory works, linear infrastructure and any staff accommodation areas.

A. **Potential destruction of habitats and organisms** could take place during construction and operations, construction and use of roads by vehicles and machinery, clearing of land, building of infrastructure, within laydown areas, around water tanks, at accommodation, around human activities, during blasting and earthmoving, around vehicle movements, and the operation of machinery. A ccumulative impact of mining in the Kunene Region, especially on ecologically valuable rocky ridges and outcrops as follows:
   - Death of animals that are struck by earthmoving equipment, vehicles and machinery. Protected and at-risk species such as bat-eared fox, Cape fox, aardwolf and brown hyena are vulnerable to roadkill.
   - Death of animals due to poaching.
   - Raptors, bustards and migrating birds are vulnerable to power line impacts such as collision and electrocution.
   - Bird nests, nesting habitats and feeding habitats are destroyed, affecting the viability of bird populations.
   - Mammal and reptile burrows, burrow habitats and feeding habitats are destroyed, affecting the viability of the populations of these taxa.
   - Parts of territories and home ranges are destroyed.
   - Loss of plants and decline in habitat quality.
   - Dust causes a decline in air quality and creates conditions for health decline in plants and animals.
   - Noise disturbs animals and causes increase in stress.

B. **Potential disturbance of animals and interference with their behaviour** during operations, when infrastructure and roads form obstacles to the directional movement of animals, when an increase in human and vehicle presence and movement results from mining activities, as a result of loud noises caused by blasting and the operation of heavy machinery. The potential impact could be as follows:
   - Larger mammals and birds are the taxa most likely to be affected.
   - The loss of migration corridors causes stress and an increased risk of death to various taxa.
   - Birds and eggs could be poached.
   - Animals, particularly birds, are disturbed while going about their daily activities, such as feeding, roosting and breeding.
   - Dust creates conditions for health decline in plants and animals, and an increase in stress for animals.
   - Noise disturbs the normal behaviour of animals, specifically mammals.

C. **Potential light pollution as result of light sources** that are visible outdoors in the accessory works area and in the mining area. This can impact in the following ways:
   - Invertebrates that are attracted to the light provide an unnatural food source for taxa such as bats, geckos, nightjars and frogs. These insectivores are attracted to the food and then face conditions where they are more likely to die from causes such as collisions and predation.
   - Invertebrates could die every night from exhaustion or predation, potentially disrupting their population numbers and causing disturbances in ecological processes.

D. **Alteration of topography** during construction and operational phases can occur because of excavation of the ore bodies leaving a deep, open pit or several smaller quarries on the mountain. The processing plant and waste stockpiles will create large heaps of material on the surface of the landscape. This cumulative (for mining in the Kunene Region) impact acts on the level of ecosystems and could result in the following:
   - Irreversible alteration of the ecologically valuable rocky outcrops.
   - This impact may affect ecosystem functioning.
   - Direct destruction of habitat and organisms (see A above).
   - Fragmentation of habitat, leading to the loss of migration corridors for various taxa, in turn resulting in the loss of individual organisms and potentially populations.

E. **Groundwater drawdown** - Abstraction of water from the Ondoto River and Kunene for drilling, mining, ore processing and human consumption:

	➢ River vegetation is dependent on groundwater to some extent. Of particular concern are woody species in the Ondoto River, e.g. *Acacia erioloba, Faidherbia albida and Ficus spp.* ➢ Deterioration of the river habitat has negative impact on biodiversity outside the boundaries of the project site, specifically the Kunene River. F. **Contamination of soil and water** - Chemicals used in the processing of ore, e.g. radioactive thorium, escape containment and contaminate the soil, surface and groundwater ➢ Chemicals leach into soil, causing contamination of soil and eventually groundwater. ➢ Effects of chemicals are cumulative and build up in groundwater over time. ➢ Once in the groundwater, there is the potential for contamination to spread beyond site boundaries. The Kunene River is an internationally important ecological feature that could potentially be directly affected. ➢ Birds, mammals and reptiles are attracted by an unnatural source of water (open water body) and either drown or ingest contaminated water. G. **Impacts associated with accommodation of staff** – During construction, operational and closure phases, vehicles can cause death of organisms, staff could be involved in poaching and plant collection, cooking and lighting practices cause fires, water use in an arid zone with few resources, poor sewerage practices and from cooking and cleaning cause oil spillage. ➢ Direct destruction of organisms and habitat. ➢ Oil spills and sewerage contaminate soil and water. ➢ Fires destroy habitats and cause death of animals. **Flora:** The habitats and flora are either common throughout the Kaokoland and if restricted in distribution or to micro habitats, they do occur outside the planned mining areas. Riverine and drainage habitats present a high ecological value for most taxa and are considered very sensitive. Blocking of surface and/or groundwater flow will result in loss of perennial plant species and a reduction in the resources, such as food, shelter and soil stabilisation for burrows that they represent to other trophic groups. The rocky outcrops present both abundance and richness of plants that are much higher than those of the surrounding scrubland, contributing to the ecological value of this habitat. The location of the study area in the foothills of the Zebra Mountains and in the Kaokoveld centre of endemism, a biogeographical region rich in range-restricted plants and animals, further increases the sensitivity of the rocky ridges. Sodalite and the rare earth minerals are located in this habitat; it is where mining will be done and where most of the irreversible impacts (drilling, blasting and open cast mining) will take place. The largest part of ML40 consists of open Mopane scrubland. The topography is gently undulating, bisected by drainages and ridges topped with rocky outcrops. In the east and southeast of the study area the profile is flatter than in the west and northwest, where there are more and steeper rocky ridges. This habitat has been modified by human activities such as harvesting and livestock grazing. Both these activities are current and ongoing, and the village Oroutumba is in a degraded area in Mopane scrub abutting the Ondoto River. Pipelines, powerlines, roads, and the accessory work area will all be in this habitat. Species are potentially of conservation concern when they are endemic or near endemic to Namibia, have a threatened Namibian or IUCN status, or are legally protected in Namibia. Three recently described species, *Maerua sebrabergensis*, *Erythrococca kaokoensis* and *Ocimum sebrabergensis* are known only from a few specimens collected in the Zebra Mountains but they are likely to be found on the ridges and rocky outcrops in ML40 as well. The fact that they were found and described as recently as 2015 and 2019 illustrates both the importance of the Kaokoveld Centre of endemism and how under-collected it is in terms of herbarium specimens. This is largely a result of the remoteness and inaccessibility of much of the region and of the Zebra Mountains specifically. The following potential aspects were assessed: A. Mining activities may affect the ecology of the flora directly through **habitat alteration or destruction** within the planned mining claim and accessory works area: ➢ Cumulative impact: mining in Kunene Region, especially on ecologically valuable

