Namibia Nuclear Corporation (Pty) Ltd

Updated Final Environmental Impact Assessment (EIA) Report to Support the Application for the Renewal of the Environmental Clearance Certificate (ECC) for Ongoing and Proposed Mining and Exploration Activities in the Mining License (ML) No. 121, Swakopmund District,
Erongo Region, West Central Namibia

May 2023

P. O. Box 4418, Windhoek
107 Olf Palme Street, Eros Park,
Windhoek, Namibia

PROPONENT, LISTED ACTIVITIES AND RELATED INFORMATION SUMMARY

TYPE OF AUTHORISATIONS

Environmental Clearance Certificate (ECC) for
Ongoing and Proposed Mining and Exploration Activities in the
Mining License (ML) No. 121

MINISTRY OF ENVIRONMENT, FORESTRY AND TOURISM (MEFT)
ECC APPLICATION REFERENCE No.

APP-001506

NAME AND ADDRESS OF THE PROPONENT

Namibia Nuclear Corporation (Pty) Ltd
P. O. Box 4418, Windhoek
107 Olf Palme Street, Eros Park,
Windhoek, Namibia

COMPETENT AUTHORITY

Ministry of Mines and Energy (MME)

PROPOSED PROJECT

ECC for Mining License (ML) No. 121
Ongoing and Proposed Mining and Exploration Activities,
Swakopmund District, Erongo Region, Namibia

PROJECT LOCATION

Swakopmund District, Erongo Region, West Central Namibia
Latitude: -22.546812, Longitude: 14.977745

PERMITTING DE-RISKING ADVISORS AND ENVIRONMENTAL CONSULTANTS

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NON-TECHNICAL SUMMARY

1. Background

Namibia Nuclear Corporation (Pty) Ltd (the **Proponent**) holds minerals rights under the Mining License (ML) No. 121 situated in Swakopmund District in the Erongo Region, west central Namibia. The ML No. 121 is situated about 50 km to the east of Swakopmund, 9 km to the southwest of the town of Arandis, 10 km to the west of the Rössing Uranium Mine and 13 km to the northwest of the Husab Uranium Mine. The ML 121 area falls within the ǂGaingu Communal Conservancy. The north-western and western portions of the ML area border the Dorob National Park and the south and south-eastern areas borders the Namib-Naukluft Park (NNP) with ML boundary running along the Khan Ephemeral River Channel. Access to the ML area is through the B2 Road from Windhoek to Swakopmund and the ML area accessed along the private tarred road to the Husab Uranium Mine. Rail service, via a 1.067 m gauge line, is located 12.0 km away at the Rössing Uranium Mine siding.

2. Mining License (ML) No. 121

The 3534.5885 Ha ML No. 121 area was granted on 04/06/2017 and will expire on the 04/06/2027. The ML No. 121 is granted for base and rare metals, dimension stone, industrial minerals, nuclear fuels minerals and precious metals. Current operations in the ML area are focused on dimension stone with detailed exploration and feasibility evaluation for other commodity groups been undertaken.

3. Renewal of the Environmental Clearance Certificate (ECC)

The ML 121 was first granted to Stone Africa (Pty) Ltd and following the completion of the Environmental Assessment process in 2015 and in line with the provisions of the Environmental Management Act (EMA), 2007, (Act No. 7 of 2007) and the Environmental Impact Assessment (EIA), 2012 Regulations, an Environmental Clearance Certificate (ECC) was granted by the Environmental Commissioner in the Ministry of Environment, Forestry and Tourism (MEFT) on the 20th June 2015 with a condition of validity linked to the duration of the proposed mining operations. Currently, the ML No. 121 has been transferred Namibia Nuclear Corporation (Pty) Ltd as the current Proponent. This updated Environmental Impact Assessment (EIA) Report has been prepared to support the application for the renewal and amendment of the current ECC in order to align it with the current minerals rights ownership of the ML No. 121 and the prevailing regulatory requirements as provided for the Minerals (Prospecting and Mining) Act, 1992, (Act No. 33 of 1992) and the Environmental Management Act (EMA), 2007, (Act No. 7 of 2007) as well, as the associated Regulations as administered by MEFT and MME, respectively. The current ECC need to be renewed, and amended to reflect only the ML No. 121 and Namibia Nuclear Corporation (Pty) as the Proponent. This updated EIA Report covers the impact assessment for ongoing and proposed mining and exploration activities with respect to the following project developmental stages:

(i) Preconstruction and site clearing for quarry and supporting infrastructure area such as storage / yard area/ supporting containerised area/ access and all related services points for water and energy supplies as may be required.

(ii) Construction of the proposed quarry and supporting infrastructure.

(iii) Operation, ongoing monitoring and rehabilitation, and.

(iv) Decommissioning, closure and aftercare.

This report provides for mining of dimension stones only and if there is a need for new modifications that may require regulatory approvals such as mining of new commodity as granted in the ML 121 other than dimension stones, an increase in the size or additional new land to the ML area, the Proponent will be required to apply for a new / amended ECC before such modifications may be implemented. This EIA excludes all the activities associated with the processing of the mined granites once it arrives at the processing plant as well as the export of the raw or finished products through the Port of Walvis Bay. All the mitigation measures for proposed project activities with significant impacts on the receiving

environment as detailed in this EIA Report are presented in the Environmental Management Plan (EMP) Report.

4. Summary of the Proposed Project

The following is the summary of the key components of the proposed project:

- **Commodity Group**: Dimension stone with special focus granites and other economic rock rocks. The Proponent, has applied to the Competent Authority (Ministry of Mines and Energy (MME)) to include base and rare metals, industrial minerals, precious metals, and semi-precious stone group of minerals on ML No. 121.

- **Size of Deposit**: Multiple quarries have been opened with mining only focused on one quarry based on the market needs and all supported by ongoing exploration activities.

- **Estimated duration of the operations**: An ML is valid for a maximum period of 25 years and renewable as provided for in the Minerals (Prospecting and Mining) Act, 1992, (Act No. 33 of 1992).

- **Socioeconomic benefits / Project Motivation**: The Proponent has invested extensively in the Namibian economy in last 20 years and in particular the Erongo Region. The project continues to create employment opportunities, value addition, in-situ potential underground minerals resources and high beneficiation opportunities in Namibia and additional socioeconomic benefits in terms of capital investments, license rental fees, royalties payable to Government, export earnings, foreign direct investments and various taxes payable to the Government.

- **Mining Technique:** Quarry, with a diamond wire saws and stone cutting machines used for cutting out small block 2 m x1 m x 0,6 m (majority), and larger blocks 2,8 m x1 ,3 x 0,8 m (minority) rectangular blocks.

- **Processing**: Further processing of the mined-out and sorted / graded granite blocks will take place at the processing plant. At the processing plant, a giant saw is used to cut up the granite into more manageable pieces.

- **Sources of water supply:** Greywater supplies from Arandis and groundwater from a local borehole drilled.

- **Sources of electricity supply**: National grid, diesel generator and solar.

- **Mining and operational equipment**: Multiple excavators, wheel-loaders, forklift loaders, diesel generator sets, four-cylinder mining machines, wire saw machines, giant saws, semi-automatic drilling machines, containers, trucks, 4 by 4 cars and air-compressors, and.

- **Waste Rock**: Waste rock is being stockpiled and used for other engineering applications such as coastal defences and mine final rehabilitation process. Fine grounded materials from the giant saw are being tested for potential use in soil enhancements for improved crops production applications in the agricultural industry. The effective capacity of the waste rock facility will vary but is likely to be in range of 120 × 90 m^3, calculated with 0.85 as capacity utilisation coefficient of waste rock per quarry area opened and fully operated.

The Proponent continue to conducted detailed exploration activities with respect to potential resources opportunities for base and rare metals, industrial minerals, nuclear fuels minerals and precious metals in the ML No. 121.

5. Receiving Environment and Alternatives Project Development

The ML 121 falls within the Arandis Constituency has an estimated population of 10,093 and includes the towns of Arandis and Henties Bay. As of 2020, the constituency had 8,888 registered voters. The

socioeconomic activities of the immediate surrounding ML No. 121 area are centred on the uranium and dimension stone mining operations with Arandis as the nearest town. Tourism and trading in towns are key socioeconomic activities. The ML area lies about 450 mams (meters above mean sea level) and within the hyper-arid zone Namibia with annual rainfall of less than 500mm. The ML area falls within the far southern portion of the ǂGaingu Communal Conservancy. It is estimated that at least 54 reptile, 5 amphibian, 45 mammal, 129 bird species (breeding residents), 20-47 species of larger trees and shrubs (>1m in height) and up to 50 grasses are known to or expected to occur in the general/immediate sites of which a large proportion are endemic species. Project alternatives have been considered in this Updated EIA Report covering locations of the granite and other associated dimension quarries, mining methods to be used, transport options, processing options, water resources, energy sources, the no-action alternative, other current and future alternative land uses, potential land use conflicts, and ecosystem function (what the ecosystem does), services, use values, and non-use or passive use.

6. Methodology and Impact Assessment

The assessment covered the ongoing and proposed granite and other potential dimension stone materials quarrying operations and supporting infrastructures (roads and water supply services) for the proposed mine preconstruction, construction, mine operation, ongoing monitoring and rehabilitation and decommissioning, closure and aftercare in the ML 121. The impact assessment methodology for this project adopted a two-dimensional matrix approach in predicting the potential impacts of the ongoing and proposed project activities on the receiving environment. The impact assessment considerations included land disturbance/land use impacts. potential impacts to specially designated areas. impacts to soil, water and air resources. impacts to vegetation, wildlife, wildlife habitat, and sensitive species. visual, cultural, paleontological, climate change, and socioeconomic.

7. Summary of EIA Conclusions and Recommendations

The impact assessment process for the ongoing and proposed mining operations in the ML 121 has been undertaken in accordance with the requirements of the national applicable regulations. The ongoing and proposed granite and other dimensions stone mining operations and supporting infrastructure in the ML 121 poses localised negative impacts to the receiving environment with great offset /trade-offs/ benefits in form of socioeconomic benefits and investments. The overall extent of the ongoing and proposed operations is limited in area extent with respect to the granite and other potential dimension stone resources, the pits and supporting infrastructures areas. The Proponent is focusing on developing and utilising the already disturbed areas from previous exploration and mining operations and the strategy will greatly be beneficial to the future rehabilitation of the ongoing and proposed mining and exploration operations. Due to the localised extent of the likely negative impacts, compared to the likely positive impacts, it is hereby recommended that a detailed updated EMP Report be prepared to address all the identified impacts. It is hereby recommended that the ongoing and proposed dimension stone mining operations and supporting infrastructures in the ML No. 121 shall be issued with a new Environmental Clearance Certificate (ECC). The following is the summary of the key conditions that shall be implemented by the Proponent for the proposed project activities:

(i) The Proponent shall prepare a detailed EMP Report in order to address all the identified medium and high rated impacts.

(ii) The Proponent shall negotiate land access agreement with the owner/s / land rights holders covering the ML No. 121 area.

(iii) The Proponent shall implement and adhere to all the provisions of the EMP report.

(iv) Environmental monitoring shall be implemented as provided for the in EMP and Environmental Clearance Certificate (ECC) conditions, and.

(v) The Proponent shall notify the local community through the Erongo Reginal Council, local Councillor/s, ≠Gaingu Communal Conservancy Management Committee and the !Oe-≠Gân Traditional Authority on the ongoing and implementation of the proposed project once the ECC has been granted. Such communications shall be maintained throughout the lifecycle of the proposed project.

1. PROJECT BACKGROUND

1.1 Introduction

Namibia Nuclear Corporation (Pty) Ltd (the **Proponent**) holds minerals rights under the Mining License (ML) No. 121. The 3534.5885 Ha ML No. 121 area was granted on 04/06/2017 and will expire on the 04/06/2027. The ML No. 121 is granted for base and rare metals, dimension stone, industrial minerals, nuclear fuels minerals and precious metals. Current operations in the ML area are focused on dimension stone with detailed exploration and feasibility evaluation for other commodity groups been undertaken. The ML No. 121 was first granted to Stone Africa (Pty) and was later transferred to Namibia Nuclear Corporation (Pty) Ltd as the current Proponent.

1.2 National Regulatory Requirements

The national legislation governing minerals prospecting and mining activities in Namibia fall within the jurisdiction of the Competent Authority (Ministry of Mines and Energy (MME)) responsible for granting authorisations in form of Mining Claims (MCs), Reconnaissance Licenses, Exclusive Exploration Licences (EPLs) and Mining Licenses (MLs). The Minerals (Prospecting and Mining) Act (No. 33 of 1992) is the most important legal instrument governing minerals prospecting and mining activities in Namibia.

The ongoing and proposed mining, minerals processing and ongoing exploration activities in the ML No. 121 are listed in the Environmental Management Act, 2007, (Act No. 7 of 2007) and the Environmental Impact Assessment (EIA) Regulation, 2012 as among the activities with the potential to cause significance negative impact on the receiving physical, biological and socioeconomic environments. All listed activities cannot be undertaken without an Environmental Clearance Certificate (ECC).

In order to obtain an ECC, the Proponent is required to have undertaken Environmental Assessment (EA) comprising Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) for the proposed listed activities. The Environmental Assessment process shall be undertaken in accordance with the provisions of the Environmental Impact Assessment Regulations, 2012 and the Environmental Management Act, 2007, (Act No. 7 of 2007).

Following the completion of the Environmental Assessment process that was undertaken in 2015 and in line with the provisions of the Environmental Management Act (EMA), 2007, (Act No. 7 of 2007) and the Environmental Impact Assessment (EIA), 2012 Regulations, an ECC was granted to then Proponent (Stone Africa (Pty) Ltd) by the Environmental Commissioner in the Ministry of Environment, Forestry and Tourism (MEFT) on the 20th June 2015 with a condition of validity linked to the duration of the proposed mining operations (Fig. 1.1).

This Updated Environmental Impact Assessment (EIA) Report has been prepared to support the application for the renewal and amendment of the current ECC as shown in Fig. 1.1, in order to align it to the current minerals rights ownership of the ML No. 121 and the prevailing regulatory requirements as provided for the Minerals (Prospecting and Mining) Act, 1992, (Act No. 33 of 1992) and the Environmental Management Act (EMA), 2007, (Act No. 7 of 2007) as well, as the associated Regulations as administered by MEFT and MME, respectively.

The current ECC as shown in Fig. 1.1 need to be renewed, and amended to reflect only the ML No. 121 and Namibia Nuclear Corporation (Pty) as the Proponent.

This Updated EIA Report provides for mining of dimension stones only and if there is a need for new modifications that may require regulatory approvals such as mining of new commodity as granted in the ML 121 other than dimension stones, an increase in the size or additional new land to the ML area, the Proponent will be required to apply for a new / amended ECC before such modifications may be implemented.

REPUBLIC OF NAMIBIA

MINISTRY OF ENVIRONMENT AND TOURISM

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Enquiries: Mr D. Nchindo

Cnr of Dr. Kenneth David Kaunda Street
& Robert Mugabe Avenue
Private Bag 13306
Windhoek
04 June 2015

OFFICE OF THE ENVIRONMENTAL COMMISSIONER

Managing Director
Stone Africa (Pty) Ltd
P. O Box 1204
Walvis Bay
Namibia

Dear Sir

SUBJECT: ENVIRONMENTAL CLEARANCE FOR THE PROPOSED INTERNAL BOUNDARY ADJUSTMENTS FOR THE MINING LICENSES (MLS) NOS. 120, 121 AND 123 FOR POSSIBLE MINING OF SULPHITES AND ASSOCIATED MINERALS

The Environmental Impact Assessment made a satisfactory analysis of environmental issues. The Environmental Management Plan contains adequate provisions for control and monitoring, especially on flora and fauna destruction.

This letter serves as an environmental clearance for the proposed adjustment of internal boundary and proposed mining operations. However, this clearance letter does not hold the Ministry of Environment and Tourism accountable for any misleading information provided, nor any adverse effects that may arise from these activities. Instead, full accountability rests with Stone Africa (Pty) Ltd and their Consultants.

This environmental clearance is valid for the proposed mining period, unless withdrawn by this office.

Yours sincerely,

MINISTRY OF ENVIRONMENT AND TOURISM P/Bag 13306 Windhoek, Namibia 2015 -06- 26 Office of the Environmental Commissioner

Teofilus Nghitila
ENVIRONMENTAL COMMISSIONER

All official correspondence must be addressed to the Permanent Secretary

Figure 1.1: Copy of the ECC that was granted to then the Proponent (Stone Africa (Pty) Ltd) with respect to the MLs Nos. 120, 121 and 123 and the ECC has a validity period for the duration of the proposed mining period. ML No. 121 covered in this report, were first granted to Stone Africa (Pty) and were transferred to Starting Right 265 (Pty) Ltd, now renamed Namibia Nuclear Corporation (Pty) Ltd as the current Proponent. This ECC need to be renewed, and amended to reflect only the ML No. 121 and Namibia Nuclear Corporation (Pty) as the Proponent.

1.3 Project Motivation

The ML No. 121 is situated in a highly prospective area for base and rare metals, dimension stone, industrial minerals, nuclear fuels minerals and precious metals associated with local Damara metamorphic rocks.

The ongoing and proposed mining operations and exploration activities will have good socioeconomic benefits including value addition to the potential granite resources in the area which otherwise would not have been known if the exploration in the ML No. 121 did not take place.

The ongoing and proposed project development will have great positive benefits at local (Arandis, Swakopmund and Walvis Bay Areas), regional (Erongo Region) and national (Namibia) levels and these benefits include the following:

(i) The Proponent has invested in local economy in last 20 years and continue to provide direct and many more indirect contracts and employment opportunities, to local Namibians especially in the Erongo Region where the quarries and the stones processing facilities are all located.

(ii) Other direct and indirect socioeconomic benefits in terms of increased in local communities purchasing power and support to local businesses and services providers including the local authorities of Arandis, Swakopmund and Walvis Bay.

(iii) Additional socioeconomic benefits will also be realised at regional and national levels in terms of capital investments, license rental fees, royalty taxes payable to Government, export earnings, foreign direct investments and various taxes payable to the Government.

(iv) Support to the increase in local minerals resources value addition and beneficiation opportunities.

(v) Support to the local skills transfer and training of local Namibians in dimension stones mining and processing techniques and technological know-how, and.

(vi) Through ongoing exploration and the potential discovery of additional economic minerals resources and the expansion of the ongoing and proposed mining and minerals processing operations will have much greater local, regional and national socioeconomic benefits.