	rocky ridges and outcrops. ➢ Loss of plants and decline in habitat quality. ➢ Dust causes a decline in air quality and creates conditions for health decline in plants and animals. B. **Alteration of topography –** the sources of the impact during the construction and operational phases are from excavation of the orebodies that leave deep open pits caused by drilling, blasting and open cast mining and the use of equipment such as excavators, compressor driven drill rigs and cutting machines. The processing plant and mineral waste is deposited on the cleared ground. ➢ This is a cumulative impact of mining in the Kunene Region. ➢ Irreversible alteration of the ecologically valuable rocky ridges. ➢ This impact may affect ecosystems. ➢ Direct destruction of plants and habitat. ➢ Fragmentation of habitat, leading to the disruption or loss of colonisation pathways for seed dispersal, in turn resulting in the loss of individual organisms and potentially populations. **C. Groundwater drawdown** - Abstraction of water from the Ondoto River for drilling, mining, ore processing and human consumption. ➢ River vegetation is dependent on groundwater to some extent. Of particular concern are woody species in the Ondoto River and drainages, e.g. *Acacia erioloba, Faidherbia albida and Ficus spp.* ➢ Deterioration of the drainage and river habitat has negative impact on biodiversity outside the boundaries of the project site, specifically the Kunene River D. **Contamination of soil and water -** Chemicals used in the processing of ore, e.g. radioactive thorium, escape containment and contaminate the soil, surface and groundwater. ➢ Chemicals leach into soil, causing contamination of soil and eventually groundwater. ➢ Effects of chemicals are cumulative and build up in groundwater over time. ➢ Once in the groundwater, there is the potential for contamination to spread beyond site boundaries. The Kunene River is an internationally important ecological feature that could potentially be directly affected.
Nature	Negative
Phases	Phases during which mining activities may impact the ecology and biodiversity through habitat alteration or destruction are highlighted below; The significance assessment was carried out on both the construction and operational phases.

Construction Phase	**Operational Phase**	**Decommissioning Phase**	**Post Closure**
Flora	Flora	Flora	Flora
Fauna	Fauna	Fauna	Fauna
Habitat	Habitat	Habitat	Habitat
Species diversity	Species diversity	Species diversity	Species diversity

Severity	Moderate / measurable deterioration. Noticeable loss of resources.
Duration	Permanent, beyond closure, long term.
Spatial Scale	Localised - Within the site boundary for flora but beyond the site boundary for fauna
Probability	Possible/frequent

Unmitigated	**Severity**	**Duration**	**Spatial Scale**	**Consequence**	**Probability of Occurrence**	**Significance**
Fauna - A. Potential destruction of habitats and organisms						
Fauna A.	**M**	**H**	**M**	**H**	**M**	**H**
Fauna – B. Potential disturbance of animals and interference with their behaviour						
Fauna B.	**M**	**M**	**L**	**M**	**H**	**M**
Fauna – C. Potential light pollution as result of light sources						
Fauna C.	**M**	**M**	**L**	**M**	**H**	**M**

Fauna - D. Alteration of topography						
Fauna D.	**M**	**H**	**M**	**H**	**H**	**H**
Fauna - E. Groundwater drawdown						
Fauna E.	**M**	**M**	**M**	**M**	**M**	**M**
Fauna - F. Contamination of soil and water						
Fauna F.	**M**	**H**	**M**	**H**	**M**	**M**
Fauna - G. Impacts associated with the accommodation of staff						
Fauna G.	**M**	**M**	**M**	**M**	**M**	**M**
Flora – A. Destruction of plant and habitats						
Flora A.	**H**	**H**	**L**	**H**	**H**	**H**
Flora – B. Alteration of Topography						
Flora B.	**M**	**H**	**M**	**H**	**H**	**H**
Flora – C. Groundwater Drawdown						
Flora C.	**M**	**M**	**M**	**M**	**M**	**M**
Flora – D. Contamination of soil and water						
Flora D.	**M**	**H**	**M**	**H**	**M**	**M**
Significance of Consequence	The mining activities will alter the habitats that previously existed. Soil and flora will be removed. Some fauna will relocate and compete for resources in adjacent habitats, but many will be destroyed and/or affected negatively. Dust and lighting will also impact ecosystem. Mitigating & rehabilitation mechanisms are imperative.					
Prevention	Not possible as at least many specimens of the most common flora taxa found in the district will be removed during construction activities and quarry creation.					
Mitigation Action	*Suggested by fauna specialist:* A. **Destruction of organisms and their habitats:** ➢ Keep the overall development footprint as small as possible. ➢ The extent and location of the construction site should be fenced and all construction activities should take place within the fence. Adherence should be strictly enforced. ➢ The location of roads, pipelines and power lines must be planned to minimise fragmentation or disturbance of habitats. ➢ Anti-erosion measures must be taken where roads and tracks cross a wash or drainage. ➢ Carefully plan the placement of stockpiling construction material so as to avoid sensitive areas. ➢ Limit construction activities to daytime hours to reduce noise. ➢ Educate construction and permanent staff as to their environmental obligations. All contractors should be held responsible for transgressions and significant penalties should be levied in order to ensure compliance. ➢ Position temporary construction infrastructure (e.g. accommodation) in areas that will definitely be disturbed during operations. ➢ Erect linear structures (power lines, water pipelines) as close as possible to existing roads and tracks. Maintenance roads/tracks for linear structures should be built as close as possible to the structure and access should be limited to essential maintenance. ➢ Do not put water tanks, power pylons or any other large infrastructure in the river or washes. ➢ No sewerage overflow or French drain may be placed within 100 m of a wash or river. ➢ A vertebrate specialist should identify nests, dens and other breeding locations and demarcate them before construction so that these sites can be avoided as part of the EMP.					

	➢ Reptiles and amphibians that are exposed during ground clearing should be captured for translocation by a qualified expert. ➢ No collection of plants should be allowed. No fires should be allowed. ➢ A comprehensive restoration plan should be drawn up by an expert BEFORE construction commences, at least at conceptual level, and should make provision for monitoring and adaptive management as the project develops. Some rehabilitation actions should be implemented during operations in order to be effective, e.g. removal and location of topsoil; location of waste rock dumps to ensure efficient restoration later; road and pipeline locations. B. **Disturbance of animals and interference with their behaviour**: ➢ The extent of the operation should be clearly demarcated on site layout plans and fenced in. The nature of a fence would be informative rather than restrictive – it is to make the boundaries of the area of operations clear to staff, visitors and contractors, and to effectively control access to undeveloped areas. ➢ Areas surrounding the mine and accessory works that are not part of the demarcated development should be considered a no-development zone. ➢ No employees, visitors or machinery should be allowed in such a zone. ➢ No off-road driving should be allowed. ➢ Limit activities to day-time hours so as to reduce noise. ➢ Only controlled and contained fires should be allowed for cooking and heating purposes. Only wood collected during the clearing of areas during the construction phase should be used for firewood. ➢ The significance of this impact is somewhat decreased by the fact that human presence and human-caused disturbance in the region is already interfering with the presence and movement of many taxa, particularly large mammals. ➢ Staff and contractors should be trained in sensitive human-wildlife interaction. C. **Light Pollution**: Not much is known about the effect of light on populations and ecosystems and the precautionary principle is applied here. ➢ Install motion detectors to limit light use to the minimum possible. ➢ Outdoor lights should be directed downwards and not up into the sky. ➢ Use yellow or amber outdoor lights because invertebrates don't detect yellow light as well as white. ➢ Install insect screens in doors and windows located in buildings that are used at night. D. **Alteration of Topography**: ➢ It may not be possible to rehabilitate the site significantly, but a comprehensive restoration plan would mitigate impacts to some extent. ➢ A comprehensive restoration plan with financial mechanisms for implementation should be drawn up by an expert during the construction phase. It is possible that some mitigation measures and rehabilitation actions should be implemented during operations in order to be effective; therefore, a restoration plan should be in place at the start of operations. ➢ Implement the restoration programme as soon as possible after the impact has ceased. **E. Groundwater drawdown:** ➢ Monitor groundwater levels. ➢ Monitor plant and vertebrate diversity downriver from the abstraction site at a minimum of once a year. F. **Contamination of Soil and Water**: ➢ Containment measures should be strictly enforced to the highest existing standards. Open water structures should be sealed and provide no opportunity for either leakage or entry by animals. ➢ Constant monitoring of open bodies of water and their associated pipes, lining and covers is essential to ens.ure that there is no malfunction, tear or opening. ➢ Treatment of the final discharge of water should be in such a way as to eliminate any possibility of active chemicals entering the soil or groundwater. **G. Impacts linked to accommodation of staff** ➢ All inhabitants and visitors in the staff compound should receive environmental awareness training, including training on indiscriminate defecation. ➢ The staff compound should be fenced in and the only access allowed outside the fence is on the entrance road. ➢ All cleaning and washing should take place inside a designated area (e.g. kitchen,

	laundry) and fat traps should be installed at the drain outlet from these areas. ➢ No collection of plants or plant material should be allowed. ➢ No open fires or flames should be allowed in the staff compound. ➢ Gas cooking facilities should be provided. ➢ Lights should be solar, or generator powered - no candles or paraffin lamps. ➢ Firefighting equipment should be placed in the compound. Equipment should always be tested regularly and be in working condition. All inhabitants of the compound should be trained in the use of this equipment and know where it is. ➢ Water saving measures should be put in place, e.g. low-pressure shower heads and taps; daily checks of pipes and tanks; immediate repair of leaks. ➢ Sewerage should be of sufficient capacity for the number of people, and should be a sealed breakdown system. ➢ No sewerage overflow structure or French drain may be placed within 100 m of a wash, drainage line or river. *Suggested by flora specialist:* A. **Habitat alteration and destruction** - The spatial extent of the infrastructure should be planned to keep it as small as possible. Then when clearing areas, where possible, do not fell the larger and older trees as they act as seed (genetic stock) sources. By changing the location of the new processing plant and WRD and area of lower diversity will be impacted. However, it is not possible to reduce the impact of the quarries on the rocky habitat that harbours several protected tree species. It is recommended that a the NBRI be supported in doing a comprehensive survey of the area during the MEFT EIA review period. Roads, pipelines and power lines must be planned in order to minimise fragmentation or disturbance of habitats The following most important mitigations should be implemented: ➢ Do not put water tanks, power pylons or any other large infrastructure in the river or washes. ➢ Position temporary construction infrastructure (e.g. accommodation) in areas that will definitely be disturbed during operations. ➢ Erect linear structures (power lines, water pipelines) as close as possible to existing roads and tracks. ➢ Carefully plan the placement of stockpiling construction material so as to avoid sensitive areas. Awareness training for management & other personnel must focus on: ➢ Training of all personnel to limit the habitat alteration during the construction and operational phases of the mine ➢ Teach knowledge and understanding of the flora and its ecology The following basic rules must be adhered too: ➢ No littering ➢ Driving only on existing roads (roads created by the mine inside the mining areas. ➢ Firewood should come from trees that were felled within the cleared areas and no additional clearing for firewood should occur. A restoration plan should be drawn up by an expert BEFORE operations commences, at least at conceptual level before construction starts, and should make provision for monitoring and adaptive management as the project develops. Some rehabilitation actions should be implemented during operations to be effective, e.g. removal and location of topsoil; location of waste rock dumps to ensure efficient restoration later; road and pipeline locations. **B. Alteration of Topography** ➢ It may not be possible to rehabilitate the mining sites significantly, but a comprehensive restoration plan would mitigate impacts to some extent. ➢ A restoration plan should be drawn up by an expert BEFORE operation commences. ➢ Implement the restoration programme as soon as possible after the impact has ceased. **C. Groundwater drawdown** ➢ Conduct a specialist hydrogeological study for the project. ➢ Monitor groundwater levels. ➢ Monitoring of the plant and vertebrate diversity downriver from the abstraction site is recommended and at a frequency that is warranted. ➢ Ensure sustainable water supply to the project based on the findings of the hydrogeological study. **D. Contamination of soil and water**