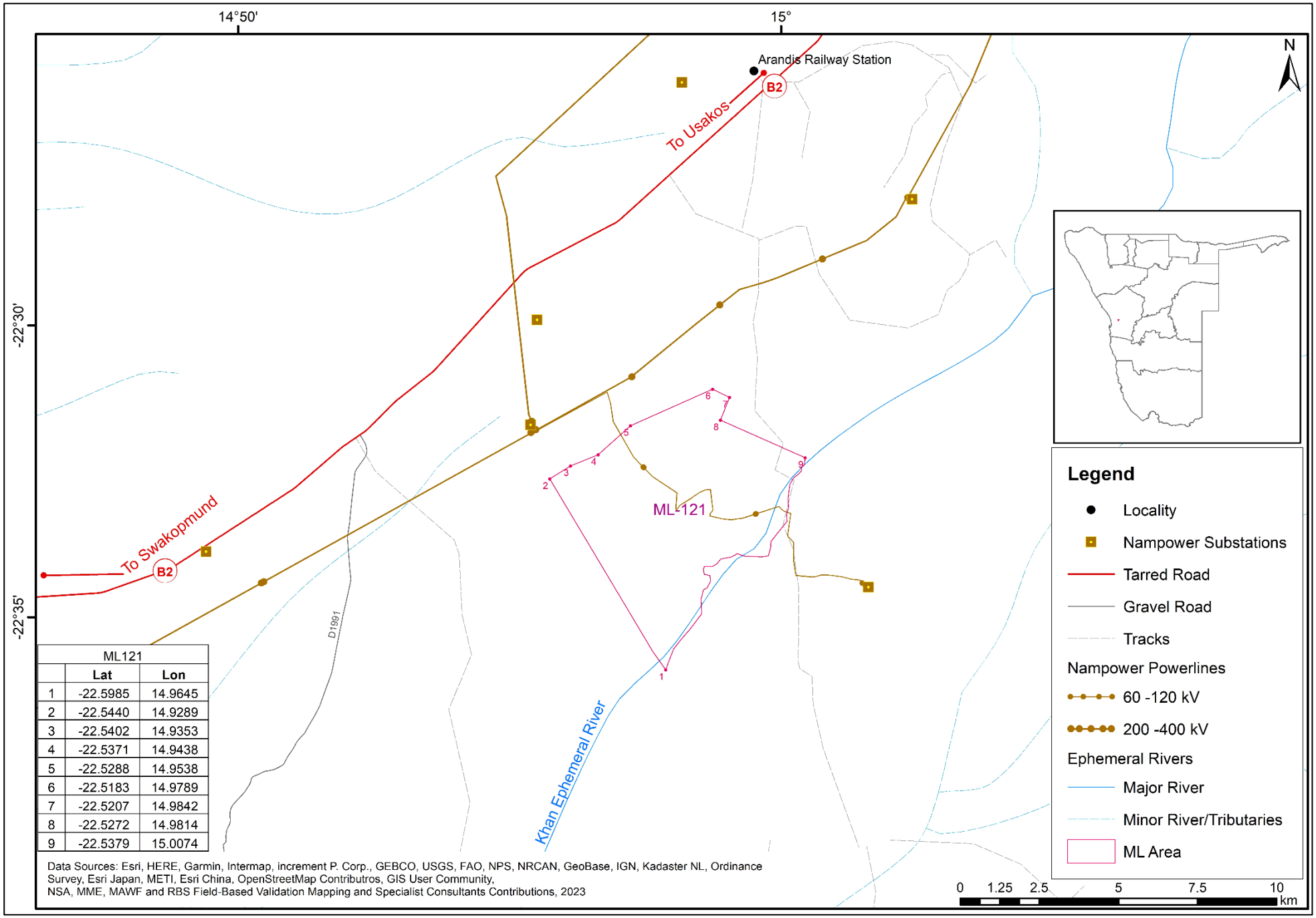
1.4 Location, Site Description, Land Use and Infrastructure

1.4.1 Location and Land Use

The ML No. 121 area totalling 3534.5885 Ha falls within the Swakopmund District, Erongo Region, west central Namibia (Fig. 1.1-1.4). The ML No. 121 is situated about 50 km to the east of Swakopmund, 9 km to the southwest of the town of Arandis, 10 km to the west of the Rössing Uranium Mine and 13 km to the northwest of the Husab Uranium Mine. The ML 121 area falls within the state land of the ǂGaingu Communal Conservancy. The north-western and western portions of the ML area border the Dorob National Park and the south and south-eastern areas borders the Namib-Naukluft Park (NNP) with ML boundary running along the Khan Ephemeral River Channel (Fig. 1.5).

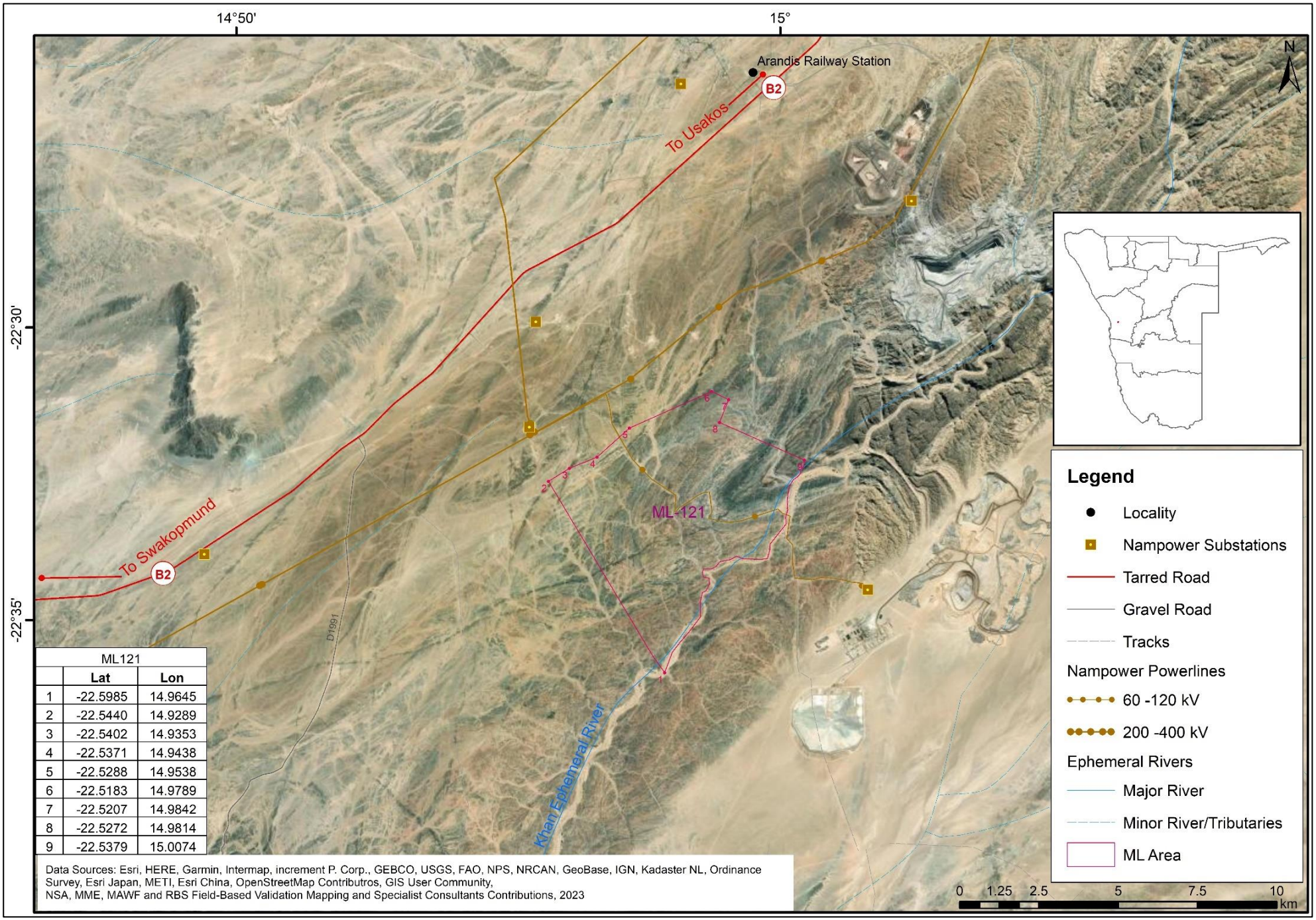
The main key land uses around the ML area is dominated by large-scale commercial uranium and dimension stone mining operations. The ML area falls within the southern portions of the ǂGaingu Communal Conservancy. This southern portion of the conservancy does not have conservancy tourism activities or agriculture comprising cattle and small stock commercial / subsistence communal farming activities that dominate the central and northern portions of this conservancy (Fig. 1.5). The key business operations of the ǂGaingu Communal Conservancy area are centred around Spitskoppe. In addition to the campsite at Spitskoppe, a number of lodges are found in the general surrounding areas but not within or near the ML No. 121 boundaries. A number of quarry areas have been identified within the ML area but not all of them are active (Plates 1.1 and 1.2). A number of quarry areas have been opened in the ML No. 121 and surrounding areas but not all of them are active (Plates 1.1-1.4).

Figure 1.2: Regional location of the ML No. 121.



ML121		
	Lat	Lon
1	-22.5985	14.9645
2	-22.5440	14.9289
3	-22.5402	14.9353
4	-22.5371	14.9438
5	-22.5288	14.9538
6	-22.5183	14.9789
7	-22.5207	14.9842
8	-22.5272	14.9814
9	-22.5379	15.0074

Figure 1.3: Detailed regional location of the ML No. 121 with comer coordinates and existing infrastructure.



ML121		
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6	-22.5183	14.9789
7	-22.5207	14.9842
8	-22.5272	14.9814
9	-22.5379	15.0074

Figure 1.4: Detailed satellite map of the ML No. 121 and surrounding areas.

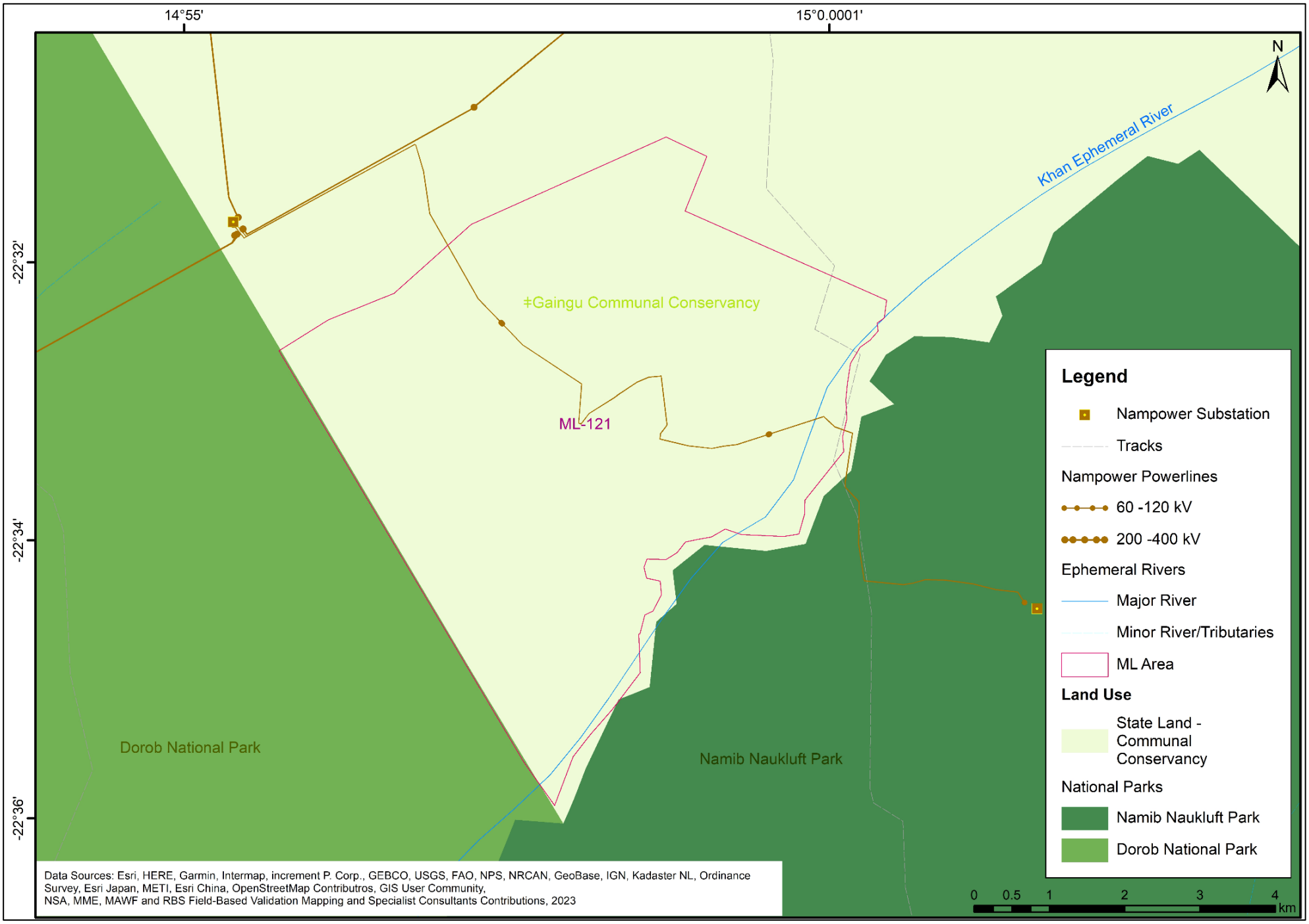

Figure 1.5: Detailed regional map of the ML No. 121 and surrounding land uses.

Plate 1.1: Overview overhead drone image view example of multiple quarry operational areas.

Plate 1.2: Detailed overview a granite quarry operational area, stockpile, sorted waste blocks for reuse and workshop and processing operations.

Plate 1.3: Drone image view to the southwest working face of one of the quarries found in ML No. 121 with the workshop in the background.

Plate 1.4: Overview of the existing access within the ML No. 121.

1.4.2 Supporting Infrastructure and Services

The ML 121 area falls within the state land with western portion of the ML No. 120 bordering the Dorob National Park (Fig. 1.5). Access to the ML area is through the B2 Road from Windhoek to Swakopmund and the ML area accessed along the private tarred road to the Husab Uranium Mine (Fig. 1.2-1.5). Rail service, via a 1.067 m gauge line, is located 12.0 km away at the Rössing Uranium Mine siding. The following supporting infrastructures and services will be required:

(i) External and internal roads network: The Proponent is utilising the already existing external and internal road networks and created additional new access road linking the quarries (mine) sites to the main access.

(ii) Water supply: Raw water continue to be sourced from local Arandis greywater facilities as well as local groundwater resources. The Proponent will utilise the existing boreholes and will also drill additional boreholes as may be required.

(iii) Energy Sources: Ongoing and proposed mining operations in ML No. 121 uses electricity supply from the national grid, diesels and solar energy sources.

(iv) Onsite administrations and offices (supporting infrastructure): Central facilities including workshop and other operational areas have been created in the ML area, and.

(v) Staff transport arrangements from Arandis and Swakopmund to the mine sites are provided by the Proponent as required.

1.5 Methodology and Terms of Reference

1.5.1 Overview

Risk-Based Solutions (RBS) was appointed by the Proponent to prepare the Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) reports in order to support the applications for Environmental Clearance Certificates (ECC) for the proposed mining operations within the ML No. 121. The impact assessment process has been undertaken in accordance with the Terms of Reference (ToR) and the requirements of the Environmental Impact Assessment Regulations, 2012 and the Environmental Management Act, 2007, (Act No. 7 of 2007). The proposed project activities have all been assessed against the receiving environment covering the physical, biological, socioeconomic and ecosystem services (function, use values and non-use) (Annex 1).

1.5.2 Objectives of the EIA and EMP Phases

The aims and objectives of the Environmental Assessment (EA) covering Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) to be prepared are:

(i) To assess all the likely positive and negative short- and long-term impacts on the receiving environment (physical, biological and socioeconomic environments) at local (ML Area), regional (Erongo Region), national (Namibia) and Global levels using appropriate assessment guidelines, methods and techniques covering the complete project lifecycle.

(ii) The development of appropriate mitigation measures that will enhance the positive impacts and reduce the likely negative influences of the negative impacts identified or anticipated. Such mitigation measures shall be contained in a detailed EMP report covering the entire project lifecycle, and.

(iii) The EIA and EMP will be performed with reasonable skill, care and diligence in accordance with professional standards and practices existing at the date of performance of the assessment and that the guidelines, methods and techniques that have been applied are all in conformity to the national regulatory and GIIP requirements, process and specifications in Namibia as required by Ministry of Mines and Energy (MME), Ministry of Environment, Forestry and Tourism (MEFT).

The EIA and EMP deliverables shall be prepared in line with the January 2015 MEFT Environmental Assessment Reporting Guidelines.

1.5.3 Approach Summary of the Environmental Assessment

This Updated EIA Report has been prepared based on the Terms of Reference (ToR) and outcomes of screening and impact assessment process with aim of identify the key environmental and social aspects that required mitigation measures to be prepared as detailed in the Updated Environmental Management Plan (EMP) Report.

The preparation of this EIA Report started with the review of the previous assessment and management report prepared in 2015. This was followed by the review of the current and proposed project activities and baseline data sets in order to develop a detailed understanding of the social and environmental aspects that have the potential to be affected by the proposed project activities.

The national regulatory requirements have based on the provisions of the Environmental Impact Assessment (EIA) Regulations No. 30 of 2012 and the Environmental Management Act, (EMA), 2007, (Act No. 7 of 2007) as illustrated in the Fig. 1.6.

1.5.4 Environmental Assessment Process and Steps

The processes and steps that have been followed in the preparation of this updated EIA Report took into considerations the provisions of the Environmental Impact Assessment Regulations, 2012, the Environmental Management Act, 2007, (Act No. 7 of 2007) (Fig. 1.6). The complete lifecycle of the ongoing and proposed mining and exploration activities in the ML No. 121 and inclusive of the supporting infrastructure such as access, energy and water supplies have all been reassessed in this updated EIA Report based on the assessment undertaken in 2015. The key developmental stages that have been included are: Preconstruction, construction, operation with ongoing monitoring and rehabilitation and decommissioning, closure, and aftercare. The assessment processes and steps undertaken are summarised as follows:

- Reviewed the previous environmental assessment and management report and conditions of the current ECC undertaken in February 2023.

- Screened the project against the applicable legislations and regulations undertaken in February 2023.

- Preparation of the Background Information Document (BID) used for registration of the ongoing and proposed project on the MEFT digital platform undertaken in May 2023.

- Registered the project on the MEFT digital platform in May 2023.

- On receipt of the acknowledgment of the ECC notification from MEFT, finalised the BID / and prepared Draft Updated EIA and EMP Reports as well as the monitoring reports covering the period under review from 2015-2023 undertaken in May 2023, and.

- Finalised the Updated EIA and EMP and monitoring reports for submission to the Environmental Commissioner in MEFT through the Mining Commissioner in the MME (Competent Authority) in support of the application for renewal and amendment of the current ECC for the proposed project (Undertaken in May 2023).

The complete lifecycle of the ongoing and proposed mine development, inclusive of the supporting infrastructure such as onsite infrastructure, roads, energy, water and supply services have all been assessed in the environmental assessment process.

The environmental assessment processes has been performed with reasonable skill, care and diligence in accordance with professional standards and practices existing at the date of performance of the assessment and that the guidelines, methods and techniques that have been applied are all in conformity to the national regulatory requirements, process and specifications in Namibia as required

by Ministry of Mines and Energy (MME), Ministry of Environment, Forestry and Tourism (MEFT) and the client (Proponent). This Updated EIA Report has been prepared in line with the January 2015 MEFT Environmental Assessment Reporting Guideline.

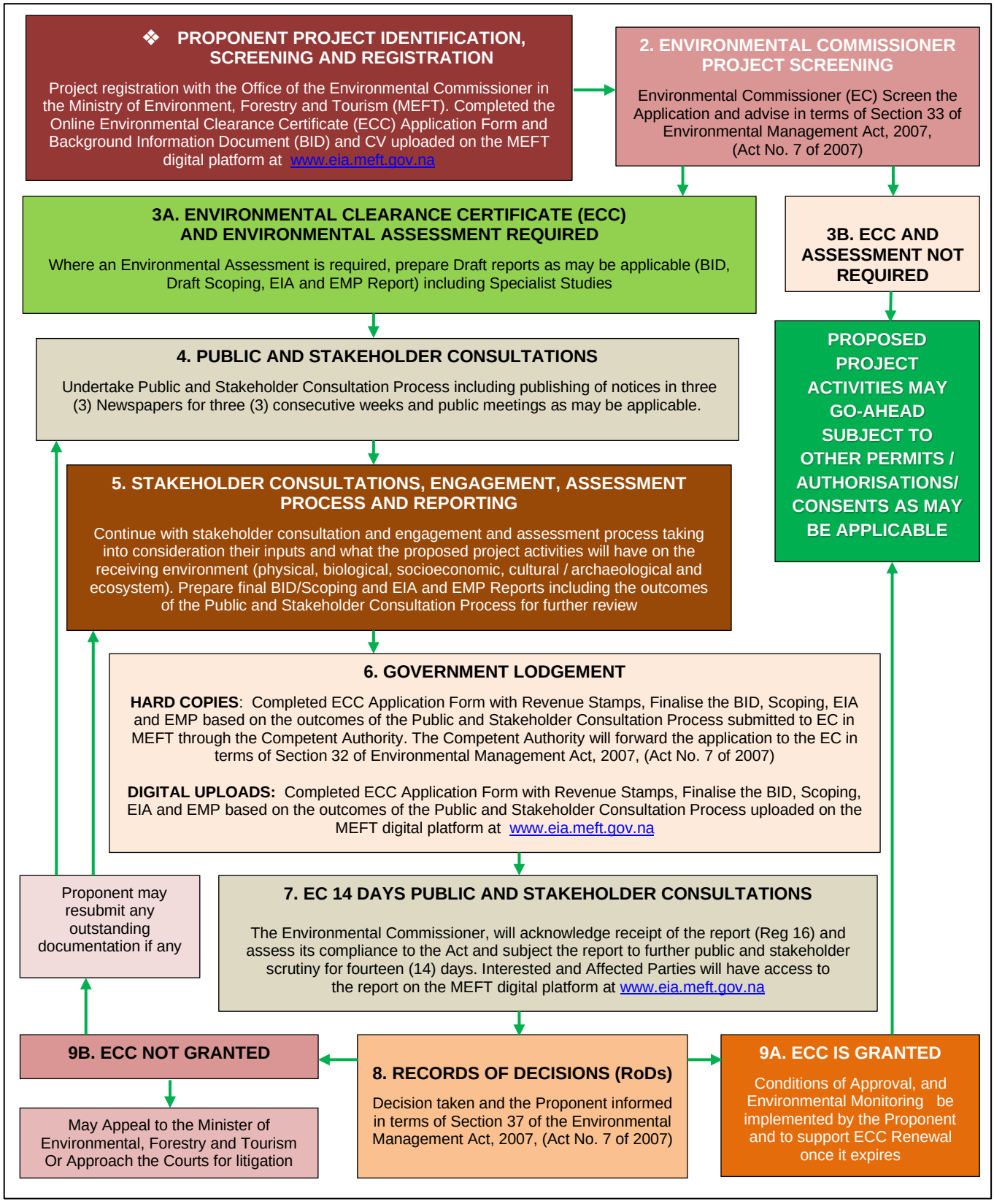

Figure 1.6: Schematic presentation of Namibia's Environmental Assessment Procedure in line with the provisions of the EIA Regulations No. 30 of 2012 and the EMA, 2007, (Act No. 7 of 2007).