	➢ Conduct specialist work on element mobilisation from the different types of ore and waste rocks. ➢ Containment measures should be strictly enforced to the highest existing standards in the mining industry. ➢ Constant monitoring of open bodies of water and their associated pipes, lining and covers is essential to ensure that there is no malfunction, tear or opening. ➢ Treatment of the final discharge of water should be in such a way as to eliminate any possibility of active chemicals entering the soil or groundwater.
Rehabilitation	Rehabilitation at mine closure should be applied to the accessory works areas as defined in the project description in this flora assessment. The waste rock dump should be constructed in such a way that fits in with the surrounding physical features and so that water infiltration is maximised, and erosion minimised. These latter points will allow for natural regrowth of the vegetation on the waste rock dump. The following aspects should be considered when finalising the mine closure plan: ➢ The infrastructure removal and landscaping of the accessory works area to match as far as possible the baseline conditions. ➢ Funds for rehabilitation should be set aside from the start of the operational phase. A mechanism for securing these funds should be in place during the construction phase. ➢ Reasonable and acceptable ways of rehabilitation should be implemented on an ongoing basis as well as at the time of site closure. ➢ Where the ground has been affected by spillages such hydrocarbons, these soils should be stockpiled and appropriately treated to regulate the contamination levels prior to being used for rehabilitation purposes.

Mitigated	**Severity**	**Duration**	**Spatial Scale**	**Consequence**	**Probability of Occurrence**	**Significance**
Fauna A.	**M**	**M**	**L**	**M**	**M**	**M**
Fauna B.	**L**	**L**	**L**	**L**	**L**	**L**
Fauna C.	**L**	**M**	**L**	**L**	**M**	**L**
Fauna D.	**M**	**M**	**L**	**M**	**M**	**M**
Fauna E.	**L**	**M**	**M**	**L**	**L**	**L**
Fauna F.	**L**	**L**	**L**	**L**	**L**	**L**
Fauna G.	**L**	**L**	**L**	**L**	**L**	**L**
Flora A.	**M**	**M**	**L**	**M**	**M**	**M**
Flora B.	**M**	**M**	**L**	**M**	**M**	**M**
Flora C.	**L**	**M**	**M**	**L**	**L**	**L**
Flora D.	**L**	**L**	**L**	**L**	**L**	**L**

Significance of Consequence	If the mitigation hierarchy is followed through to rehabilitation then the resultant consequence could be insignificant overall.
Confidence Level	A well designed and well implemented rehabilitation programme will provide the necessary confidence that the altered habitats could be rehabilitated at mine closure to a degree that the final footprint of the mine will be acceptable. Provided the waste rock dump is covered with the stockpiled topsoil at mine closure, natural revegetation of this area could occur in the long term.
Monitoring	**Planning:** ➢ List of plant species expected to occur within the area is on file. ➢ Bush clearing permit must be applied for prior to clearing of any areas. ➢ Environmental Clearance Certificate is on file ➢ Schedule for developing EMS documentation is on file. ➢ Visual baseline imagery to indicate which plant species preferred which habitats. ➢ Train personnel regarding the impact on the surrounding habitats. ➢ Plan mine layout to reduce the footprint size and thereby conserve more biodiversity **Construction & Operation:**

	➢ Monitor compliance and file report. ➢ Mine closure plan to be developed and put on file. ➢ Rehabilitation of cleared areas to be planned and put on file. (use baseline imagery for planning) **Decommissioning:** ➢ Monitor compliance and file report. Compare final revegetation layout with visual baseline imagery

Table 13. Water Resource Management Programme: a. sustainable water use

Impact Event	**Mining activities may affect water resources through over utilisation**					
Description	Water demand for mining, processing and domestic use is estimated as 100,000 m³/year. During the construction phase and first year of operation, water will be sourced from the Ondoto River hand dug well, close to Mining License 40 boundary. The sustainable yield of the Ondoto River is low mainly due to irregular river flow and recharge. The mine area is underlain by anorthosite that generally has poor groundwater potential.					
Nature	Negative					
Phases	Phases during which mining activities may impact the water resources are highlighted below.					
Construction Phase	**Operational Phase**	**Decommissioning Phase**	**Post Closure**			
Alluvial hand dug well of the Ondoto River	Hand dug well of the Ondoto River & the pipeline from the Kunene River	Hand dug well of the Ondoto River & the pipeline from the Kunene River	With ceasing of abstraction, water level in the aquifer will be restored with time.			
Groundwater (via borehole abstraction)	Groundwater (via borehole abstraction)	Groundwater (via borehole abstraction)				
Severity	Recommended water level could often be violated. Interruption of supply to mine and community.					
Duration	Reversible over time.					
Spatial Scale	Fairly widespread, at the mine site and neighbouring Oroutumba village.					
Probability	Definite / continuous					
Mitigation	**Severity**	**Duration**	**Spatial Scale**	**Consequence**	**Probability of Occurrence**	**Significance**
Unmitigated	**H**	**M**	**M**	**M**	**H**	**H**
Significance of Consequence	A high significance is expected if no mitigation measures are implemented.					
Prevention	Alternative water sources to be developed such as direct intake from the Kunene River or aquifer in the bank of the Kunene River are sustainable sources. Monitoring of groundwater level and water quality should serve as early warning of overexploitation of groundwater.					
Mitigation Action	Limit the use of the Ondoto River alluvium to initial stages of the project. If the Ondoto River alluvial aquifer shows signs of overexploitation (drop in groundwater level and increasing salinity), the use of the resource should be stopped, and alternative sources used. The community affected by the disruption of supply should be supplied from the alternative source till supply from the Ondoto River is restored. Develop the alternative source of water (Kunene River or Dwyka Aquifer) for long term use.					
Decommissioning & Rehabilitation	Upon decommissioning of the mine the water levels in the borehole of the Onodoto river will resume the levels that existed prior to use by the mine. The pipeline bringing water to the mine from the Kunene River borehole could be handed over to the community to maintain and future use so that a more sustainable source of water could supply the community.					
Mitigation	**Severity**	**Duration**	**Spatial Scale**	**Consequence**	**Probability of Occurrence**	**Significance**
Mitigated	**M**	**M**	**L**	**M**	**L**	**L**
Significance of Consequence	Provided the development of the alternative Kunene River borehole source goes ahead the impact would be low as the abstraction from the Ondoto River alluvial aquifer for mine process water could be stopped. The groundwater level will be restored with natural recharge over time.					
Confidence Level	The restoration of any impact of abstraction of groundwater is dependent on groundwater replenishment by river flow. Arid region river flow and recharge is episodic and not often predictable. Continuous monitoring will provide feedback on the restoration of conditions of the water resource.					