1.5.5 Assumptions and Limitations

The following assumptions and limitations underpin the approach adopted, overall outcomes and recommendations of the environmental assessment process and this EIA Report:

(i) The ongoing and proposed mining and exploration activities as well as all the plans, maps, ML No. 121 boundary / coordinates and appropriate data sets received from the Proponent, project partners, regulators, Competent Authorities and specialist consultants are assumed to be current and valid at the time of conducting the studies and preparation of this EIA Report.

(ii) The impact assessment outcomes, mitigation measures and recommendations provided in the EIA and EMP Reports are valid for the lifecycle of the ongoing and proposed mining and exploration activities in the ML No. 121.

(iii) A precautionary approach has been adopted in instances where baseline information and impact assessment guidelines were insufficient or unavailable or site-specific project activities were not yet available, and.

(iv) Mandatory timeframes as provided for in the EIA Regulations No. 30 of 2012 and the EMA, 2007, (Act No. 7 of 2007) have been observed.

1.5.6 Structure of the Report

The following is the summary structure outline of this Updated EIA Report:

- **Section 1: Project Background** covering Introductions, regulatory requirements, project motivation, site description, Terms of Reference summary, Environmental Assessment Process and Steps and Structure of report.

- **Section 2: Description of the Proposed Project** covering site description, project design and activities to be undertaken.

- **Section 3: Regulatory Framework providing** a summary of the applicable legislations and permitting requirements.

- **Section 4: Receiving Environment** covering physical environment (climate, water, air quality, and geology), Biological environment (flora, fauna and ecosystem services and functions) and socioeconomic environment.

- **Section 5: Assessment of Likely Impact** covering assessment procedure, summary of likely Impacts covered in the EIA and the method of assessment.

- **Section 6: EIA Conclusions and Recommendations** covering the key issues identified and summarised recommendations.

2. DESCRIPTION OF PROJECT

2.1 Overview

Dimension stone is the name given to natural rock that has been quarried and shaped to certain dimensions or specifications for use in building and construction, and in the production of sculpture, monuments and memorials. Dimension stone is an important building material used worldwide, and therefore a valuable natural resource. Namibia has numerous deposits of good quality dimension stone displaying a variety of attractive colours, patterns and textures. The main rock types that are quarried in Namibia are marble, granite, dolerite, conglomerate, and sodalite. The mining of dimension stone mining involves the extraction of small 2 m x 1 m x 0,6 m (majority), and larger blocks 2,8 m x 1 ,3 x 0,8 m (minority) rectangular blocks, sorting, storage, transportation to a final processing facility. The processed dimension stones will be sold locally and exported oversees.

Namibia Nuclear Corporation (Pty) Ltd has undertaken a detailed exploration programme and has successfully evaluated the technical and economic viability of mining dimension stones (granites) within the ML No. 121. The following is a summary of the project developmental stages that will be implemented from construction of infrastructure to the closure and final rehabilitation of the mine and aftercare stages:

(i) Preconstruction of the supporting infrastructures to access the resources (Mine Preconstruction activities).

(ii) Construction of quarry (mine / pit/s) site/s area/s including the primary, screening, secondary, and cutting facilities (Quarry Construction and Development).

(iii) Construction of rock waste and generals waste disposal site (Mine Construction and Development).

(iv) Mining, loading and transporting of the mined Blocks (Mine Operation).

(v) Ongoing exploration, rehabilitation and environmental monitoring (Mine Operation), and.

(vi) Mine Closure, decommissioning, final rehabilitation / remediation / reclamation, post-closure and aftercare including monitoring (Final mine closure and aftercare).

2.2 Uses of Granite

Granite when rough-cut or polished is used as material for the construction of building walls, bridge piers, monuments, pavements, road curbs, and other exterior works. Also, it is used as coarse aggregate in concrete, aggregates in road construction, external wall cladding material, and ballast for railways. The following explains the various uses of granite in various applications:

- Granite is extensively used in making solid slab kitchen countertops and backsplashes.
- Granite in Building Facades
- Granite is an excellent material for use in building facades due to its inherent toughness and durability.
- As an aesthetic material, granite is used in indoor spaces as a wall finish to enhance the natural look of a room.
- Granite tiles are often used as floor finishes.
- Granite crushed stone is used to form the layers i.e., as sub-base and as a base layer constructing roads and highways. In sewage system drain fields, granite is used as a base material for creating foundations and constructing slabs.

- ❖ Crushed granite mixed and existing in attractive colours also can be used as a landscape stone and in putting in planters, and.

- ❖ Granite used as a decorative element within a house or office environment such as a fireplace mantel.

2.3 Mine Preconstruction

The following is the summary of the key activities to be undertaken as part of the preconstruction stage of the ongoing and proposed mining and exploration activities the ML No. 121.

1. General site clearing of the quarry areas, administration block, waste rock, supporting infrastructure (Office blocks, storage, water and electricity other site infrastructure).

2. Open pit geotechnical drilling and site investigations to inform the mine design and layout.

3. Engineering design of the pit areas and the support facilities including water and energy supplies, storage areas, workshops and containerised administration block.

4. Access roads upgrading of existing tracks / creation of new routes as may be required.

5. Human resources planning, development of community and social programs and development of environmental and social management programs for the operational phase of the project.

6. Top soil removal and storage.

7. Development of the temporary construction camp, and.

8. Installation of containerised offices, workshops, storage facilities.

The development and operation of a solid waste disposal site for municipal related solid waste is not allowed within the ML Area. The Proponent shall only operate a transfer faciality / station. All solid waste shall be stored in a closed container and disposed off at the Arandis or Walvis Bay municipal waste disposal. All liquid waste such as sewage shall be managed through a French Drain System or chemical toilets / an onsite waste water treatment faciality to be approved by the Department of Water Affirms in the Ministry of Agriculture, Water and Land Reform (MAWLR). Discharge of waste water in public stream (dry Ephemeral River Channels) or in the natural environment without treatment is prohibited under the Water Act, 1956, (Act No. 54 of 1956.

2.4 Mine Construction and Operations

2.4.1 Mine Design and Construction

The mining techniques to be employed for the proposed project will be an open pit mining method using conventional diesel-powered equipment and a drill and blast, load and haul operation.

1. Transportation facilities, including access roads to the site and on-site roads.

2. Waste rock and mine blocks stockpiles.

3. Water supply systems.

4. Power infrastructure, including powerline and distribution systems (Generator and Solar).

5. Administration blocks and warehouses.

6. Fuel supply and storage.

7. Workshop and equipment maintenance facilities.

8. Wastewater treatment systems.

9. Domestic solid waste disposal storage / transfer facility, and.

10. Storm water management in the pit and supporting infrastructure.

2.4.2 Mine Operations (Extracting Dimension Stones)

The mine operational phase will involve the extraction of the granite blocks from the quarry using special cutting saws. The cut-out blocks will be pulled from the quarry to the stockpiling and sorting area (Plates 2.1-2.8). A basic shape of a large rectangle is aimed for, so that it is easier to shape the granite into useful objects during further processing. The following is the overall summary of the activities to be undertaken during the mining stage:

1. Mining operations (actual mining operations as may be required).

2. Transportation of the mined blocks from pit to the sorting areas.

3. Storage and transportation of granite blocks for further processing.

4. Waste rock management / reprocessing / recovery.

5. Ongoing exploration support.

6. Ongoing rehabilitation and maintenance.

7. Waste water management.

8. Municipal solid waste management / transfer to Arandis, and.

9. Environmental performance monitoring.

The following is the indicative summary of the key equipment to be used for the proposed granite mining operations to be developed in the ML No. 121:

- Excavators, wheel-loaders, forklift loaders, diesel generator sets, four-cylinder mining machines, wire saw machines, semi-automatic drilling machines, containers, trucks, 4 by 4 vehicles, and air-compressors.

2.4.3 Transporting Dimension Stone

Once the granite is removed from the quarry, the blocks will be examined for quality. All the granite of a particular colour will be placed together. Cracks and impurities will be eliminated from the granite. The granite blocks will then be transported to the processing plant or customer by truck or rail.

2.4.4 Forming Dimension Stone

Once the granite arrives at the processing plant, each block will be set up so that different pieces of granite can be cut out of the larger blocks. A giant saw will be used to cut up the granite into more manageable pieces. It can take up to a week to cut the granite enough to break into usable sections. The person running the giant saw has to be very skilled at his /her job because the different qualities of rock can change the way the saw cuts into the granite.

Plate 2.1: Overhead drone image view of the granite in the ML No. 120 showing the granite blocks extraction / operational faces.

Plate 2.2: Drone image showing the eastern view of the working / extraction faces and floors and extracted small 2 m x1 m x 0,6 m (majority), and larger blocks 2,8 m x 1 ,3 x 0,8 m (minority) rectangular blocks at a granite quarry in the ML No. 120.

Plate 2.3: Drone image showing the eastern view of the working / extraction face and extracted materials at a granite quarry in the ML No. 120 with the workshop area in the background.

Plate 2.4: Drone image showing the southwestern view of a working / extraction face at a granite quarry in the ML No. 123.

Plate 2.5: Drone image showing the south view of a working / extraction face at a granite quarry in the ML No. 123 with the workshop area in the background.

Plate 2.6: Extracted small 2 m x 1 m x 0,6 m (majority), and larger blocks 2,8 m x 1 ,3 x 0,8 m (minority) rectangular blocks stockpiled and sorted before being transported to the plant for final processing.

Plate 2.7: Extraction \ mining face of the rectangular blocks, stockpiled and sorted before being transported to the plant for final processing.

Plate 2.8: Giant saw used the in the extraction of the granite blocks.

2.4.5 Final Processing and Polishing Dimension Stone

During the processing stage, the granite will be cut into more usable shapes. This may involve running through epoxy and other treatment processes followed by polishing processes to make it usable. The granite is cut into different shapes for different tasks. Some of the most common types of granite products include: sculpture granite, granite tiles, countertop granites and others. Finally, the granite is shipped to different places where it can be sold locally and internationally (export).

2.4.6 Ongoing Rehabilitation

The ongoing rehabilitation will be undertaken during the operational phase of the mine and will be funded from the annual ongoing operational budget. The Proponent will undertake ongoing rehabilitation activities as soon as possible on land that is no longer needed for current or future operational requirements inclusive of all excavation and ongoing exploration footprints/ scars.

2.5 Mine Closure, Decommissioning, Rehabilitation and Aftercare

2.5.1 Overview

In line with the new regulatory requirements by the Ministry of Mines and Energy (MME), a Mine Closure Plan will be required to be submitted to the regulators. The Mine Closure shall provide a detailed plan of actions and commitments including financial and human resources for effective management of the likely environmental liabilities at mine closure and aftercare stages of the proposed mining and ongoing activities in the ML No. 121. Regular assessments and evaluation of the environmental liabilities during the mining stage shall be undertaken to ensure that adequate provision of the necessary resources towards good environmental management at mine closure and aftercare stages. The following is the summary of the activities to be associated with the mine closure and aftercare stages:

1. Implementation of sustainable socioeconomic plan.
2. Closure of open pits.
3. Closure of solid waste transfer station.
4. Backfill all excavated areas.
5. Closure of the mined blocks storage area.
6. Decommissioning of water and electricity infrastructure.
7. Overall land reclamation and restoration of internal roads, and.
8. Revegetation and aftercare as may be required.

2.5.2 Mine Closure Plan

The Mine Closure Plan activities shall consist of following five (5) steps that will be implemented by Proponent and where applicable in consultation with the key stakeholders:

(i) Ongoing rehabilitation: This will be implemented during the exploration phase and from day one (1) of the mine starting to produce coupled with the recruitment of a new workforce. Unwanted exploration and mine sites excavated or disturbed during the mine operation phase will not wait the final mine closure rehabilitation but will be attended to as ongoing activities and financed within an ongoing annual mine operational budget allocation to be detailed in the Mine Closure Plan Report.

(ii) Mine closure: Once production stops, the number of workers will be reduced and a small labour force will be retained to permanently shut down the mine. The mining company may have to provide re-training or early retirement options to their workers before the mine is closed. The

cost of the re-skilling, early retirement and retrenchments will be funded from the final Mine Closure Plan budget allocations to be detailed in the Mine Closure Plan Report.

(iii) Decommissioning: Will be undertaken by a small crews or contractors who will be responsible for decommissioning or taking apart the mining supporting infrastructure and equipment. Pipelines will be drained, equipment and valuable parts will be cleaned and may be sold, buildings will be repurposed or demolished, warehouse materials will be recovered, and waste will be disposed of. The cost of the decommissioning will be funded from the final Mine Closure Plan budget allocations to be detailed in the Mine Closure Plan Report.

(iv) Final rehabilitation\Remediation\reclamation: The objective of reclamation will be to return the Mining License (ML) area to an acceptable standard of socioeconomic use, ensuring that any landforms and structures are stable, and any watercourses are of acceptable water quality. Reclamation will involve a number of activities such as removal of any hazardous materials, reshaping the land, restoring topsoil, and planting native grasses, trees, or ground cover as may be applicable. The cost of the remediation/reclamation will be funded from the final Mine Closure Plan budget allocations to be detailed in the Mine Closure Plan Report, and.

(v) Post-closure and aftercare including monitoring: Monitoring programmes will be used to assess the effectiveness of the reclamation measures and to identify any corrective action that may be needed during the post closure and aftercare stage. In addition, the project area (ML No. 121) will also require long-term care and maintenance after mine closure such as periodic monitoring and maintenance of waste rock containment structures and secured hazardous areas, and monitoring any ongoing remediation technologies that have been implemented. The aftercare period will run for period of between two (2) to five (5) years or as may be agreed with the stakeholders especially the land owners and relevant Government regulators such as MME, MEFT and MAWLR. The cost for post-closure and aftercare will be funded from the final Mine Closure Plan budget allocations to be detailed in the Mine Closure Plan Report.

3. LEGISLATIVE FRAMEWORK

3.1 Overview

There are four sources of law in Namibia: (1) statutes (2) common law (3) customary law and (4) international law. These four kinds of law are explained in more detail in the other factsheets in this series. The constitution is the supreme law of Namibia. All other laws must be in line with it. The most important legislative instruments and associated permits\licenses\authorisations\concerts\ compliances applicable to the ongoing mining and exploration activities include: Minerals exploration and mining, environmental management, land rights, water, atmospheric pollution prevention and labour as well as other indirect laws linked to the accessory services of exploration and possible test mining operations.

3.2 Key Applicable Legislation

3.2.1 Minerals Exploration and Mining Legislation

The national legislation governing minerals prospecting and mining activities in Namibia fall within the jurisdiction of the Ministry of Mines and Energy (MME) as the Competent Authority (CA) responsible for granting authorisations. The Minerals (Prospecting and Mining) Act (No 33 of 1992) is the most important legal instrument governing minerals prospecting and mining activities in Namibia. A new Bill, to replace the Minerals (Prospecting and Mining) Act (No 33 of 1992) is being prepared and puts more emphasis on good environmental management practices, local participation in the mining industry and promotes value addition as prescribed in the Minerals Policy of 2003.

The Minerals (Prospecting and Mining) Act (No 33 of 1992) regulates reconnaissance, prospecting (exploration) and mining activities. The Mining Commissioner, appointed by the Minister, is responsible for implementing the provisions of this Act including reporting requirements, environmental obligations as well as the associated regulations such as the Health and Safety Regulations.

3.2.2 Environmental Management Legislation

The Environmental Assessment (EA) process in Namibia is governed by the Environmental Impact Assessment (EIA) Regulations No. 30 of 2012 gazetted under the Environmental Management Act, (EMA), 2007, (Act No. 7 of 2007) in the Ministry of Environment, Forestry and Tourism (MEFT). The objectives of the Act and the Regulations are, among others, to promote the sustainable management of the environment and the use of natural resources to provide for a process of assessment and control of activities which may have significant effects on the environment. The Minister of Environment, Forestry and Tourism (is authorised to list activities which may only be undertaken if an environmental clearance certificate has been issued by the environmental commissioner, which activities include those relating to exploration and mining operations.

In addition to the requirements for undertaking Environmental Assessment prior to the project implementation, the Environmental Management Act and the EIA Regulations also provide for obligations of a license holder to provide for project rehabilitation and closure plan. In the regulations, the definition of “rehabilitation and closure plan” is a plan which describes the process of rehabilitation of an activity at any stage of that activity up to and including closure stage.

3.2.3 Water Legislation

Water Act 54 of 1956 under the Minister of Agriculture, Water and Land Reform (MAWLR) provides for the control, conservation and use of water for domestic, agricultural, urban and industrial purposes. In terms of Section 6, there is no right of ownership in public water and its control and use is regulated and provided for in the Act. In accordance with the Act, the ongoing exploration must ensure that mechanisms are implemented to prevent water pollution. Certain permits will also be required to abstract groundwater as well as for “water works”. The broad definition of water works will include the reservoir on site (as this is greater than 20,000m^3), water treatment facilities and pipelines. Due to the water scarcity of the area, all water will be recycled (including domestic wastewater). The Act requires the license holder to have a wastewater discharge permit for discharge of effluent.

The Water Act 54 of 1956 is due to be replaced by the Water Resources Management Act 24 of 2004 which is currently being revised. The Water Resource Management Act 2004 *provides for the management, development, protection, conservation and use of water resources.*

3.2.4 Atmospheric Pollution Prevention Legislation

The Atmospheric Pollution Prevention Ordinance, 11 of 1976 falling under the Ministry of Health and Social Services (MHSS) provide for the prevention of the pollution of the atmosphere, and for matters incidental thereto. Part III of the Act sets out regulations pertaining to atmospheric pollution by smoke. While preventative measures for dust atmospheric pollution are outlined in Part IV and Part V outlines provisions for Atmospheric pollution by gases emitted by vehicles.

3.2.5 Labour, Health and Safety Legislations

The Labour Act, 1992, Act No. 6 of 1992 as amended in the Labour Act, 2007 (Act No. 11 of 2007), falling under the Ministry of Labour, Industrial Relations and Employment Creation (MLIREC) makes reference to severance allowances for employees on termination of a contract of employment in certain circumstances and health, safety and welfare of employees.

In terms of the Health Safety and Environment (HSE), the Labour Act, 2007 protects employees and every employer shall, among other things: provide a working environment that is safe, without risk to the health of employees, and that has adequate facilities and arrangements for the welfare of employees, provide and maintain plant, machinery and systems of work, and work processes, that are safe and without risk to the health of employees, and ensure that the use, handling, storage or transportation of hazardous materials or substances is safe and without risk to the health of employees. All hazardous substances shall have clear exposure limits and the employer shall provide medical surveillance, first-aid and emergency arrangements as fit for the operation.

3.2.6 Other Applicable National Legislations

Other Important legislative instruments applicable to the proposed and ongoing mining and exploration operations in the ML No. 121 include the following (Table 3.1):

- Explosives Act 26 of 1956 (as amended in SA to April 1978) – Ministry of Home Affairs, Immigration, Safety and Security (MHAISS).
- National Heritage Act 27 of 2004 – Ministry of Education, Arts and Culture (MEAC).
- Petroleum Products and Energy Act 13 of 1990 – Ministry of Mines and Energy (MME).
- Nature Conservation Ordinance, No. 4 of 1975 – Ministry of Environment, Forestry and Tourism (MEFT).
- Forest Act 12 of 2001 – Ministry of Environment, Forestry and Tourism (MEFT).
- Hazardous Substances Ordinance 14 of 1974 – Ministry of Health and Social Services (MHSS), and.
- Public Health Act 36 of 1919 – Ministry of Health and Social Services (MHSS).

Table 3.1 summarises the key selected legislations relevant applicable to the ongoing exploration in the ML No. 121.

Table 3.1: Legislation relevant to the proposed and ongoing mining and exploration operations in the ML No. 121.

LAW	SUMMARY DESCRIPTION
Constitution of the Republic of Namibia, 1990	The Constitution is the supreme law in Namibia, providing for the establishment of the main organs of state (the Executive, the Legislature, and the Judiciary) as well as guaranteeing various fundamental rights and freedoms. Provisions relating to the environment are contained in Chapter 11, article 95, which is entitled "promotion of the Welfare of the People". This article states that the Republic of Namibia shall – "Actively promote and maintain the welfare of the people by adopting, inter alia, policies aimed at … maintenance of ecosystems, essential ecological processes and biological diversity of Namibia and utilisation of living natural resources on a sustainable basis for all Namibians, both present and future. The Government shall provide measures against the dumping or recycling of foreign nuclear waste on Namibian territory."
Minerals (Prospecting and Mining) Act, 1992 ***Ministry of Mines and Energy (MME)***	The Minerals Act governs minerals prospecting and mining. The Act *provides for the reconnaissance, prospecting, and mining for, and disposal of, and the exercise of control over minerals in Namibia. and to provide for matters incidental thereto. A new Minerals Bills is currently under preparation.*
Environmental Management Act (2007) - ***Ministry of Environment, Forestry and Tourism*** **(MEFT)**	The purpose of the Act is *to give effect to Article 95(l) and 91(c) of the Namibian Constitution by establishing general principles for the management of the environment and natural resources. to promote the co-ordinated and integrated management of the environment. to give statutory effect to Namibia's Environmental Assessment Policy. to enable the Minister of Environment and Tourism to give effect to Namibia's obligations under international conventions*. In terms of the legislation, it will be possible to exercise control over certain listed development activities and activities within defined sensitive areas. The listed activities in sensitive areas require an Environmental Assessment to be completed before a decision to permit development can be taken. The legislation describes the circumstances requiring Environmental Assessments. Activities listed as per the provisions of the Act will require Environmental Assessment unless the Ministry of Environment, Forestry and Tourism, in consultation with the relevant Competent Authority, determines otherwise and approves the exception.
Water Act 54 of 1956 **Minister of Agriculture, Water and Land reform (MAWLR)**	This Act provides for the control, conservation and use of water for domestic, agricultural, urban, and industrial purposes. In terms of Section 6, there is no right of ownership in public water and its control and use is regulated and provided for in the Act. In accordance with the Act, the proposed project must ensure that mechanisms are implemented to prevent water pollution. Certain permits will also be required to abstract groundwater (already obtained) as well as for "water works". The broad definition of water works will include the reservoir on Site (as this is greater than 20,000m^3), water treatment facilities and pipelines. Due to the water scarcity of the area, all water will be recycled (including domestic wastewater) and the Mine will be operated on a zero-discharge philosophy. It will, therefore, not be necessary to obtain permits for discharge of effluent. Section 23 of the Act requires environment rehabilitation after closure of the Mine, particularly, in this instance to obviate groundwater pollution and potential pollution resulting from run-off. This Act is due to be replaced by the Water Resources Management Act 24 of 2004.
Forest Act 12 of 2001 - **Minister of Environment, Forestry and Tourism (MEFT)**	The Act provide for the establishment of a Forestry Council and the appointment of certain officials. to consolidate the laws relating to the management and use of forests and forest produce. to provide for the protection of the environment and the control and management of forest fires. Under Part IV Protection of the environment, Section 22(1) of the Act, it is unlawful for any person to: cut, destroy, or remove: (a) any vegetation which is on a sand dune or drifting sand or in a gully unless the cutting, destruction or removal is done for the purpose of stabilising the sand or gully or (b) any living tree, bush or shrub growing within 100m of a river, stream, or watercourse. Should either of the above be unavoidable, it will be necessary to obtain a permit from the Ministry. Protected tree species as listed in the Regulations shall not be cut, destroyed, or removed.
Hazardous Substance Ordinance 14 of 1974 ***Ministry of Health and Social Services***	Provisions for hazardous waste are amended in this act as it provides "*for the control of substances which may cause injury or ill-health to or death of human beings by reason of their toxic, corrosive, irritant, strongly sensitizing or flammable nature or the generation of pressure thereby in certain circumstances. to provide for the prohibition and control of the importation, sale, use, operation, application, modification, disposal or dumping of such substance. and to provide for matters connected therewith"*

Table 3.1: *Cont.*

Agricultural (Commercial) Land Reform Act, 1995, Act No.6 of 1995 ***Ministry of Agriculture, Water and Land Reform*** **(MAWLR)**	This Act provide for the acquisition of agricultural land by the State for the purposes of land reform and for the allocation of such land to Namibian citizens who do not own or otherwise have the use of any or of adequate agricultural land, and foremost to those Namibian citizens who have been socially, economically or educationally disadvantaged by past discriminatory laws or practices. to vest in the State a preferent right to purchase agricultural land for the purposes of the Act. to provide for the compulsory acquisition of certain agricultural land by the State for the purposes of the Act. to regulate the acquisition of agricultural land by foreign nationals. to establish a Lands Tribunal and determine its jurisdiction. and to provide for matters connected therewith.
Explosives Act 26 of 1956 (as amended in SA to April 1978) - ***Ministry Home Affairs, Immigration, Safety and Security (MHAISS)***	All explosive magazines are to be registered with the Ministry of Mines and Energy as accessory works. In addition, the magazines must be licensed as required by Section 22. The quantity of explosives and the way it is stored must be approved by an inspector. The inspector has powers to enter the premises at any time to conduct inspections regarding the nature of explosive, quantity and the way it is stored. At closure, all explosives are to be disposed of accordingly.
Atmospheric Pollution Prevention Ordinance 11 of 1976. ***Ministry of Health and Social Services (MHSS)***	This regulation sets out principles for *the prevention of the pollution of the atmosphere and for matters incidental thereto.* Part III of the Act sets out regulations pertaining to atmospheric pollution by smoke. While preventative measures for dust atmospheric pollution are outlined in Part IV and Part V outlines provisions for Atmospheric pollution by gases emitted by vehicles.
The Nature Conservation Ordinance, Ordinance 4 of 1975, ***Ministry of Environment, Forestry and Tourism*** **(MEFT)**	During the Mine's activities, care must be taken to ensure that protected plant species and the eggs of protected and game bird species are not disturbed or destroyed. If such destruction or disturbance is inevitable, a permit must be obtained in this regard from the Minister of Environment and Tourism. Should the Proponent operate a nursery to propagate indigenous plant species for rehabilitation purposes, a permit will be required. At this stage, however, it is envisaged that this type of activity will be contracted out to encourage small business development.
Labour Act, 1992, Act No. 6 of 1992 as amended in the Labour Act, 2007 (Act No. 11 of 2007 **Ministry of Labour, Industrial Relations and Employment Creation (MLIREC)**	The labour Act gives effect to the constitutional commitment of Article 95 (11), to promote and maintain the welfare of the people. This Act is aimed at establishing *a comprehensive labour law for all employees. to entrench fundamental labour rights and protections. to regulate basic terms and conditions of employment. to ensure the health, safety and welfare of employees* under which provisions are made in chapter 4. *Chapter* 5 of the act improvises on the *protection of employees from unfair labour practice.*
Petroleum Products and Energy Act 13 of 1990 ***Ministry of Mines and Energy (MME)***	Any consumer installation as envisaged in this Act must be licensed. Appropriate consumer installation certificate will need to be obtained from the Ministry for each fuel installation. The construction of the installation must be designed in such a manner as to prevent environmental contamination. Any certificate holder or other person in control of activities related to any petroleum product is obliged to report any major petroleum product spill (defined as a spill of more than 200ℓ per spill) to the Minister. Such person is also obliged to take all steps as may be necessary in accordance with good petroleum industry practices to clean up the spill. Should this obligation not be met, the Minister is empowered to take steps to clean up the spill and to recover the costs thereof from the person. General conditions apply to all certificates issued. These include conditions relating to petroleum spills and the abandonment of the Site. The regulation further provides that the Minister may impose special conditions relating to the preparation and assessment of environmental assessments and the safe disposal of petroleum products.
National Heritage Act 27 of 2004 ***Ministry of Education, Arts and Culture (MEAC)***	This Act provides provisions for the protection and conservation of places and objects of heritage significance and the registration of such places and objects. The proposed activities will ensure that if any archaeological or paleontological objects, as described in the Act, are found during the implementation of the activities, such a find shall be reported to the Ministry immediately. If necessary, the relevant permits must be obtained before disturbing or destroying any heritage

3.3 Key Regulators / Competent Authorities

The environmental regulatory authorities responsible for environmental protection and management in relation to the proposed project including their role in regulating environmental protection are listed in Table 3.2.

Table 3.2: Government agencies regulating environmental protection in Namibia.

AGENCY	RESPONSIBILITY
Ministry of Environment, Forestry and Tourism (MEFT)	Issue of Environmental Clearance Certificate (ECC) based on the review and approval of the Environmental Assessments (EA) reports comprising Environmental Scoping, Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) prepared in accordance with the Environmental Management Act (2007) and the Environmental Impact Assessment Regulations, 2012
Ministry of Mines and Energy (MME)	The competent authority for minerals prospecting and mining activities in Namibia. Issues Exclusive prospecting License (EPL), Mining Licenses (ML) and Mining Claims (license) as well as all other minerals related permits for processing, trading and export of minerals resources
Ministry of Agriculture, Water and Land Reform (MAWLR)	The Directorate of Resource Management within the Department of Water Affairs (DWA) at the MAWLR is currently the lead agency responsible for management of surface and groundwater utilisation through the issuing of abstraction permits and waste water disposal permits. DWA is also the Government agency responsible for water quality monitoring and reporting. The National Botanical Research Institute's (NBRI) mandate is to study the flora and vegetation of Namibia, in order to promote the understanding, conservation and sustainable use of Namibia's plants for the benefit of all. The Directorate of Forestry (DOF) is responsible for issuing of forestry permits with respect to harvest, transport, and export or market forest resources.

3.4 International and Regional Treaties and Protocols

Article 144 of the Namibian Constitution provides for the enabling mechanism to ensure that all international treaties and protocols are ratified. All ratified treaties and protocols are enforceable within Namibia by the Namibian courts and these include the following:

- The Paris Agreement, 2016.
- Convention on Biological Diversity, 1992.
- Vienna Convention for the Protection of the Ozone Layer, 1985.
- Montreal Protocol on Substances that Deplete the Ozone Layer, 1987.
- United Nations Framework Convention on Climate Change, 1992.
- Kyoto Protocol on the Framework Convention on Climate Change, 1998.
- Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and Their Disposal, 1989.
- World Heritage Convention, 1972.
- Convention to Combat Desertification, 1994. and
- Stockholm Convention of Persistent Organic Pollutants, 2001.
- Southern Africa Development Community (SADC) Protocol on Mining, and.
- Southern Africa Development Community (SADC) Protocol on Energy.

3.5 Standards and Guidelines

Industrial effluent likely to be generated by the proposed activities must comply with provisions of the Government Gazette No 217 dated 5 April 1962 (Table 3.3) while the drinking water quality comparative guideline values are shown in Table 3.4.

The only key missing components to the regulatory frameworks in Namibia are the standards, and guidelines with respect to gaseous, liquid, and solid emissions. However, in the absence of national gaseous, liquid, and solid emission limits for Namibia, the proposed project shall target the Multilateral Investment Guarantee Agency (MIGA) gaseous effluent emission level and liquid effluent emission levels (Table 3.5).

Noise abatement measures must target to achieve either the levels shown in Table 3.6 or a maximum increase in background levels of 3 dB (A) at the nearest receptor location off-site (MIGA guidelines).

Table 3.3: R553 Regional Standards for Industrial Effluent, in Government Gazette No 217 dated 5 April 1962.

Colour, odour and taste	The effluent shall contain no substance in concentrations capable of producing colour, odour or taste	
pH	Between 5.5 and 9.5	
Dissolved oxygen	At least 75% saturation	
Typical faecal coli	No typical faecal coli per 100 ml	
Temperature	Not to exceed 35 °C	
Chemical demand oxygen	Not to exceed 75 mg/l after applying a correction for chloride in the method	
Oxygen absorbed	Not to exceed 10 mg/l	
Total dissolved solids (TDS)	The TDS shall not have been increased by more than 500 mg/l above that of the intake water	
Suspended solids	Not to exceed 25 mg/l	
Sodium (Na)	The Na level shall not have been increased by more than 50 mg/l above that of the intake water	
Soap, oil and grease	Not to exceed 2.5 mg/l	
Other constituents	Residual chlorine	0,1 mg/l as Cl
	Free & saline ammonia	10 mg/l as N
	Arsenic	0,5 mg/l as As
	Boron	1,0 mg/l as B
	Hexavalent Cr	0,05 mg/l as Cr
	Total chromium	0,5 mg/l as Cr
	Copper	1,0 mg/l as Cu
	Phenolic compounds	0,1 mg/l as phenol
	Lead	1,0 mg/l as Pb
	Cyanide and related compounds	0,5 mg/l as CN
	Sulphides	1,0 mg/l as S
	Fluorine	1,0 mg/l as F
	Zinc	5,0 mg/l as Zn

Table 3.4: Comparison of selected guideline values for drinking water quality (after Department of Water Affairs, 2001).

Parameter and Expression of the results			WHO Guidelines for Drinking-Water Quality 2nd edition 1993		Proposed Council Directive of 28 April 1995 (95/C/13-1/03) EEC	Council Directive of 15 July 1980 relating to the quality intended for human consumption 80/778/EEC		U.S. EPA Drinking water Standards and Health Advisories Table December 1995	Namibia, Department of Water Affairs Guidelines for the evaluation of drinking-water for human consumption with reference to chemical, physical and bacteriological quality July 1991			
			Guideline Value (GV)		Proposed Parameter Value	Guide Level (GL)	Maximum Admissible Concentration (MAC)	Maximum Contaminant Level (MCL)	Group A Excellent Quality	Group B Good Quality	Group C Low Health Risk	Group D Unsuitable
Temperature	t	°C		-	-	12	25		-	-	-	-
Hydrogen ion concentration	pH, 25° C	-	R	<8.0	6.5 to 9.5	6.5 to 8.5	10		-	6.0 to 9.0	5.5 to 9.5	4.0 to 11.0	<4.0 to >11.0
Electronic conductivity	EC, 25° C	mS/m		-	280	45	-		-	150	300	400	>400
Total dissolved solids	TDS	mg/l	R	1000	-	-	1500		-	-	-	-	-
Total Hardness	$CaCO_3$	mg/l		-	-	-	-		-	300	650	1300	>1300
Aluminium	Al	µ g/l	R	200	200	50	200	S	50-200	150	500	1000	>1000
Ammonia	NH_4^+	mg/l	R	1.5	0.5	0.05	0.5		-	1.5	2.5	5.0	>5.0
	N	mg/l		1.0		0.04	0.4		-	1.0	2.0	4.0	>4.0
Antimony	Sb	µ g/l	P	5	3	-	10	C	6	50	100	200	>200
Arsenic	As	µ g/l		10	10	-	50	C	50	100	300	600	>600
Barium	Ba	µ g/l	P	700	-	100	-	C	2000	500	1000	2000	>2000
Berylium	Be	µ g/l		-	-	-	-	C	4	2	5	10	>10
Bismuth	Bi	µ g/l		-	-	-	-		-	250	500	1000	>1000
Boron	B	µ g/l		300	300	1000	-		-	500	2000	4000	>4000
Bromate	BrO_3^-	µ g/l		-	10	-	-	P	10	-	-	-	-
Bromine	Br	µ g/l		-	-	-	-		-	1000	3000	6000	>6000
Cadmium	Cd	µ g/l		3	5	-	5	C	5	10	20	40	>40
Calcium	Ca	mg/l		-	-	100	-		-	150	200	400	>400
	$CaCO_3$	mg/l		-	-	250	-		-	375	500	1000	>1000
Cerium	Ce	µ g/l		-	-	-	-		-	1000	2000	4000	>4000
Chloride	Cl^-	mg/l	R	250	-	25	-	S	250	250	600	1200	>1200
Chromium	Cr	µ g/l	P	50	50	-	50	C	100	100	200	400	>400
Cobalt		µ g/l		-	-	-	-		-	250	500	1000	>1000
Copper after 12 hours in pipe	Cu	µ g/l	P	2000	2	100	-	C	TT##	500	1000	2000	>2000
		µ g/l		-	-	3000[1]	-	S	1000	-	-	-	-
Cyanide	CN^-	µ g/l		70	50	-	50	C	200	200	300	600	>600
Fluoride	F^-	mg/l		1.5	1.5	-	at 8 to 12 ºC: 1.5	C	4	1.5	2.0	3.0	>3.0
		mg/l		-	-	-	at 25 to 30 ºC: 0.7	P,S	2	-	-	-	-
Gold	Au	µ g/l		-	-	-	-		-	2	5	10	>10
Hydrogen sulphide	H_2S	µ g/l	R	50	-	-	undetectable		-	100	300	600	>600
Iodine	I	µ g/l		-	-	-	-		-	500	1000	2000	>2000
Iron	Fe	µ g/l	R	300	200	50	200	S	300	100	1000	2000	>2000
Lead	Pb	µ g/l		10	10	-	50	C	TT#	50	100	200	>200
Lithium	Li	µ g/l		-	-	-	-		-	2500	5000	10000	>10000
Magnesium	Mg	mg/l		-	-	30	50		-	70	100	200	>200
	$CaCO_3$	mg/l		-	-	7	12		-	290	420	840	>840
Manganese	Mn	µ g/l	P	500	50	20	50	S	50	50	1000	2000	>2000
Mercury	Hg	µ g/l		1	1	-	1	C	2	5	10	20	>20
Molybdenum	Mo	µ g/l		70	-	-	-		-	50	100	200	>200
Nickel	Ni	µ g/l		20	20	-	50		-	250	500	1000	>1000
Nitrate*	NO_3^-	mg/l	P	50	50	25	50		45	45	90	180	>180
	N	mg/l		-	-	5	11	C	10	10	20	40	>40
Nitrite*	NO_2^-	mg/l		3	0.1	-	0.1		3	-	-	-	-
	N	mg/l		-	-	-		C	1	-	-	-	-
Oxygen, dissolved	O_2	% sat.		-	50	-	-		-	-	-	-	-
Phosphorus	P_2O_5	µ g/l		-	-	400	5000		-	-	-	-	-
	PO_4^{3-}	µ g/l		-	-	300	3350		-	-	-	-	-
Potassium	K	mg/l		-	-	10	12		-	200	400	800	>800
Selenium	Se	µ g/l		10	10	-	10	C	50	20	50	100	>100
Silver	Ag	µ g/l		-	-	-	10	S	100	20	50	100	>100
Sodium	Na	mg/l	R	200	-	20	175		-	100	400	800	>800
Sulphate	SO_4^{2-}	mg/l	R	250	250	25	250	S	250	200	600	1200	>1200
Tellurium	Te	µ g/l		-	-	-	-		-	2	5	10	>10
Thallium	Tl	µ g/l		-	-	-	-	C	2	5	10	20	>20
Tin	Sn	µ g/l		-	-	-	-		-	100	200	400	>400
Titanum	Ti	µ g/l		-	-	-	-		-	100	500	1000	>1000
Tungsten	W	µ g/l		-	-	-	-		-	100	500	1000	>1000
Uranium	U	µ g/l		-	-	-	-	P	20	1000	4000	8000	>8000
Vanadium	V	µ g/l		-	-	-	-		-	250	500	1000	>1000
Zinc after 12 hours in pipe	Zn	µ g/l	R	3000	-	100	-	S	5000	1000	5000	10000	>10000
		µ g/l		-	-	5000	-		-	-	-	-	-
			P: Provisional R: May give reason to complaints from consumers					C: Current. P: Proposed. S: Secondary. T#: Treatment technique in lieu of numeric MCL. TT##: treatment technique triggered at action level of 1300 µ g/l				

Table 3.5: Liquid effluent emission levels (MIGA /IFC).

Pollutant	**Max. Value**
pH	6-9
Total suspended solids	50 mg/l
Total metals	10 mg/l
Phosphorous (P)	5 mg/l
Fluoride (F)	20 mg/l
Cadmium (Cd)	0.1 mg/l

Table 3.6: Noise emission levels (MIGA /IFC).