Monitoring	Monitor groundwater level, gauge river level, rainfall, and abstraction daily. Groundwater levels monitoring is recommended for the Ondoto River hand-dug well, and also for the proposed new boreholes. Water levels are to be measured continuously, preferably by using pressure transducers. Overall the water balance of the mine and associated operations is to be monitored particularly on the following main components: ➢ Water disposal in tailings ➢ Recovered water and decrease in recovered water volumes ➢ Intake of freshwater to the mine and plant form the water supply wellfield ➢ Increase or decrease of outflow to the evaporation dam Gauging of the Ondoto River is recommended at a selected reach where the river has a straight course and flows over bedrock. The purpose of such monitoring will be to record river flow and therefore the frequency of recharge of the groundwater resource in the alluvium in case this source is tapped for mine supply. Declining water levels can be related to abstraction or lack of recharge. Monitoring is to be carried out using a pressure transducer housed in an installed perforated borehole casing. The level of the pressure transducer, cross-section and slope of the reach can be surveyed, and flow rates estimated from the information. **Planning:** ➢ Water Management Plan on file ➢ Application for effluent discharge submitted to competent authority and receipt on file ➢ Water abstraction permit on file ➢ Keep water abstraction permit and effluent discharge permit on file **Construction & Operations:** ➢ Monitor compliance and file report ➢ All certificates for hazardous waste disposal filed. ➢ Checklists and schedule for auditing compliance to the EMP are filed. ➢ Reports are filed. ➢ Awareness training attendance lists signed and filed ➢ Monitor oil water separators, oil sumps, bunds and assess compliance and file reports. ➢ Monitor water use and report on file. **Decommissioning:** Monitor rehabilitation and report on file.

Table 14 Water resource quality management: b. contamination

<table>
<tr><th>Impact Event</th><th colspan="6">Mining activities may affect water resources through contamination</th></tr>
<tr><td>Description</td><td colspan="6">The containment effluents and runoff from the tailings and waste rock dumps, particularly in the rainy season is of concern. Water diversion structures and a containment dam for the run-off and seepage need to be constructed with design capacity of the diversion and containment dam adequate for handling large rainfall events as experienced in this area. Potential impacts are as follows:
➢ Leaching of contaminants and erosion of material from the TSF and waste rock dumps into surface water channels by discarded process water and rain events are of high intensity. The leachate from the TSF and mine waste is however likely to be alkaline thus limiting the mobility of metals.
➢ Erosion of material and mobilisation of precipitates and fines is possible.
➢ Wastewater disposal reaching natural drainage</td></tr>
<tr><td>Nature</td><td colspan="6">Negative</td></tr>
<tr><td>Phases</td><td colspan="6">Phases during which mining activities may impact the water resources are highlighted below.</td></tr>
<tr><td>Construction Phase</td><td colspan="2">Operational Phase</td><td colspan="2">Decommissioning Phase</td><td colspan="2">Post Closure</td></tr>
<tr><td>Hand dug well of the Ondoto River</td><td colspan="2">Hand dug well of the Ondoto River & the pipeline from the Kunene River</td><td colspan="2">Hand dug well of the Ondoto River & the pipeline from the Kunene River</td><td colspan="2" rowspan="2">The waste rock dump and TSF will remain exposed to risk of erosion and mobilisation into surface water channels. Wastewater disposal will cease.</td></tr>
<tr><td>Eroded material and fines reaching the alluvial aquifer during severe rainfall events.</td><td colspan="2">Eroded material and fines reaching the alluvial aquifer during severe rainfall events.</td><td colspan="2">Eroded material and fines reaching the alluvial aquifer during severe rainfall events.</td></tr>
<tr><td>Severity</td><td colspan="6">The mobilisation of material from the TSF and waste rock dump into natural water channels and eventually to the Ondoto River is possible. The area experiences high intensity rainfall following extended dry periods that can mobilise sediments and material.</td></tr>
<tr><td>Duration</td><td colspan="6">The duration of the impact will continue through the development, operational and after closure of the mine.</td></tr>
<tr><td>Spatial Scale</td><td colspan="6">Fairly widespread, in the mine site and neighbouring village.</td></tr>
<tr><td>Probability</td><td colspan="6">Possible / continuous</td></tr>
<tr><td>Mitigation</td><td>Severity</td><td>Duration</td><td>Spatial Scale</td><td>Consequence</td><td>Probability of Occurrence</td><td>Significance</td></tr>
<tr><td>Unmitigated</td><td>M</td><td>H</td><td>M</td><td>H</td><td>M</td><td>H</td></tr>
<tr><td>Significance of Consequence</td><td colspan="6">A high significance is expected if no mitigation measures are implemented.</td></tr>
<tr><td>Prevention</td><td colspan="6">Reclaim of process water and reuse to limit the amount of water used. Design, construction and maintenance of TSF and waste rock dumps to prevent erosion.</td></tr>
<tr><td>Mitigation Action</td><td colspan="6">Measures to mitigate contamination of the soils, surface water and groundwater are as follows:
➢ Construction of a containment dam downstream of the processing plant, TSF, waste rock dump and other stockpiles.
➢ Evaporation of contained water that is not reused.
➢ Maintain water balance as a check on any significant water leakage from the operation.
➢ Regular inspection of TSF and WRDs.
➢ During the operation of the mine, the sediment material accumulated in the containment dam should be moved to the tailings at regular intervals so that the maximum capacity of the dam is retained and the risk of mobilising the material downstream is reduced.