	Maximum Allowable Leq (hourly), in dB(A)	
Receptor	Day time (07:00 – 22:00)	Night time (22:00 – 07:00)
Residential, institutional, educational	55	45
Industrial, commercial	70	70

3.6 Recommendations on Permitting Requirements

It is hereby recommended that the Proponent must follow the provisions of all relevant national regulatory throughout the proposed project lifecycle and must obtain the following permits/ authorisations as may be applicable / required as the proposed project develops:

(i) Valid ML No. 121 as may be applicable from Department of Mines in the MME.

(ii) Valid ECC from the Department of Environmental Affairs in the MEFT.

(iii) The Proponent shall apply for a fresh water abstraction and waste water discharge permits from the Department of Water Affairs (DWA) in the MAWLR before drilling a water borehole and discharge wastewater into the environment respectively, and.

(iv) All other permits as may be become applicable to the proposed and ongoing mining and exploration operations.

4. RECEIVING ENVIRONMENT

4.1 Regional Physical Geography

The proposed project area falls within the Erongo Region in the central western part of Namibia. On the Western part of the region is the Atlantic Ocean with Ugab River in the North and Kuiseb River as the southern boundary (Ministry of Mines and Energy (MME), 2010). The Namib Desert borders the Namibian coastline with Atlantic Ocean and stretching inwards to about 120-150 km. The Topography of land rises steadily from about 1000 mamsl (meters above mean sea level) across the Namib Desert. Most of the land within Namib Desert is flat to undulating gravel plains, with occasional ridges and isolated inselberg hills and mountains. In the far north of the Erongo Region lies the Brandberg at a highest peak of 2579 mamsl, making it the country's highest mountain.

The ML area falls within the western edge Great Escarpment. The area is characterised by relatively flat topography, with the exception of local ridges and hills where more competent rocks occur, forming conspicuous topographic elevated surface expressions. Small, ephemeral rivers that flow only when it rains and dry most of the year dominate the general drainage. The local topographic profile ranges from 400 to 550 mamsl the north-eastern and northwest portions of the ML area respectively (Fig. 4.1).

Ephemeral rivers in Erongo region run through from their inland catchment to seawards direction. These rivers include the Swakop River with its main tributary the Khan River, the Omaruru River, Kuiseb and Ugab River (Fig. 4.2). The surface flows of the ephemeral rivers in the region are short-lived and only their alluvial aquifers provide a source of groundwater. Palaeochannels in the Omaruru River form the underground Omaruru delta also providing a significant source of surface water for the central Namib. There are two water supply schemes in the Kuiseb (Gobabeb) namely, Swartbank and Rooibank.

4.2 Climatic Settings

4.2.1 Overview

The climate patterns of the ML No. 121 and surrounding areas can be characterised as follows and as summarised in Fig. 4.2:

- The rainfall around ML area is less than 50 mm per year. The weather station situated at Rössing Uranium Mine which is in proximity of the proposed project area indicates a mean annual rainfall mainly showers between 30 and 35 mm in the area, while on the upper areas of the Khan River catchment, an average annual rainfall of 400 mm is received.

- Coastal fog that brings moisture in frequent but small amounts, which moderates the heat and moisture extremes on the western side.

- A steep rainfall gradient across the short breadth of the Namib and relatively wetter areas in the eastern part of the region. The rain and fog gradients run in opposite directions, with the zone of low precipitation from both sources in the middle zone.

- The wind regime which includes prominent southerly and south-westerly winds during the summer, and north-easterly winds in the winter that sometimes reach gale force and mobiles the entire desert surface, and.

- The Erongo region has different climate zones running parallel to the coastline four coastal climatic zone including the Coastal Foggy Zone, Middle Desert Zone, Eastern Desert Zone, Pro-Namibian Zone, the escarpment and the Namibian Highlands. The proposed project area is within the Middle Desert Zone.

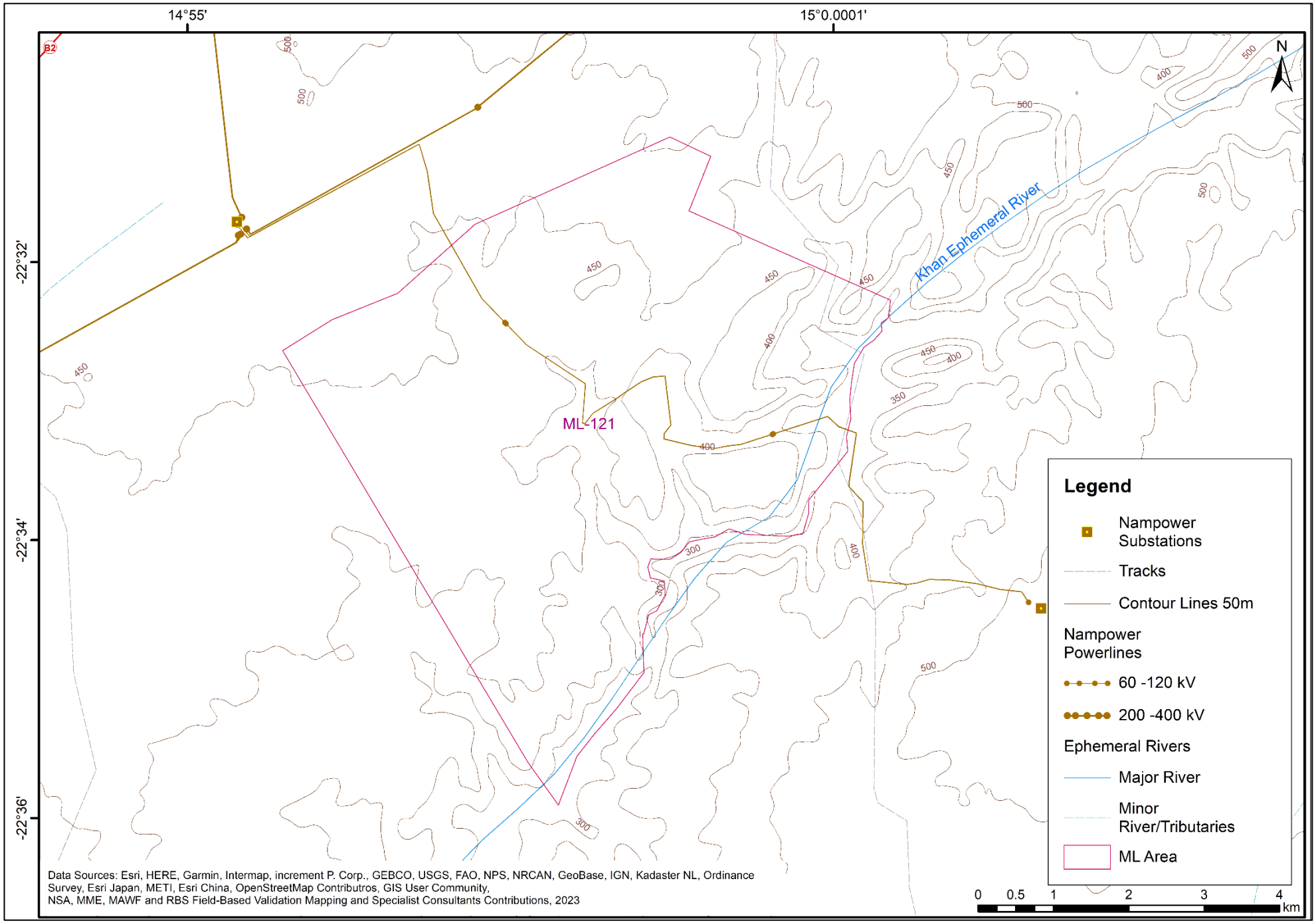

Figure 4.1: Detailed topographic map of the ML No. 121 and surrounding areas.

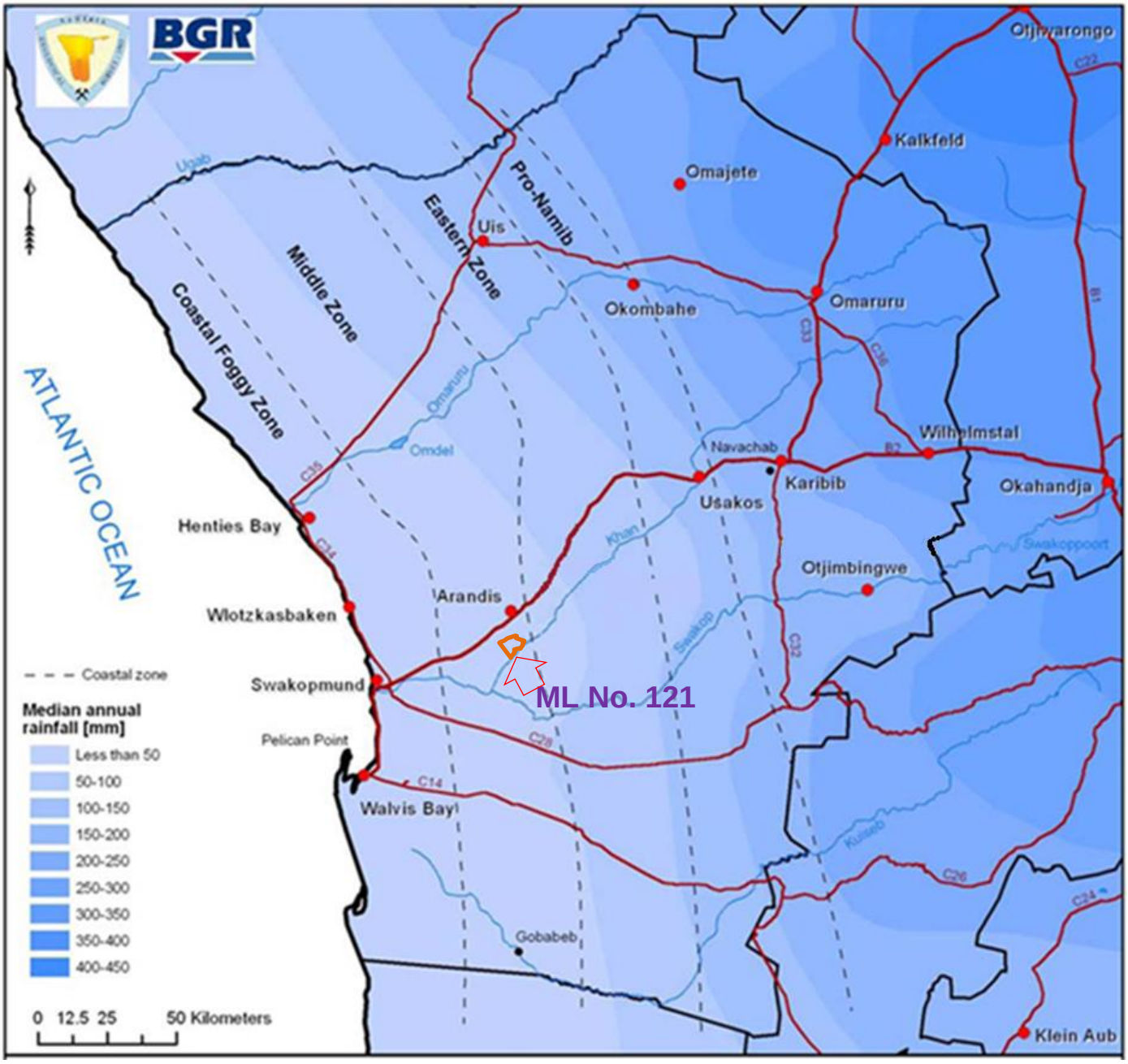

Figure 4.2: Median annual rainfall of central Namib Desert showing the location of the project area, ML No. 121 (Source: Ministry of Mines and Energy (MME), 2010).

4.2.2 Wind Patterns

The Namib Desert is heavily influenced by high pressure systems, the sub continental high and the South Atlantic high. The coastal winds are driven by the South Atlantic high-pressure systems, resulting in strong winds prevailing from the south or south-west (Fig. 4.3). The cold Benguela Current on the Namibian coastline influences the South-westerly winds.

The Stronger winds experienced in the coastal towns and surroundings are mainly north-easterly or east winds. These winds are usually dry and hot with a wind speed of about 27km/hour. This influence is experience to up to 50 days annually between the months of April to September. Within the project area, stronger winds are dominated by the south-westerly or a north-easterly component (Fig. 4.3). The wind is stronger in winter due to high pressure system of inland regions.

Local historical weather data from the Rössing Uranium Mine weather stations situated to the northeast of the ML area is shown in Fig. 4.4.

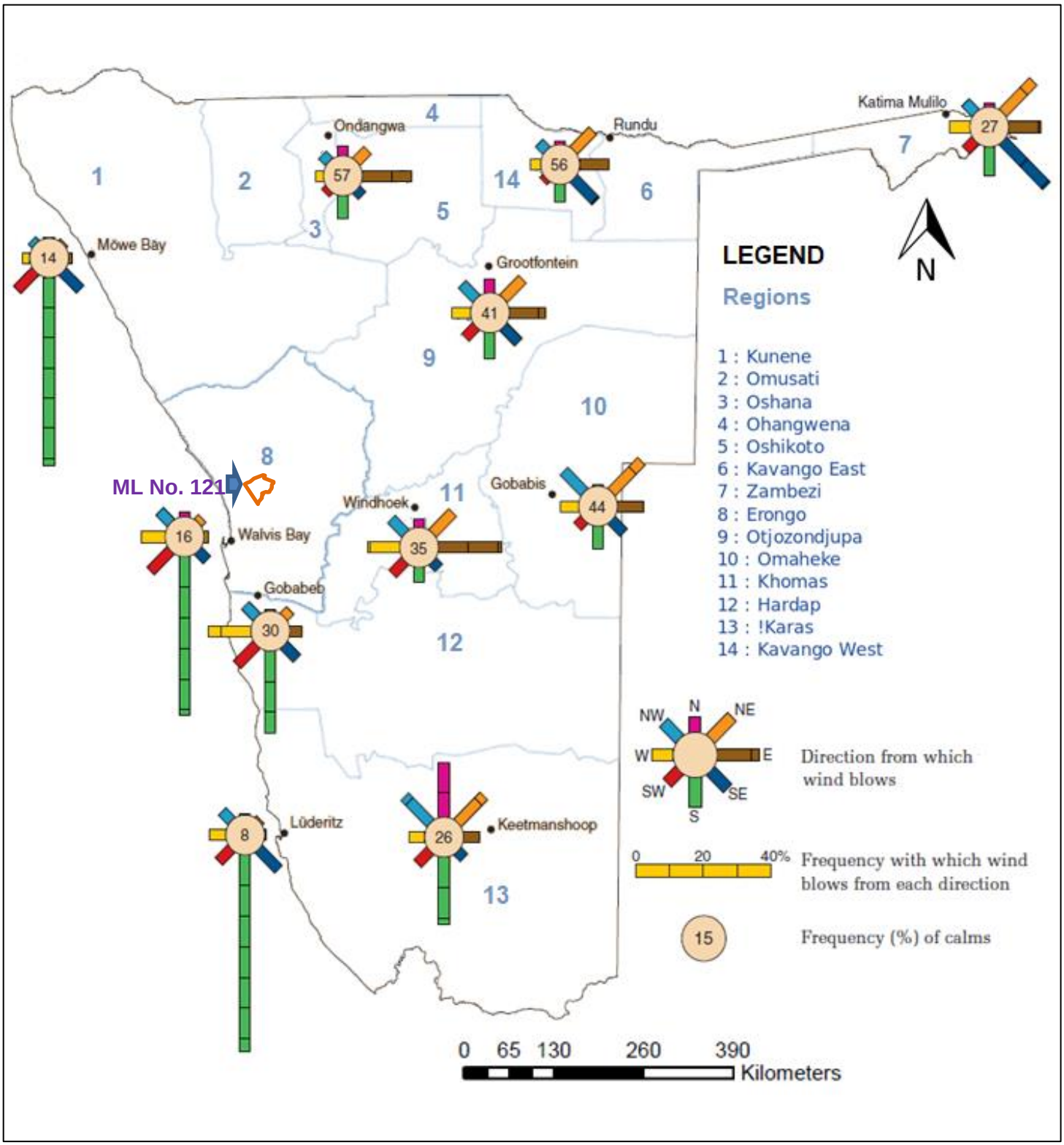

Figure 4.3: Regional wind patterns (Data Source: Directorate of Environmental Affairs, 2002).

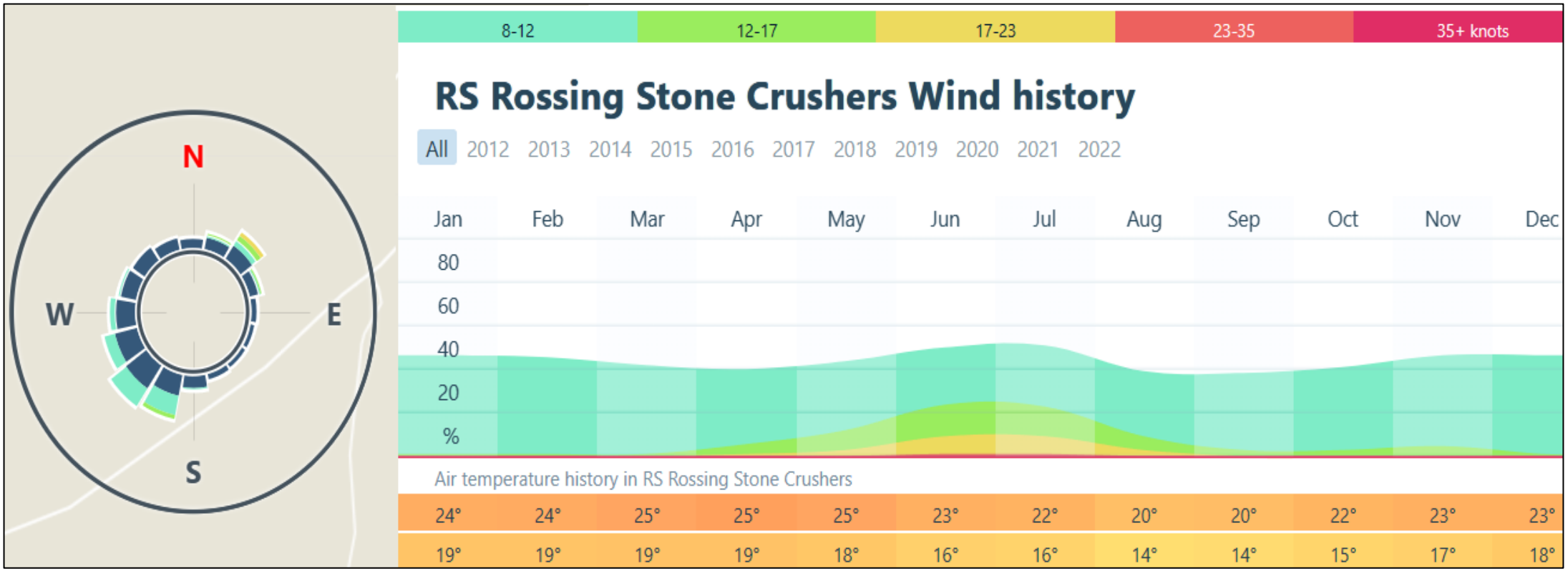

Figure 4.4: Historical weather data from the Rössing Uranium Mine weather stations situated to the northeast of the ML area (Source: https://windy.app/).

4.2.3 Regional and Local Air Quality Assessment

The need for air quality monitoring is important and must be focused on evaluating the likely influence of any pollutant that may be associated with the proposed project activities. Ambient air quality monitoring for suspended particulate matter, sulphur dioxide, and nitrogen oxides should be carried out over a longer period during the operation of the mine. The aim should be to study diurnal and seasonal variation and spatial distribution of said pollutants. Dust fall rate measurements should also be carried out for a period of one month out of each season and for all the four seasons of the year. Mining and associated activities may raise the background levels of particulate pollution in the local area. Movement of mined blocks as well as general vehicles movements and poorly maintained roads are potential sources of particulate pollution in mining operations. Burning of fuel and transportation activities could be among the major sources of SO_2 and NO_x in mining operations.

4.2.4 Noise and Air Emissions

Assessment of baseline and future noise and air emission trends were undertaken as part of the environmental assessment. The main aim of the air quality assessment of the likely impact of the proposed project in the ML No. 121 determined the likely contaminant sources, possible pathways and targets with respect to the likely noise and air quality impacts. The general air quality ranged from 16.61 to 101.88 (mg/m^{2}day) while the noise levels ranged from 59.8 - 76.2 (dBA). The study has found that the existing air quality and noise pollution are below acceptable limit hence following or adopting the proposed recommendations will help to improve compliance during mining operations.

4.2.5 Recommendations on the Climatic Components

Based on the regional climatic data sets and the results, it is likely that a proportion of windblown dust will be generated during the proposed project lifecycle covering exploration, preconstruction, construction, operation, rehabilitation, closure and aftercare stages. Due to the proximity of other mines and quarries in the area, there will be potential for cumulative impacts on the air quality occurring. This is likely to occur when the threshold wind speed of 4.5 m/s is exceeded. The threshold wind speed is dependent on the erosion potential of the exposed surface, which is expressed in terms of availability of erodible material per unit area. Any factor that binds the erodible material will significantly reduce the availability of erodible material on the surface, thus reducing the erosion potential of the surface. Namibia does not have air quality standards. Nonetheless, the Proponent, must aim at reducing hazardous air pollutant (HAPs) emissions to levels that comply with long-term regional (SADC) and international standards air quality guidelines.

4.3 Habitat and Ecosystem

4.3.1 Overview

The ML No. 121 fall in the general area commonly referred to as the Central Namib (Giess 1971) or the Central Desert (Mendelsohn et al. 2002). Locally, the ML area falls within the central desert environmental zone (Fig. 4.5). The vegetation structure is classified as sparse shrubs and grasses with most grasses being annuals (Mendelsohn et al. 2002) with the plains being “normally” bare, but covered with scattered clumps of Mesembryanthemun cryptanthum, Sporobolus nebulosus and Stipagrostis species after rains (Fig. 4.5).

The ML No. 121 fall within the ≠Gaingu Communal Conservancy and the communal land controlled by the !Oe-≠Gân Traditional Authority (area: 7,731 km²) while no freehold (commercial) conservancies are within the immediate area (Mendelsohn et al. 2002, NACSO 2010). The major wildlife resources of the ≠Gaingu Communal Conservancy are viewed as kudu, gemsbok, springbok and leopard while the most important features are the Spitzkoppe National Monument Area and Rössing Mountain (Figs. 4.5 and 4.6).

The general ML area is regarded as “low” in overall (all terrestrial species) diversity while the overall terrestrial endemism on the other hand is “moderate to high” (Mendelsohn et al. 2002). The overall diversity and abundance of large herbivorous mammals (big game) is viewed as “low” with 1-2 species

while the overall diversity of large carnivorous mammals (large predators) is viewed as “average to high” with 4 species important of which brown hyena have “medium” densities (Mendelsohn et al. 2002).

Often deserts and plants associated with this marginal area may look “dead” although are not, and thus not viewed as important. All desert vegetation serves as a source of habitat and/or food for desert dwelling fauna – e.g., arthropods and reptiles. Although the focus during this literature survey was on the more visible trees, shrubs, grasses and more important other species potentially occurring in the general area, many more species occur throughout the area and are viewed as important.

Overall, it is estimated that at least 54 reptile, 5 amphibian, 45 mammal, 129 bird species (breeding residents), at least 20-47 species of larger trees and shrubs (>1m) and up to 50 grasses are known to or expected to occur in the general ML area of which a high proportion – especially reptiles (53.7%) – are endemics species.

4.3.2 Fauna

4.3.2.1 Reptiles

The high percentage of endemic reptile species (54%) known and/or expected to occur in the general ML area underscores the importance of this area for reptiles. Geckos, with 13 of the 15 species expected to occur in the general area being endemic, are the group of reptiles viewed as most important. The reptile species of greatest concern and expected to occur in the general area, are probably the endemic Afroedura africana africana (African flat gecko), Pedioplanis husabensis (Husab sand lizard), Leptotyphlops occidentalis (western thread snake) and Lycophidion namibianum (Namibian wolf snake).

4.3.2.2 Amphibians

Of the 5 species of amphibians expected to occur in the general ML area, 40% (2 species) are of conservation value – i.e., Poyntonophrynus hoeschi and Phrynomantis annectens. However, with the exception of the temporary pools along the Ephemeral Rivers Channels after rains, the general area is viewed as marginal for amphibians.

4.3.2.3 Mammals

Of the 45 species of mammals expected to occur in the general ML area, 7 species (15.6%) are endemic and 12 species (26.7%) are classified under international conservation legislation. The most important species from the general area are the Namibian wing-gland bat (Cistugo seabrai) listed as endemic and rare; Littledale’s whistling rat (Protomys littledalei namibensis) – of which the subspecies “namibensis” is known to occur in the ephemeral river courses and listed as endemic; brown hyena (Hyaena brunnea) and leopard (Parthera pardus) listed as near threatened and vulnerable (population trends decreasing), respectively by the IUCN (2020). However, brown hyena and leopard are only expected to occasionally pass through the general area not viewed as favoured habitat.

4.3.2.4 Birds

The high proportion of endemics – 7 of the 14 endemics to Namibia (i.e. 50% of all endemics) – expected to occur in the general ML area underscore the importance of this area. Furthermore, 43 species have a southern African conservation rating with 9 species classified as endemic (20.1% of southern African endemics or 7% of all the birds expected) and 34 species classified as near endemic (79.1% of southern African endemics or 26.4% of all the birds expected) (Hockey et al. 2006). The most important birds known/expected to occur in the general ML area are all the endemics species such as the Rüppels korhaan, Gray’s lark and Herero chat. Gray’s lark one of the species with the most restricted range in Namibia (Simmons 1998a).

Other important species are the birds listed as endangered (Ludwig’s bustard, white-backed vulture, black harrier, martial eagle, tawny eagle, booted eagle, black stork), vulnerable (Lappet-faced vulture, secretarybird) and near threatened (Rüppell’s parrot, Cape eagle owl, kori bustard, Verreaux’s eagle and peregrine falcon) by Simmons et al. (2015) and the species classified as critically endangered

(white-backed vulture), endangered (Ludwig's bustard, lappet-faced vulture, black harrier), vulnerable (martial eagle, tawny eagle, secretary bird) and near threatened (kori bustard) by the IUCN (2020).

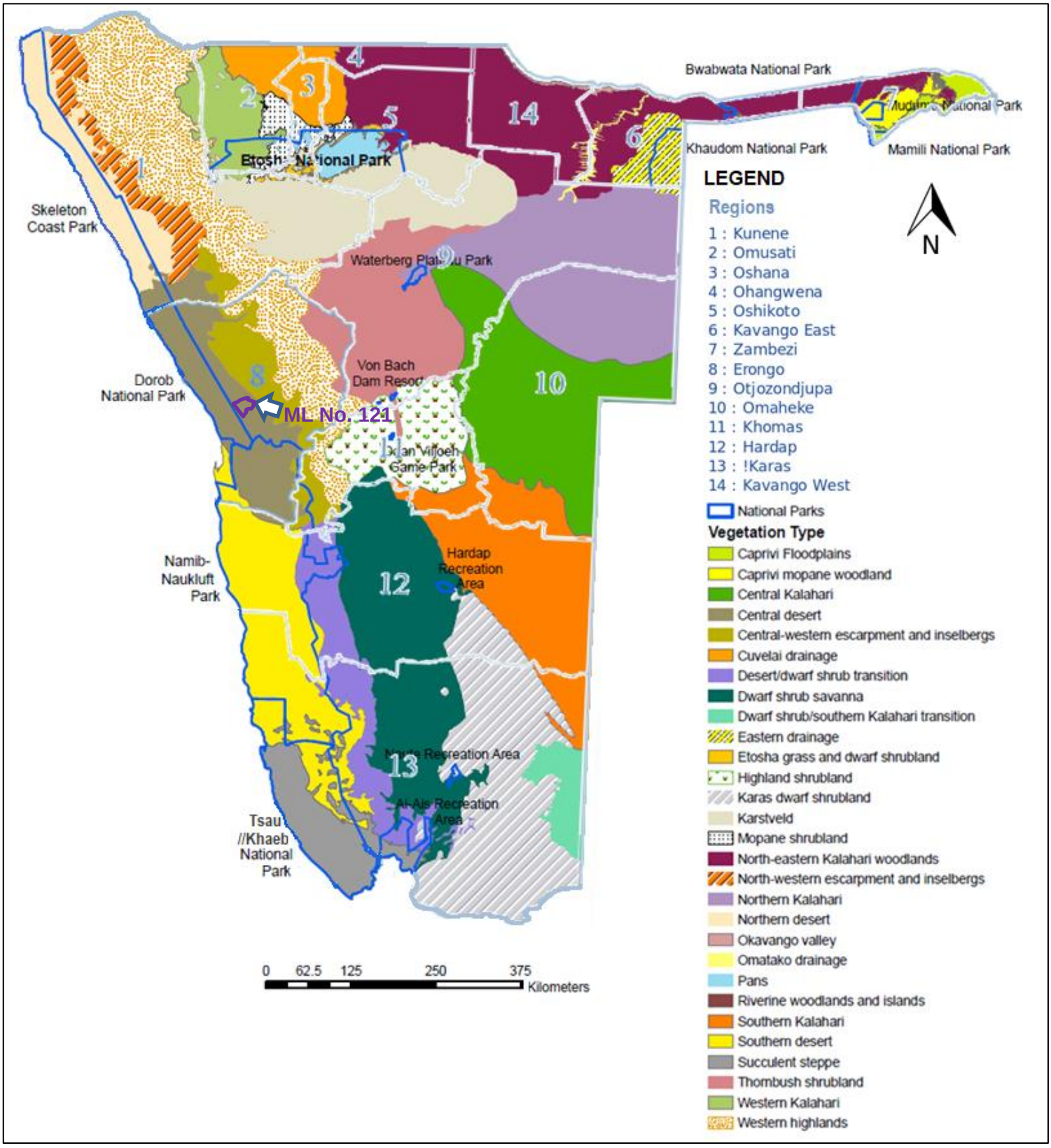

Figure 4.5: Regional vegetation map of Namibia showing the location of the ML No. 121 falling at the edge of the central western escarpment and inselbergs and west highlands boundary (Directorate of Environmental Affairs, 2002).

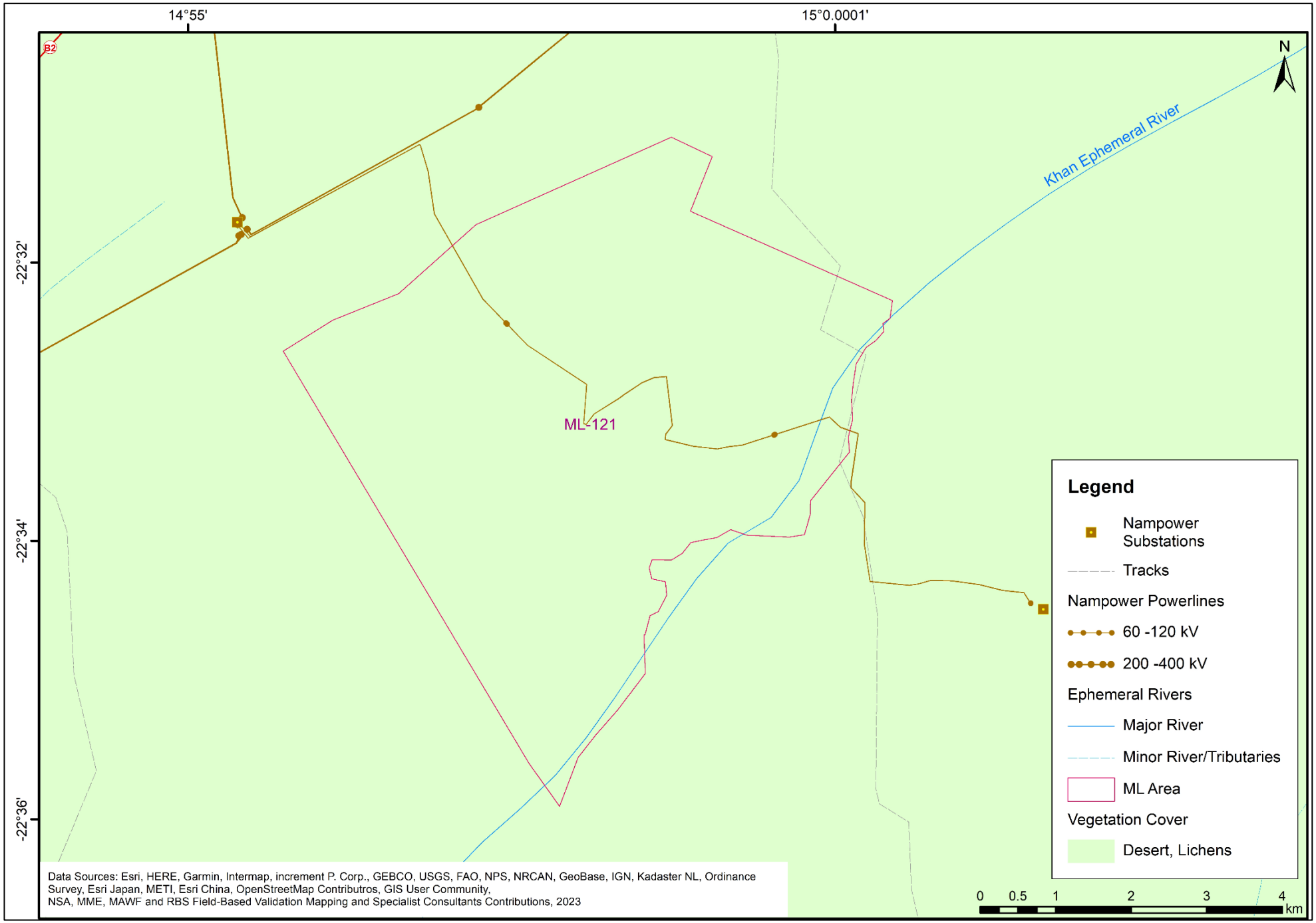

Figure 4.6: Vegetation map showing the location of the ML No. 121.

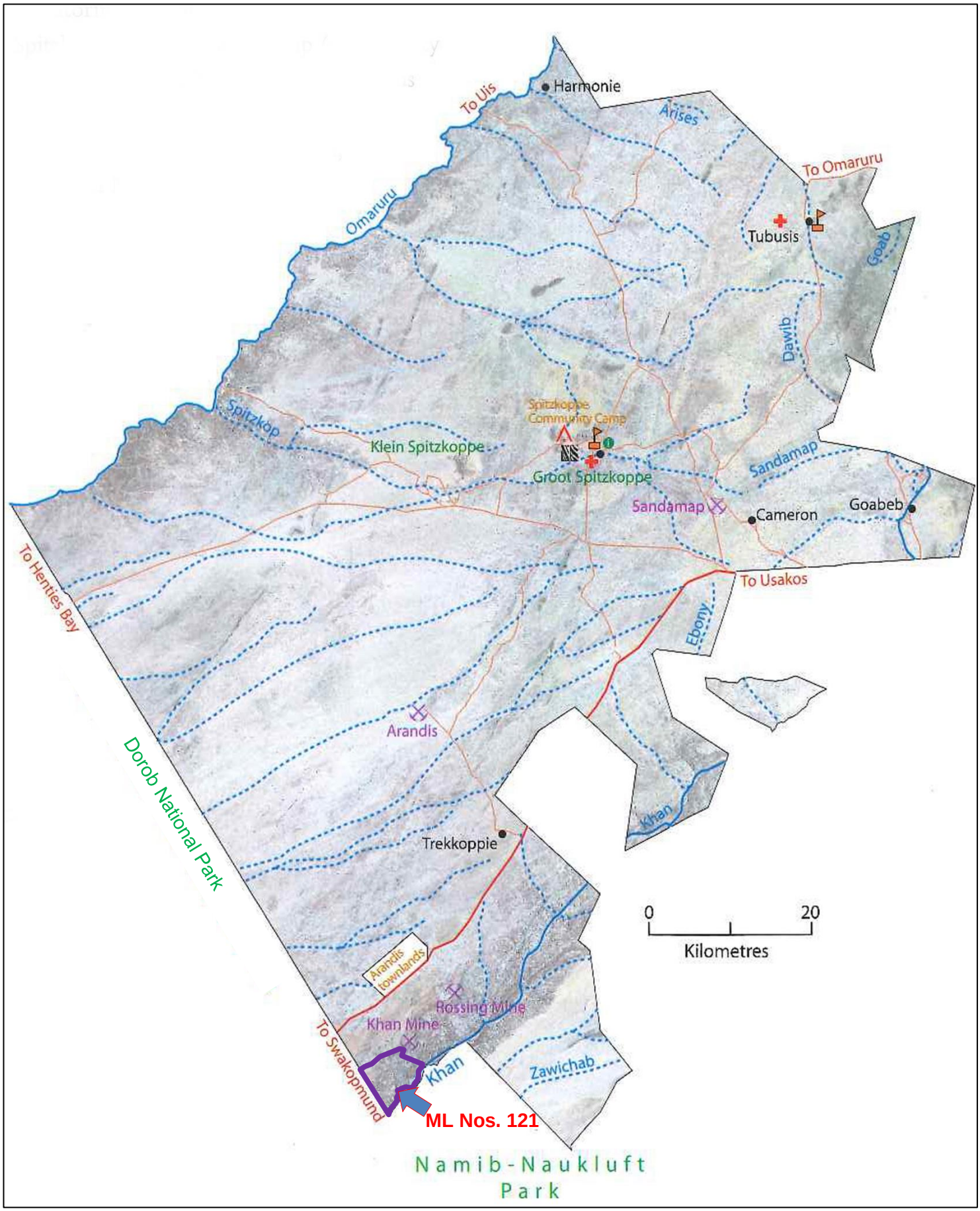

Figure 4.7: Location of the ML No. 121 falling within the ǂGaingu Communal Conservancy area used for communal conservation, tourism and agriculture comprising cattle and small stock commercial / subsistence communal farming in eastern and northern portions of the conservancy (Source: www.nacso.org.na).

4.3.3 Flora

4.3.3.1 Trees/Shrubs and Grasses

The Namib Desert is an important area in Namibia with numerous endemics and near-endemic species as well as a host of other plant species classified with some kind of formal protection. Adenia pechuelii (protected Forestry, endemic and least concern – IUCN 2020), Capparis hereroensis (endemic), Commiphora dinteri, C. saxicola, C. virgata (protected and endemic) as well as Welwitschia mirabilis (protected Forestry and Nature Conservation, near-endemic, CITES Appendix 2) are probably the most important larger trees/shrubs that occur in the general area.

Threats include unscrupulous collectors (e.g. Adenia pechuelii, Aloe and Lithop species) and off-road desert driving (Welwitschia mirabilis). The most important grasses expected in the area are the endemics (Eragrostis omahekensis, Pennisetum foermeranum and Stipagrostis sabulicola) although they probably do not make up a large proportion of the grass biomass which is usually dominated by Stipagrostis obtusa in the general area and this only after rains.

4.3.3.2 Other Species

Other species of great importance likely to occur in and around the ML No. 121 is:

(i) **Aloes**: All the aloes are protected in Namibia (See Nature Conservation Ordinance No. 4 of 1975). Other than *Aloe dichotoma* listed in Table 14, *Aloe asperifolia*, *A. hereroensis* and *A. namibensis* probably also occur in the general area (Rothmann 2004).

(ii) **Commiphora**: Many endemic Commiphora species are found throughout Namibia (Steyn 2003) with other important and endemic *Commiphora* species from the area are *Commiphora dinteri*, *C. saxicola*, *C. virgata* and *C. wildii*. Furthermore, *C. wildii* is also known to have an economic potential – i.e. resin properties used in the perfume industry (Knott and Curtis 2006).

(iii) **Ferns**: At least 64 species of ferns, of which 13 species being endemic, occur throughout Namibia. Ferns in the general ML area include at least 2 endemic species (*Cheilanthes nielsii*, *Isoetes giessii*,) and 9 indigenous species (*Actiniopteris radiata*, *Asplenium cordatum*, *Cheilanthes dinteri, C. inaequalis*, *C. marlothii*, *C. parviloba*, *Isoetes aequinoctialis*, *Ophioglossum polyphyllum, Pellaea calomelanos*) (Crouch *et al.* 2011). Although the ML area is marginal habitat for ferns the general area is under collected with more species probably occurring than presented above.

(iv) **Lithop**: Are known to occur in the general area and often difficult to observed, especially during the dry season when their aboveground structures wither. Lithop species known to occur in the general ML area include *Lithops ruschiorum* var. *ruschiorum* and *L. gracilidelineata* var. *gracilidelineata* (Cole and Cole 2005, Loots 2005), and.

(v) **Lichens**: The overall diversity of lichens is poorly known from Namibia, especially the coastal areas and statistics on endemicity is even sparser (Craven 1998). More than 100 species are expected to occur in the Namib Desert with the majority being uniquely related to the coastal fog belt. Lichen diversity is related to air humidity and generally decreases inland form the Namibian coast (Schults and Rambold 2007). Off road driving is the biggest threat to these lichens which are often rare and unique to Namibia.