For the management and mitigation of possible impacts from the mining pits the following measures are recommended.
➢ The pits to a maximum depth of 40 m bgl will be above the groundwater level and no groundwater inflow is expected.
➢ Surface flow to the pits is possible and the pits should be protected against inflow of surface runoff</td></tr>
</table>

	water and discharge from the pits should be avoided. Therefore, the pits should be cordoned off with berms (1 m high) to avoid surface inflow to the pit					
Decommissioning & Rehabilitation	Upon closure of the mine, the surface of the TSF should be graded to avoid ponding and encourage surface runoff thus limiting infiltration. Placement of a low permeability seal on the TSF is the preferred measure to avoid infiltration and salt accumulation in accordance with best practice measures proposed by the British Columbia Acid Mine Drainage Task Force (1989). For establishing such top seal, a large quantity of clay rich material would be required which may not be available locally. Alternatively, other material of good compatibility or low permeability such as compacted calcrete can be used. On closure the pits should be cordoned off with berms to avoid and prevent access to the sites by animals and humans.					
Mitigation	**Severity**	**Duration**	**Spatial Scale**	**Consequence**	**Probability of Occurrence**	**Significance**
Mitigated	**M**	**L**	**L**	**M**	**L**	**L**
Significance of Consequence	The possibility of wastewater, leachate and eroded material reaching the natural river channels is significantly reduced by the construction of a containment dam. The overall risk of leaching of metals will be low due to the alkaline nature of the tailings.					
Confidence Level	Continuous monitoring and implementation of mitigation measures will significantly reduce the probability of waste material reaching the downstream natural drainage channels.					
Monitoring	Monitor field water quality parameters of downstream aquifer, seepage (TSF, waste dumps, containment dam); quarterly sampling and analyses The following recommendations are made for the water quality monitoring. ➢ Water quality monitoring will include the following well head parameters for all water points. Well head chemistry parameters would include pH, EC, temperature, and alkalinity. Monitoring will be carried out in-house at one-month intervals. ➢ The above parameters will be monitored also on the ponding on the storage /evaporation dam and outflow, if any, from the tailings and waste rock dumps. ➢ Quarterly sampling and analyses of water chemistry is to be done during the initial year of operation from the supply boreholes, storage / evaporation dam, the Ondoto hand-dug well and any water point established in the future downslope of the mine (north). The parameters will include major ions, minor and trace ions analysed during the project (Appendix B of the Water Study Report). ➢ Reassessment of sampling parameters and frequency of the sampling is recommended after 1 year of operation.					

Table 15. Traffic Management Programme

Impact Event		**Transporting bulk sodalite dimension stones and other mineral concentrates by trucks (PBS) along national roads**				
Description		The potential impacts of the haulage of bulk sodalite dimension stones and other minerals can be categorised in terms of public safety and capacity of the road to handle 67 tonne vehicles. For public safety the Proponent or contractor must abide by the rules and regulations that are enforced by the Roads Authority. The vehicles need to be routinely checked for road worthiness and the containment of the goods needs to be such that no harm may come to the public and other road users during the transit from the mine to the Port of Walvis Bay. No product may be strewn along the roadside as part of the normal transit. Covers over bulk transporters must be adequate at all times. Drivers must follow the rules of the road at all times. Additionally, the route provides for adequate visibility on hills and turns and that the road will be safe for two-way traffic at all times except where single traffic bridges exist. The capacity of the whole road should be such that the surface is not damaged beyond the normal wear as a result of the load and that the bridges to be crossed have the integrity to handle multiple crossings at the frequency expected. A route might need to be altered should a bridge not be sufficiently strong to handle the 67tonne laden vehicle. Additionally, the frequency of trucks per day is such that it does not exceed the threshold that was originally designed for the route. A maximum of 5 trucks per day are expected to travel along either of the possible routes. The preferred shorter route is less frequented by traffic but currently has long stretches of gravel road. The PBS option will mean slower travel and less impact on the road surface. Thus the gravel road sections are expected to be less dusty due to slower travelling speeds and will not be negatively impacted by the 67 tonne laden vehicles.			
Nature		Negative				
Phases		Significance assessment was carried out on the operational phase which represents the period the road, road users and the general public are exposed to the hazard.				
Construction Phase		**Operational Phase**		**Decommissioning Phase**		**Post Closure**
		Public safety – pedestrians and road users Road design – surface integrity and bridge strength Regulations – mass of vehicles when fully laden and permits				
Severity		Moderate / measurable deterioration. Noticeable loss of resources.				
Duration		Medium term. Life of Mine.				
Spatial Scale		Widespread – Far beyond site boundary. National				
Probability		Possible/ frequent				
Mitigation	**Severity**	**Duration**	**Spatial Scale**	**Consequence**	**Probability of Occurrence**	**Significance**
Unmitigated	**M**	**M**	**H**	**H**	**M**	**H**
Significance of Consequence		Mitigations to reduce risks to Public Safety are imperative.				
Prevention		The removal of all hazards will not be possible.				
Mitigation Action		As far as public safety is concerned it is not possible to prevent all incidents from occurring completely but the probability can be reduced if the following aspects are considered:- ➢ Draw up operational procedure manual				

	➢ Provide road safety awareness training ➢ Establish specific rules for driving including travelling speed and rest times. ➢ Devise and implement emergency response plans ➢ Close coordination with the traffic authorities to ensure road safety signs are strategically placed and ensure all employee drivers are well trained ➢ Provide easy access to Material Safety Data Sheets (MSDS) for drivers ➢ Provide first aid training ➢ Devise emergency medical procedures for all eventualities ➢ Undertake daily safety reminders and/or drills ➢ Establish regulations for handling fuel ➢ Establish and implement measures to exclude discharge of minerals particulates during travel As far as capacity is concerned the frequency and of trucks must be maintained at the stated daily rate and there should be at least 2 km travelling distance between trucks. Only one truck should travel over a bridge at any one time. Avoidance of travelling during peak times on busy sections of road should be practiced. The capacity of the road to handle the additional 11 trucks per day is within the road design.