To indicate how poorly known lichens are from Namibia, the recent publication by Schultz *et al.* (2009) indicating that 37 of the 39 lichen species collected during BIOTA surveys in the early/mid 2000's was new to science (i.e. new species), is a case in point. Lichens are expected to occur in the general ML area, but what and how many species in currently unknown.

4.3.4 Important Habitat Areas and Conclusions

The most important areas in the general ML No. 121 isa are:

(i) **Rocky area – e.g. Dolerite hills/ridges and granite outcrops:** Rocky areas including the targeted granite resources generally have high biodiversity and consequently viewed as important habitat for all vertebrate fauna and flora. Escarpments, mountains and inselbergs are generally considered as sites of special ecological importance with granite domes are high in biotic richness and endemism (Curtis and Barnard 1998). Dolerite hills/ridges in particular have unique fauna – e.g. *Pachydactylus* and *Rhoptropus* species – and flora – e.g. *Aloe asperifolia*, *A. namibensis*, various *Commiphora* species, etc. Granite outcrops (white geology) have unique fauna – e.g. the endemic and range restricted *Pedioplanis husabensis*.

(ii) **Ephemeral drainage lines**: Ephemeral drainage lines usually support larger trees and consequently viewed as important habitat for all vertebrate fauna and flora. Ephemeral rivers are viewed as sites of special ecological importance mainly for its biotic richness; large desert-dwelling mammals; high value for human subsistence and tourism (Curtis and Barnard 1998). Such vegetated rivers in an otherwise extreme arid environment are unique habitat and a virtual lifeline to many desert dwelling faunas. Temporary rainwater pools and seeps are also known to occur in some of the major Ephemeral Rivers making these habitats a virtual lifeline to various desert dwelling fauna, and.

(iii) **Gravel plains**: Gravel plains in the area are known to host a variety of important lichen species as well as patches of *Aloe asperifolia*, while quartz dominated areas are known habitat for Lithop species.

As all developments have potential negative environmental consequences, identifying the most important faunal species including high risk habitats beforehand, coupled with environmentally acceptable mitigating factors, lessens the overall impact of such development.

Vertebrate fauna species most likely to be adversely affected by the ongoing and proposed mining and exploration activities in the ML No. 121 would be sedentary reptile species associated with specific geology granite ridges/hills/outcrop targeted for mining– e.g. Pedioplanis husabensis and various *Pachydactylus* and *Rhoptropus* species. Important flora potentially adversely affected would be *Aloe asperifolia*, *A. namibensis*, various *Commiphora* species and *Lithops ruschiorum* var. *ruschiorum* and *L. gracilidelineata* var. *gracilidelineata*.

There are various anthropomorphic activities throughout the general ML area such as existing roads and tracks, and previous exploration activities, etc.) and the proposed developments would have a limited footprint and not be expected to affect the whole ML No. 121 isa and associated unique amphibians, mammals, reptiles and flora species negatively. The implementation and monitoring of the mitigation measures as detailed in the EMP Report is likely to lessen the extent of the likely negative impacts.

4.4 Ground Component

4.4.1 Overview

The geological description covering the stratigraphy, structures and the associated maps have been adapted from the exploration and development reports of the ML area prepared by Lionel Howes.

4.4.2 Stratigraphy

The stratigraphic succession in the study area has been considerably disrupted by tectonics. As a result, it becomes difficult to reconcile the stratigraphic column without involving structural complications. Many portions of the stratigraphic column, at both unit and formational scale, have been either thrust duplicated or thrust out along the NW AMC Khan Dome contact, and progressively thickened along the NE verging AMC contact. Most, if not all lithological contacts have been significantly tectonised. The stratigraphic column has been modified from 1967 to include the Nosib Formation within the Damara

Sequence. The lower and upper stages were consequently separated into the Etusis and Khan Formations respectively (Table 4.1 and Fig. 4.8).

A large detachment fault is suspected to occur along the NW flank of the Khan Dome, which appears to have given rise to a thrust duplex or thrust stack. This is now believed to be the manifestation of a splay of the Omaruru Lineament Zone (OMLZ).

A very large dilational flower structure is resident on the saddle between the Khan Dome and the Rossing Dome, both having undergone ***differential rotation***, due to ***en echelon,*** fractures/shears along the Welwitschia/Omaruru splay Lineaments oblique intersection.

The degree of strain accommodated by the various formations, due to their contrasting rheologies, has resulted in considerable unequal thickening and thinning around the limbs of the AMC cored domes. Four and possibly five distinct geological divisions can be made on the field work and literature studies. An 800Ma hiatus in deposition is recorded on the 2014 stratigraphic column, between the Abbabis Metamorphic Complex and the Damara Sequence. Essentially this suggests that no Palaeo-Proterozoic is recorded in this time interval. This would seem unlikely, and possibly these rocks have yet to be recognised.

Table 4.1: Reconciled simplified stratigraphic column (D.A.M. Smith/2214 Walvis) as compared to the stratigraphic column of the 1:250 000 2214 Walvis Bay geological map.

Stratigraphy (1967)	**Stratigraphy (2014)**	**Lithologies**	**Intrusive**
Superficial Deposits	Tertiary	Regolith deposits of calcrete, gypcrete, alluvium.	
Unconformity	Unconformity		
Stormberg Series	Karroo Supergroup	Flood basalts	Dolerite, felsite, porphyritic rhyolite.
Unconformity	Unconformity		
Khomas Series	Khomas Group	Schist, marble.	Evolved Li pegmatites, syn-post tectonic granites, quartz veins and blows, Karroo age dykes.
Upper Hakos Series	Aris Formation	Granite, schist.	"
Chuos Series	Chuos Formation	Glaciogenic mixtite.	"
Lower Hakos Stage	Rossing Formation	Dolomitic Granite.	"
Unconformity	Unconformity		
Nosib Formation 1.)Navachab Amphibolite		Amphibolite Hornfels and intercalated biotite quartzite.	"
1.)Nosib Upper Stage	Khan Formation	Grey green metarkose, biotite quartzite, felspathic quartzite.	"
2.)Nosib Lower Stage	Etusis Formation	Red-tan felspathic to pure quartzites, local basal conglomerate.	"
Unconformity			"
Abbabis Formation 1.)Biotite Schist 2.)Dolomitic Granite and calc-silicates. 3.)Abbabis Gneiss	Abbabis Metamorphic Complex (paragneiss, orthogneiss, amphibolite, schist, calcsilicate and migmatite).	Felspathic metarenites, biotite schist, para and orthoamphibolite, dolomitic marble, quartzite, augen gneiss, migmatite.	"

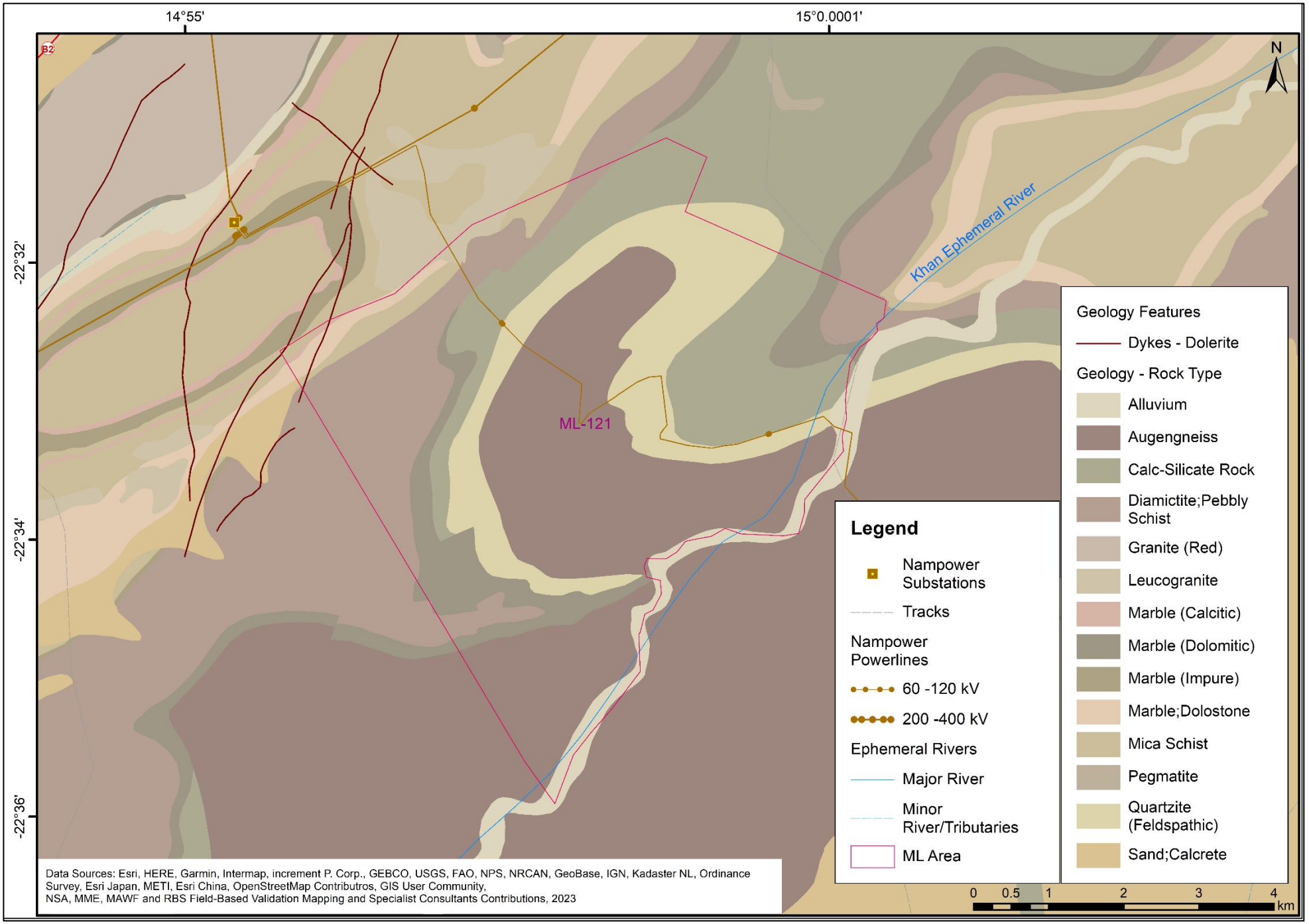

Figure 4.8: Simplified local geological map of the ML No. 121 (Source: Lionel Howes, 2020).

4.4.3 Structure

4.4.3.1 Phases of deformation

Four phases of deformation, D_1-D_4 are generally recognised as having affected the Pan-African rocks in the region (Miller, 2006). Structures in the Damaran age rocks in the study area are dominated by elongate northeast-southwest trending synforms and antiforms. The antiforms are cored by Archean-Palaeoproterozoic Abbabis metamorphic complex (AMC) rocks, themselves having been deformed during pre-Damaran times and refolded during PanAfrican orogenesis into complex interference folds. Fold axes in the PanAfrican rocks tend to upright and the folds similar and isoclinal, with vergences to the southwest. The wavelengths and amplitudes are approximately 7-9kms and 2-3kilometres respectively.

According to Martin (1983) and Coward (1983), amongst others, detail CZ deformational events. D1 and D2 effects were largely obliterated by D3. Rare S1 and S2 migmatitic banding occur in the Khan and Etusis formations, and as laminar foliations in Rössing Formation metapelites. D3 produced highly ductile flow folding in Rössing Formation marbles. The Etusis Formation exhibits brittle-ductile deformation of rare S1 and S2 migmatitic banding. D4 is expressed as rare, small isolated folds with axial planar foliations (Greenway and Basson, 2002).

The Etusis Formation (Nosib Group):Abbabis Complex contact is often indistinct due to anatexis of the Etusis Formation within D3/F3 dome cores. The Etusis Formation in the core of the Rössing Dome comprises migmatized psammites and pelites intruded by late- to post-kinematic granites. Khan Formation gneisses gradationally overly the Etusis Formation. The heterogeneous Rössing Formation paraconformably and disconformably overlies the Khan Formation. The Rössing Dome therefore demonstrates the effects of a relatively competent Etusis metaquartzite core, rimmed by relatively incompetent Khan and Rössing formations. A transpressional tectonic environment (c. 600-550 Ma, incorporating D3), is pivotal in most models of dome formation e.g. interference folding and diapiric rise of granitic basement into overlying D3-folded metasediments (Kröner, 1984), shear-induced sheath folding (Coward, 1983), doming over metamorphic core complexes (e.g. Crittenden et al., 1980) and cusping by horizontal constriction due to a basement: cover competency contrast (Oliver, 1995).

Granites form where transpression or continental collision thickens the crust and lithospheric mantle mechanical boundary layer, following which the latter enters hot asthenosphere, upwelling of which causes delamination of lithospheric mantle, fusion of the lower crust and extension/transtension, protracted upwelling and crustal assimilation (e.g. Bowden et al., 1995). Subsequent tensional or transtensional sheared environments cause magma boiling while local post-extensional (D4) structural catalysts caused repeated magma mobilization and localization, particularly at Rössing and nearby Goanikontes. CZ granite complexes yield intrusion, syn-metamorphic, tectonic or anatexis ages from 563±4 Ma to 505±4 Ma (Table 4.1).

Peak transpressional movement due to N-S oblique collision of the Kalahari and Congo cratons occurred from c. 600 to 550 Ma (Bowden et al., 1999), culminating in F3 dome formation, followed by transtensional tectonism and metamorphism from c. 542 to 526 Ma. Bowden et al. (1995) suggest that granite intrusion peaked at 510±3 Ma. Late- to post-tectonic uranium enriched granites are dated at 508±2 Ma (Briqueu et al., 1980) and c. 510 Ma (Kröner, 1982), to 468±8 Ma (e.g. Von Backström & Jacob, 1978). Notably, from sphene dating the Khan mineralization was c.600 which is similar in age to the Katangan deposits of Zambia and Congo.

4.4.3.2 Structures Recognised

In contrast to Smith (1967), where the distribution of Damaran rocks was explained by folds alone, the recognition of thrust planes along some contacts may be invoked to explain the duplication of some units (particularly the gossanous unit). Fig. 4.8 shows the distribution of thrusts along the Khan Formation contacts and the resultant duplication of the units into flower structures along the Nosib Fm. contact.The Etusis Formation along the northwest facing front of the Khan Dome (KD) has possibly been thrust out during the final D_3 compression stage, and its SE component thickened due to rotation during D_4 deformation.

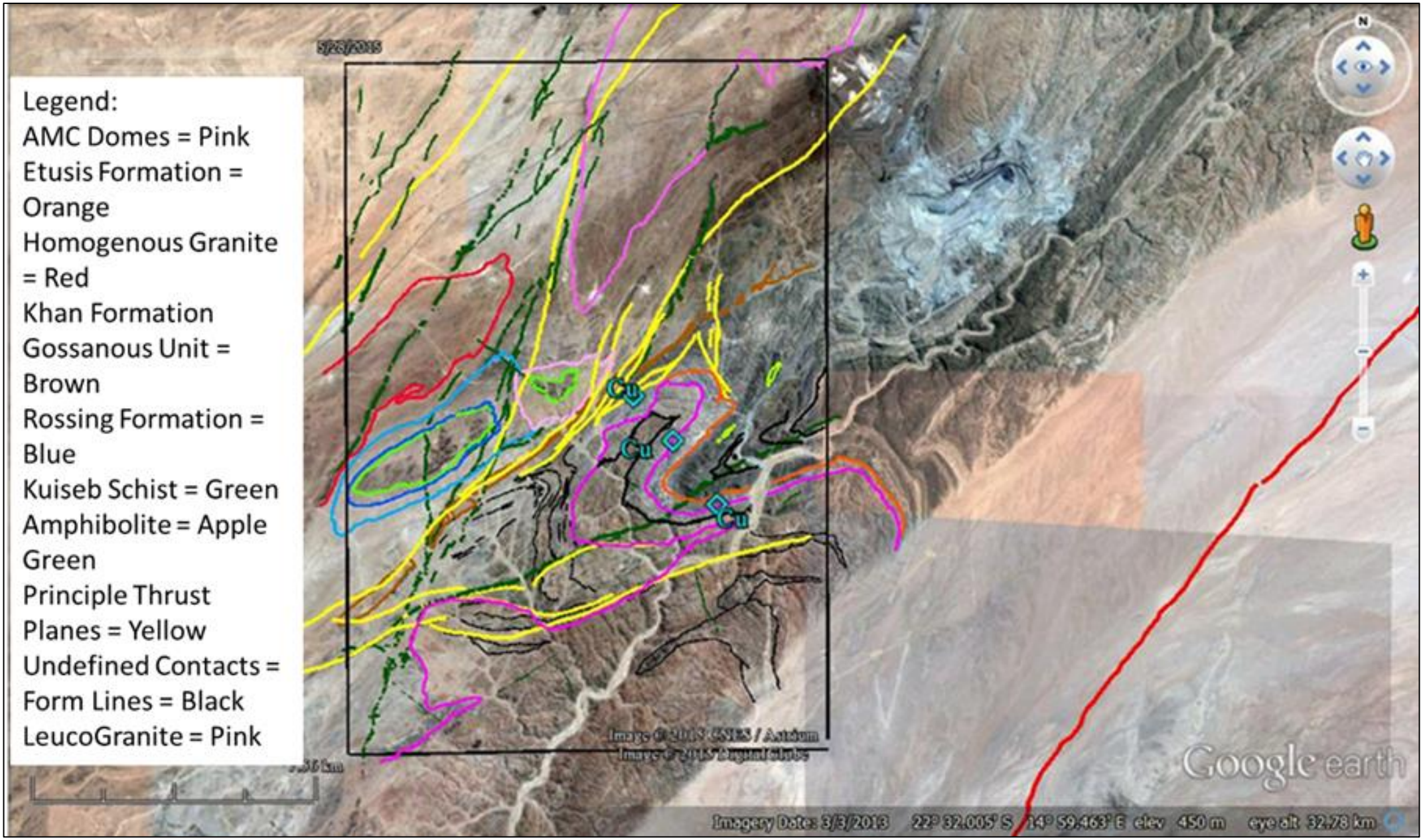

Figure 4.9: Geological re-interpretation map of the ML area (Source: Lionel Howes, 2020).

4.4.4 Geotechnical Engineering Considerations

Rocks of varying geotechnical characteristics are expected within the ML area. Table 4.2 outlines an indicative classification of the various discontinuities that are likely to be found in the area including the targeted granite outcrop. Both low and high order discontinuities are likely to be found around the targeted ML area. Based on results of the fieldwork and laboratory assessment undertaken by Namibia Nuclear Corporation (Pty) Ltd, the granite found within the ML No. 121 isa is good for dimension stone mining and depending on the dip and intersections of the various discontinuities, can withstand near vertical steep slopes required for mining operations.

Table 4.2: General rock structure scheme (Source: Mwiya *at el.,*2004).

GEOMETRY				CHARACTERISTIC				
DISCONTINUITY	LENGTH m	SPACING m	WIDTH m	TRANSMISSIVITY m^2/s	HYDRAULIC CONDUCTIVITY m/s	INFILLING THICKNESS m	EXAMPLE	INFLUENCE INDICATOR
LOW ORDER DISCONTINUITIES. ZONES OUTCROPS								
1^{ST} ORDER	$>10^4$	$>10^3$	$>10^2$	10^{-5} - 10^{-2}	10^{-7}- 10^{-5} AV. [10^{-6}]	10^0	Regional major fault systems	4 V. High
2^{ND} ORDER	10^3 - 10^4	10^2- 10^3	10^1 – 10^2	10^{-7} - 10^{-4}	10^{-8} – 10^{-6} AV. [10^{-7}]	10^{-1}	Local major fault zones	
3^{RD} ORDER	10^2 – 10^3	10^1 – 10^2	10^0 - 10^1	10^{-9} – 10^{-6}	10^{-9} – 10^{-7} AV. [10^{-8}]	$\leq 10^{-2}$	Local minor fault zones	
HIGH ORDER DISCONTINUITIES: INDEPENDENT OUTCROPS								
4^{TH} ORDER	10^1 – 10^2	10^0- 10^1	-	-	10^{-11}-10^{-9} AV.[10^{-10}]	-	Local major joint set or bedding	3 High
5^{TH} ORDER	10^0 - 10^1	10^{-1} - 10^0	-	-	10^{-12}-10^{-10} AV. [10^{-11}]	-	Local minor joints/ fractures	
6^{TH} ORDER	10^{-1} - 10^0	10^{-2} – 10^{-1}	-	-	10^{-13}-10^{-11} AV. [10^{-12}]	-	Local minor fissures / schistosity	2 Low
7^{TH} ORDER	$<10^{-1}$	$<10^{-2}$	-	-	$<10^{-13}$	-	Crystalline voids	1 V. Low

4.4.5 Sources of Water Supply

Groundwater as well as surface water (only during the rainy season) from ephemeral river channels is the sources of water supply in the area as well as much of the Erongo Region. According to the Department of Water Affairs, (2001), the Erongo Region and in particular the ML area generally has a low groundwater potential (Fig. 4.10). The area with aquifer potential, more or less reflects the rainfall distribution, decreasing westwards. Knowledge of the aquifers in this area is sparse, due to the low number of boreholes and few on groundwater. Recharge from rainfall is an important parameter determining the groundwater potential as well as the degree of metamorphism of local rocks. The groundwater potential of rocks decreases, as the degree of metamorphism increases. Crystalline rocks normally exhibit a very low tendency to store water, typical of the pegmatite zones and the alternating bands within the banded dolomitic granite and biotite-quartz schist found within the project area. The groundwater potential of these rock units is generally low, to locally moderate. Possible targets for water resources in this area are mainly fractured zones and faults that outcrop on the surface without impermeable infillings. But the success rate and yields for these rock types are generally low. The area along major ephemeral rivers may be more promising due to well developed fractures and faults that give rise to good recharge potential during the rainy season, typical of the local ephemeral spring found within the ML Area. The possible water sources for the proposed mining operations will be from groundwater sources. The hard-rock aquifer can supply sustainably at yields of up to 5 m^3/h per borehole as seen from past drilling records.