Mitigation	**Severity**	**Duration**	**Spatial Scale**	**Consequence**	**Probability of Occurrence**	**Significance**
Mitigated	**M**	**M**	**H**	**M**	**L**	**M**

Significance of Consequence	If all the mitigations listed are implemented then the significance will be maintained at medium.
Confidence Level	The significance would be lower had the spatial extent not been over such a long stretch of road.
Monitoring	A complaints register should be opened and maintained. All necessary permits should be on file and maintained in accordance with the required renewal periods.

Table 16. Port Storage & Handling Programme

Impact Event	**Bulk storage and handling of product at Walvis Bay Port**					
Description	The management of the product at the Port of Walvis Bay involves various hazards that can have an impact on the Port functioning, on third parties and on the proponent. The potential impacts on human health and safety resulting from activities at the port could include occupational accidents and injuries, vehicle accidents, exposure to weather extremes, trips and fall on uneven terrain, adverse health effects from dust generation and emissions, and contact with hazardous materials. The site of storage itself needs to be safeguarded from any impacts of the product directly. Failure to store and handle the product safely at any point between the storage facility and the stowage on board the ship could have negative impacts on the other users of the port and areas they are responsible for. The proponent and contractors must follow a set of industry-specific safety and health policies at the Port. Typical operational procedures that pose risks to operational personnel are: ➢ Operating heavy machinery such as, front-end loaders, conveyors, forklifts, articulated trucks and trains during handling and transfer to ships ➢ Operating haulage trucks during offloading ➢ Prolonged proximity to and exposure to manganese particulates either inside a warehouse or around exposed stockpiles. The REE product contains a measure of radioactive thorium. **Table 6** above mentioned health impact of this aspect and those mitigations will apply. The carcinogenic nature of the product means that precautions must be made with regards to the concentration of the radioactive element, the period of exposure and the proximity to the product. Exposure could be through inhalation (if product particulates are exposed), oral, and dermal contact. The other products are not as dangerous but manifest normal risks such as dust inhalation.					
Nature	Negative					
Phases	The significance assessment was carried out on the operations at the port. No construction phase is expected.					
Construction Phase	**Operational Phase**		**Decommissioning Phase**		**Post Closure**	
	Receiving product from the mine in bulk or bulk bags Storage and containment of bulk bags or bulk product at the port Transfer of the product to the vessel				.	
Severity	Moderate / measurable deterioration. Noticeable loss of resources.					
Duration	Medium term. Life of Mine.					
Spatial Scale	Localised - Within the site boundary. Temporary storage at Walvis Bay Harbour					
Probability	Definite and continuous					
Mitigation	**Severity**	**Duration**	**Spatial Scale**	**Consequence**	**Probability of Occurrence**	**Significance**
Unmitigated	**M**	**M**	**L**	**M**	**M**	**M**
Significance of Consequence	Mitigations to reduce exposure to health and safety risks for personnel are imperative.					
Prevention	The removal of hazards or risks will possibly prevent accidents from occurring. However, it is not possible to remove all risks.					
Mitigation Action	It is not possible to prevent all incidents from occurring completely. An accident is an unplanned incident though it could have been foreseen if the necessary precautions had been					

	taken. Not all hazards can be removed but the risk it presents can be lowered. An integrated health and safety management system acts as a monitoring tool and mitigating tool to reduce the risks. Typical mitigating measures within the health and safety management systems are:- ➢ Draw up operational procedure manuals ➢ Provide health and safety awareness training ➢ Establish practical standard housekeeping rules ➢ Colour code certain areas, equipment and substances to thereby classifying the risks. ➢ Provide signage for personal protective equipment (e.g. protective clothing like safety boots and hard hats) ➢ Institute safe working procedures and require permits to work ➢ Devise and implement emergency response plans ➢ Close coordination with the traffic authorities to ensure road safety signs are strategically placed and ensure all employee drivers are well trained ➢ Provide easy access to Material Safety Data Sheets (MSDS) ➢ Provide first aid treatment and training ➢ Devise emergency medical procedures for all eventualities ➢ Undertake daily safety reminders and/or drills ➢ Establish regulations for handling the product ➢ Establish monitoring points for particulate contamination around the storage facility if dust emissions are reported. Procedures for dealing with injuries or accidents must be in place and all contact details for emergency personnel must be available. This list is not comprehensive and could be supplemented substantially by the Health & Safety Manager With respect radiation exposure the following mitigations and monitoring are either mandatory by law or recommended: ➢ Annual medical assessment ➢ PPE – dust masks are worn by all employees exposed to manganese dust. The type used is FFP3; ➢ Rules applicable to the Port Authority must be applied. ➢ Equipment for measuring radiation emissions need to be purchased and personnel trained to use them.

Mitigation	**Severity**	**Duration**	**Spatial Scale**	**Consequence**	**Probability of Occurrence**	**Significance**
Mitigated	**L**	**L**	**L**	**L**	**L**	**L**

Significance of Consequence	If all the mitigations listed are implemented, then the significance will be maintained at low.
Confidence Level	The EAP is quite confident that the mitigations will result in low significance. Continuous training and medical monitoring of personnel and the regionally (SADC region) recommended frequency is imperative. The regionally (SADC region) accepted levels of radiation exposure in employees must be monitored and maintained. The port authority will place the onus on the proponent to provide proof that the source of pollutants is not from the site of proponent.
Monitoring	Monitoring of dust for particulates may be necessary to ensure third parties are considered and an alarm can be raised should toxic minerals particulates be present. The port authority will place the onus on the Proponent to provide proof that the source of pollutants are not from the site of the Proponent.

Table 17. Mine Closure & Rehabilitation Management Programme

Impact Event		**Abandonment of the mining site potentially exposes public and wildlife to hazards**				
Description		When a mining area is abandoned the infrastructure and altered landscape can affect the safe access of wildlife and general public if not rehabilitated. The altered habitat may or may not promote the re-establishment of organisms once found there. Visual rehabilitation to the original state is not always practical due to economic factors.				
Nature		Negative				
Phases		Phases during which decommissioning, and mine closure may impact public safety, future ecosystem functioning for domestic livestock and wildlife, economic stability and social health, and asset security. The significance assessment is carried out for the post closure phase.				
Construction Phase		**Operational Phase**		**Decommissioning Phase**		**Post Closure**
Not applicable		Not applicable		Ecosystem functioning		Ecosystem functioning
				Public safety		Public safety
				Economic uncertainty		Social challenges of unemployment
				Asset security		
Severity		Substantial deterioration after mine closure with respect to aspects listed above.				
Duration		Permanent. Beyond closure. Long term.				
Spatial Scale		Fairly widespread – Beyond the site boundary. Local				
Probability		Definite / continuous				
Mitigation	**Severity**	**Duration**	**Spatial Scale**	**Consequence**	**Probability of Occurrence**	**Significance**
Unmitigated	**H**	**H**	**M**	**H**	**H**	**H**
Significance of Consequence		A high significance is expected if no mitigation mechanisms are implemented. This is a worst case scenario where no alternative uses of the altered habitat is considered. In terms of economic benefits lost, it is important to note that the longer the mine stays open the longer the benefit to the community which if the mine did not start up would not have been realised in the first place.				
Prevention		The resources are finite and so decommissioning is inevitable at some point. The degree to which the impact of closure will have will depends on the mitigations that can be considered. Ecosystem functioning of the whole area cannot return to baseline conditions unless the excavated quarry is refilled and the area revegetated to baseline conditions. This is not practical Public harm can be prevented provided the area is secured and the risky hazards are inaccessible. Jobs within this sector will be lost. This cannot be prevented unless the employees move with the company to the next site. Theft and damage to equipment can be prevented during the decommissioning phase provided good security prevents any form of criminal behaviour by disgruntled employees.				
Mitigation Action		Visual impacts can be mitigated through a thorough removal of all infrastructure. The reduction in the size of the mine footprint during operations and decommissioning increases the probability that more habitat will become fully functional when the mine closes. Secure fencing or other physical objects (rock piles) around any hazardous quarry pits (i.e. height risks) could prevent accidents from occurring but the permanent and visually acceptable barrier to humans and wildlife would be required to prevent injuries due to falling from heights. Access down into the pit could be allowed provided there is no risk from falling rocks.				

	The access road leading to the pit, waste rock dumps areas should be closed off to the public except to those that need access to the facilities for inspection after closure. Wherever there are safe access roads that are useable by the neighbours, these should be left. Some infrastructure could remain if alternative uses for buildings could be found. When the mine closes the losses of employment will have a negative economic effect on the livelihoods of the workers and the region. To mitigate this impact all stakeholders should be notified about the mine closure in good time.
Rehabilitation	Reasonable rehabilitation of the mine site should take place. The proponent will be responsible to put aside funds for rehabilitation. The mine closure plan with the mine rehabilitation or restoration plan should be written up during the first three years of the first environmental clearance. Rehabilitation of the abandoned mining area will amongst other things include the following: ➢ All movable assets to be removed off site ➢ All waste to be removed from site to prevent later potential excavation by people trying to recover any sort of usable scrap / materials ➢ All immovable machinery to be dismantled and removed from site ➢ Possibly create shallow sloped sides of quarried areas ➢ WRD material are used in landscaping ➢ All stockpiled topsoil will be re-laid on the landscaped areas. ➢ Designed landscaped areas to be revegetated with plants from the nursery ➢ Finally, erect fencing or barriers to prevent access by public or animals to cliff faces of the quarried pits

Mitigation	**Severity**	**Duration**	**Spatial Scale**	**Consequence**	**Probability of Occurrence**	**Significance**
Mitigated	**L**	**M**	**L**	**L**	**L**	**L**

Significance of Consequence	If the mitigation hierarchy is followed through to rehabilitation, then the resultant consequence could be insignificant or at worst a low significance.
Confidence Level	A well designed and well implemented mine closure plan should provide for a low significance upon mine closure.
Legal	**Risks associated with abandoning a mine without rehabilitating according to an approved plan:** **Minerals Act: Section 54** Any person who contravenes or fails to comply with the provisions of subsection (2) shall be guilty of an offence and on conviction be liable to a fine not exceeding R8 000 or to imprisonment for a period not exceeding 12 months or to both such fine and such imprisonment. **Contractual Agreements** The Contractor's failure to meet the obligations as stipulated in the contractual agreement with regards to rehabilitation will incur penalties to the value of the cost of rehabilitating the quarry and works area to a state agreed upon by the Contractor and Proponent at the start of the contractual agreement. **Minerals Act:** **Section 54** **Abandonment of mining areas** The holder of a mineral licence may abandon the mining area by notice in writing addressed

	and delivered to the Commissioner who in turn will notify the license holder that the mine has been abandoned as from the date of the cancellation notice. (2) The holder of the mineral licence to which such area relates shall: ➢ demolish any accessory works erected or constructed by such person in such area, except in so far as the owner of the land retains such accessory works on such conditions as may mutually be agreed upon between such owner and person and remove from such land all debris and any other object brought onto such land; ➢ take all such steps as may be necessary to remedy to the reasonable satisfaction of the Minister any damage caused by any mining operations carried on by such holder to the surface of, and the environment on, the land in the area in question. ➢ The abandonment of a mining area shall not affect any legal proceedings instituted against such holder or any obligation or liability of such holder in terms of the provisions of the Act.
Monitoring	At the time of quarry closure and abandonment the contractor must rehabilitate the mine site.. In general as discussed above the following must be monitored: ➢ Removal of movable assets i.e. plant equipment ➢ Demolishment of fixed immovable assets ➢ Removal of this demolished plant and building rubble ➢ Fence off dangerously deep pits or holes in the ground that pose a threat to the public safety ➢ The proponent is to fulfil the same rehabilitation tasks as above for all the accessory works area, including infrastructure, tailings, pits and holes etc. which they created before the contractor began works in the quarry area. ➢ The proponent should regularly engage with the affected communities and stakeholders to record and respond to any grievances that may arise as a result of the project impacts and implement a monitoring process that seeks for feedback from stakeholders on the rehabilitation process. ➢ A **mine closure and rehabilitation plan** and associated checklists must be followed and signed off at each stage of the mine closure/rehabilitation process.