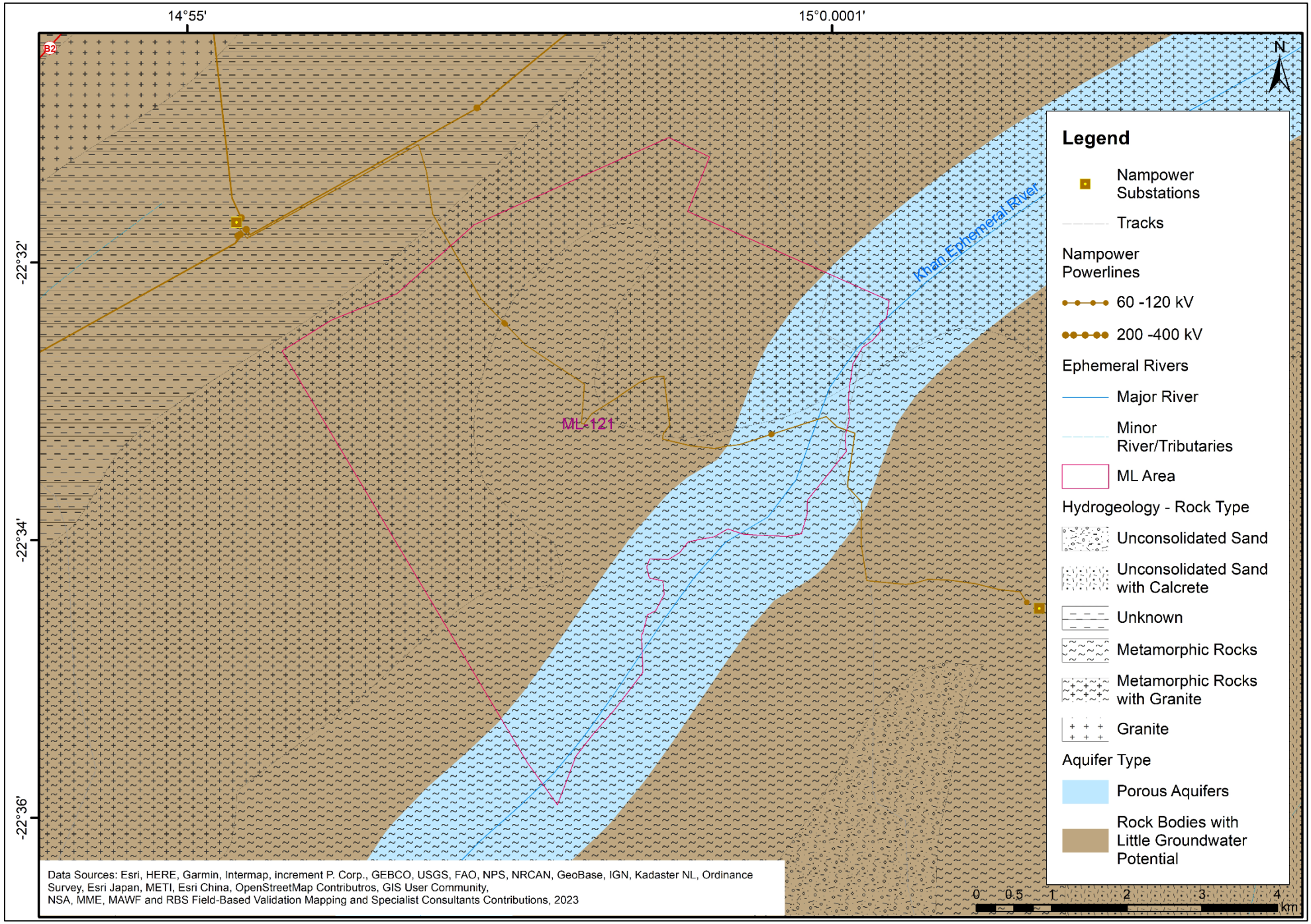

Figure 4.10: Simplified local hydrogeological map of the ML No. 121.

4.4.6 Evaluation of Water Vulnerability

Vulnerability assessment of surface water covered possible runoff, the presence of source factors and major flow routes such as ephemeral river channels, valleys and gullies as pathways and the presence of surface water body as a target. The groundwater assessments covered hydraulic properties and thickness of the unsaturated and saturated zones derived from geological and hydrogeological data. The assessment of the unsaturated characteristics was based on the ability for source factors to influence the system through known pathway factors such as discontinuities. However, groundwater or surface water will only be vulnerable to contamination if there are contaminant sources, if there are pathways for contaminant migration and there are targets (surface water or groundwater) present within the project area.

Overall, the limited local groundwater resources found in the area form part of the unconfined aquifer system that is highly vulnerable to any sources of pollution that may be associated with the ongoing and proposed mining operations (Fig. 4.9). During the rainy season, surface water bodies can be found along the major ephemeral river systems in the area with an active local spring. This surface water often recharges the local groundwater resources along the faults, solutions holes and other discontinuities along the ephemeral rivers in the area. Therefore, surface water in the area could be vulnerable to pollution sources from the proposed mining activities. It is important that all polluting activities such as waste rock stockpile, dirty water pond and ore stockpile must not be placed or undertaken in areas with high discontinuities, valleys or gullies connected to major ephemeral rivers systems in the area. Management of wastewater from the onsite administration blocks and related infrastructures will utilise French Drains. Effective monitoring will need to be put in place to avoid under designing of the facilities that may results in overflow of waste water into the surrounding receiving environment.

4.5 Socioeconomic Environment of ML Area

4.5.1 Overview

The ML No. 121 falls within the Dâures Constituency, Erongo Region in Namibia (Fig. 4.11). Dâures Constituency is bordered by the Omaruru Constituency in the east, Karibib Constituency in the southwest, Arandis Constituency in the west (Fig. 4.11). The Dâures Constituency is the largest constituency in the Erongo Region with an area of 13,490 km^2. It has a population of approximately 12000 of which the majority depend on communal subsistence farming for their livelihood. The name Dâures is derived from the Khoe Khoegowab name of the Brandberg mountain which is the highest in Namibia. The constituency office is in Okombahe, with additional settlement offices in Uis and Okombahe. Omatjete, Tubusis and Okongue are other rural residential clusters in the Arandis.

4.5.2 Socioeconomic Baseline Summary

The Erongo Region extending over 63,720 km^2 and the majority of the population lives in urban settlements, principally Swakopmund and Walvis Bay (Fig. 4.11). The surge in uranium exploration and mining operations has seen significant growth in various downstream industries in the coastal towns. The region has the second highest income per capita in the country after Khomas Region, and its relative prosperity is derived from fishing, mining and tourism.

Major mining activities in the region are Rössing Uranium, the Navachab gold mine, Langer Heinrich Uranium, Husab Uranium and the coastal salt operations. Other uranium projects that are also expected to advance further are those of Bannerman, Reptile Uranium and Swakop Uranium, but these do not exhaust the list of potential uranium operations in Erongo Region. The main commodities mined are uranium and gold. Extensive salt mining occurs along the coast at Walvis Bay and smaller companies operate at Cape Cross and Ugab.

Within the Erongo Region, access to economic opportunities and resources in the region is highly variable especially to rural communities. This is usually due to the isolation and underdeveloped infrastructures within these rural communities and is a situation experienced across all regional parts of the country. The uneven pattern to development, benefits and economic opportunity significantly has results in a regional Gini co-efficient of 0.60, with 19.7% of the population being poor and 7.1% being

extremely poor (National Planning Commission, 2006, 2007 and 2012). The Erongo Regional Council has adopted developed strategies to address poverty reduction and economic development, with primarily focus on rural areas by initiating measures to insure sound management of the region's natural resources (www.erc.com.na).

The Region's main focal areas for development include water resources, the environment, and tourism, fishing and marine resources.

Figure 4.11: Map of the Erongo Region showing the location of the ML No. 121 (Source: www.erc.com.na).

The Regional Development Plans recognises the objectives adopted in the NDPs and Vision 2030, ultimately stressing the need for an increased contribution to development by the minerals sector (National Planning Commission, 2006, 2007 and 2012).

Large parts of the Erongo Region fall within protected areas under conservation management; these include the Dorob National Park, Namib-Naukluft Park (NNP) in the south and central area, and the Skeleton Coast National Park in the north. The Ministry of Environment, Forestry and Tourism (MEFT) carries responsibility for management of these protected areas. Government land around proclaimed Townlands is presently under the control of the Ministry of Urban and Rural Development.

Communal land makes up about one third of the region and lies to the east of the NWCRA. Most of it is under conservation management through the following conservancies:

- ≠Gaingu (centred around Spitzkoppe);
- Tsiseb (focused on Brandberg), and;
- Otjimboyo and Ohungu.

East of the above conservancies, the land is under freehold title (another third of the region) and is mostly used for commercial cattle ranching. The arid nature of the landscape means that very little of the area has agricultural potential.

4.5.3 Conclusions on the Socioeconomic Assessment

The proposed mining and ongoing exploration action in the ML No. 121 will have a positive contribution to economic development and employment opportunities of the ≠Gaingu Communal Conservancy and the communal land controlled by the !Oe-≠Gân Traditional Authority, the Dâures Constituency and the Erongo Region.

The Proponent has already invested more than N$200 million in Namibian economy in the last 20 years and especially in the Erongo Region. The proposed development will coexist with the other current and future land uses in area including conservation, tourism, farming and other planned minerals exploration and mining projects in the general area.

The following is the summary of the key actions that the Proponent shall implement as part of enhancing the socioeconomic impacts of the proposed project:

- Stipulate that local resident should be employed for temporary unskilled/skilled and where possible in permanent unskilled/skilled positions as they would reinvest in the local economy. However, due to low skills levels of the local population, it is likely that the majority of skilled positions would be filled with people from outside the area.
- The recruitment selection process should seek to promote gender equality and the employment of women wherever possible.
- Ensure that contractors adhere to Namibian Affirmative Action, Labour and Social Security, Health and Safety laws.
- The local authorities, community organisations and community leaders shall be informed on final decisions regarding the project and the potential job opportunities for local people.
- Stipulate a preference for local contractors in the tender policy. The procurement of services and goods from local entrepreneurs and the engagement of local businesses people should be favoured and promoted provided that it is financially and practically feasible.
- Undertake a skills audit, develop a database of local businesses that qualify as potential service providers and invite them to the tender process.

- ❖ Scrutinise tender proposals to ensure that minimum wages were included in the costing.
- ❖ Project offers experience and on job skills development, particularly for low or semi-skilled workers. This would raise the workers experience and skills to secure jobs in future.
- ❖ Promising employees could be identified and training and skills development programme could be initiated.
- ❖ The project could organise business partnerships with local entrepreneurs or small SMEs.
- ❖ Service providers to provide opportunities for skills transfer, and.
- ❖ Provide opportunities for employees re-skilling beyond mine closure.

4.6 Archaeology

4.6.1 Regional Archaeological Setting

Modern humans and their ancestors have lived in Namibia for more than one million years, and there are fossil remains of lineal hominin ancestors as early as the Miocene Epoch (Kinahan, 2017). Namibia has a relatively complete sequence covering the mid-Pleistocene to Recent Holocene period, represented by thousands of archaeological sites mainly concentrated in the central highlands, escarpment and Namib Desert.

According to Kinahan, (2017), the Recent Holocene archaeological sequence in Namibia, i.e. the last 5 000 years, is of particular importance because it provides the background evidence for the development and recent history of the indigenous peoples of Namibia before the advent of written historical records during the colonial era.

Many archaeological sites from this period are of great significance to the understanding of Namibian history, and some are considered to be of global importance.

4.6.2 Local Archaeological Setting

The general area around the ML is well known for extensive rock-art sites linked to various granite rock outcrop shelters such as those found around the Spitzkoppe. These sites hold significance historical, cultural and spiritual value and all-important heritage area for all Namibians and are protected by the National Heritage Act, 2004 (Act No. 27 of 2004) under the National Heritage Council of Namibia.

It is unlikely that the targeted granite will hold any of the archaeological rock-art resources because most of these rock arts are associated with the granite which are more resistant to weathering compared to the granite.

Other potential archaeological resources found in the general area include colonial evidence points to impermanent settlement by groups of probably Khoe pastoralists (Kinahan, 2017). These people formed part of a regional-scale network with links to the Atlantic coast and inland sites where copper was produced.

However, there are a large assemblage of ceramic vessels associated with the general area of and represent an important addition to the regional archaeological picture.

Evidence from the early colonial period relates to mining in the general area and a combination of trade, missionary activity and wagon repair. Today, most settlements the Dâures Constituency historical importance and have a number of National Monument sites recognised under the National Heritage Act, 2004 (Act No. 27 of 2004).

4.6.3 Archaeological Desk Assessment

Early colonial remains are expected to be relatively abundant on ML No. 121, although it is likely that if these are related to historical mining activity, they will form part of the general area of mining interest in the vicinity.

It is expected that the area of mining interest will be extensively disturbed and that little might remain of either pre-colonial or early colonial sites in the near vicinity.

The targeted granite rocky outcrop areas in the ML No. 121 will not have rock shelters containing stratified archaeological deposits.

The Proponent must not disturb major natural cavities that may be unearthed because they could hold some highly significant historical or cultural sites that would require detailed documentation and possibly mitigation measures to be adopted in the event of encroachment by mining activity.

4.6.4 Archaeological Conclusions and Recommendations

The area of interest for mining operations probably has archaeological potential, although no archaeological sites have been recorded so far from within the area itself. The expectation is therefore:

(i) A high likelihood of Holocene age archaeological sites, including rock art, associated with outcropping granite in the northeast of the ML No. 121.

(ii) A high likelihood of late precolonial settlement sites throughout the entire tenement, especially in the vicinity of springs and seepages, and.

(iii) A high likelihood of early colonial settlement remains relating to the historical occupation of area that may be unknown or not recorded.

The following are the key recommended actions related to archelogy in the ML Area:

(i) Contractors working on the site should be made aware that under the National Heritage Act, 2004 (Act No. 27 of 2004) any items protected under the definition of heritage found in the course of development should be reported to the National Heritage Council.

(ii) The chance finds procedure as outlined in the EMP must be implemented at all times, and.

(iii) Detailed field survey should be carried out if suspected archaeological resources or major natural cavities / shelters have been unearthed during the mining operations.

4.7 Stakeholder Consultations and Engagement

4.7.1 Overview

Public consultation and engagement process have been part of the environmental assessment process for this project. Opportunity for stakeholders and the public to submit written comments / inputs / objections with respect to the proposed mining operations and ongoing minerals exploration activities in the ML 121 was provided during the initial EIA process.

4.7.2 Stakeholders and Public Consolations Recommendations

Overall, in meeting the need for continuous stakeholders consultation process, this EIA has recommended that the Proponent shall notify the local community through the regional or local Councillor/s on the implementation of the ongoing and proposed project once the ECC has been granted. Such communications shall be maintained throughout the lifecycle of the proposed project. This recommendation may be included as condition on the ECC to be issued.

5. ASSESSMENT OF LIKELY IMPACTS

5.1 Impact Assessment Procedure

The Environmental Assessment process that has been undertaken with respect to the ongoing and proposed mining and exploration activities in ML No. 121 has been based on the Knowledge-Based System Model Methodology (KBSMM) framework. The KBSMM system framework design is in line with the provisions of the Environmental Impact Assessment (EIA) Regulations No. 30 of 2012 gazetted under the Environmental Management Act, (EMA), 2007, (Act No. 7 of 2007). The KBSMM is a rule-based artificial intelligence (AI) expert system that captures the knowledge of human experts to support decision-making centred on the source-pathway-target /receptor risk assessment regulatory, standards, and engineering boundary conditions. The knowledge-based risk assessment methodology adopted for the impact assessment process has been based on the rule-based matrix interaction of characterised climatic, environmental, and ground model datasets as inputs data components (Knowledge-Base) in the evaluation of the significant positive and negative impacts or influences on the receiving environment as results of the proposed activities (Fig. 5.1).

The KBSMM system methodology took into consideration the interactions of the ongoing and proposed activities with respect to the source-pathway-receptor / target of the characterised climatic, environmental, and ground model datasets of the receiving environment (physical, biological, socioeconomic and ecosystem services and functions) (Figs. 5.1-5.3). The Knowledge-Base (KB) created during the EIA and EMP phases has been based on the influence assessments of the characterised components of the environment built during the previous assessment and current desktop and field-based general and specialist studies inputs to the overall impact assessment process (Figs. 5.2 and 5.3).

The impact / influence and risk assessment boundary conditions were provided by the national regulatory, standards, limits, engineering, environmental and sector-specific protocols for mining and exploration operations in Namibia and the applicable international best industry practices which are based on the Best Practicable Environmental Option (BPEO) (Figs. 5.1-5.3). The KBSMM model inputs variables for the EIA and EMP process covered the source-pathway-receptor / target characterised climatic, environmental, and ground model datasets. Source-pathway-receptor / target risk assessment looping approach has been used to determine or validate the influence (impact assessment), and ultimate likely harm that may be linked to the proposed phased activities inclusive of the supporting infrastructures such as the new access roads to each of the proposed new sites within the ML No. 121 (Figs. 5.3 and 5.4).

5.2 KBSMM Knowledge Base

5.2.1 Climatic Model Data Sets

The climatic data sets used in the regional and local site-specific desktop and field-based assessment process comprised precipitation, temperature, evapotranspiration, and wind data sets. The following is the summary explanation of the roles that climatic data sets may have with respect to the ongoing and proposed mining and exploration activities in the ML No. 121 (Figs. 5.1 and 5.2):

- Temperature: Temperature has a direct influence on the fluids that may influence the operation of each site by supporting evapotranspiration. It also has an influence on the operation and design of the sites and supporting infrastructures.

- Rainfall: Rainfall is one of the data sets used in water balance assessments with respect to potential fluids, leachate or contaminant mobilisation and flash flood occurrences. The data sets had some influence on site design and type of lining used and overall site operations.

- Evapotranspiration: This combined effect of evaporation and transpiration is important in water balance assessments with direct influences on site operations, and aftercare stages, and.

- ❖ Wind Direction and Speed: The direction and speed of the prevailing winds was critical to the site operations and determination of the optimum location. The data had a direct influence on the site operations including dust and noise management.

5.2.2 Environmental Model Data Sets

The regional or local environmental data sets comprised the proposed economic activities (ongoing and proposed mining and exploration activities in ML No. 121 including all the supporting infrastructure) and logistical support available in the region or area, types and amounts of waste generated, likely contaminants from waste generated / activities undertaken, ecological, habitats and ecosystems including fauna and flora as well as community considerations such, land ownership, social, health and safety, archaeological, cultural, and political issues. The following is the summary explanation of the interactive influences of environmental data sets with respect to the ongoing and proposed mining and exploration activities in the ML No. 121 (Fig. 5.2):

(i) Economic activities and logistic support (Proposed minerals exploration activities in the EPL No. 8115). The types of economic activities, infrastructure and logistical support services for the proposed minerals exploration activities in the EPL No. 8115 forms a key component of the environmental data sets and the determination of the likely positive or negative impacts.

(ii) Types and amount of waste: Understanding the characteristics of the liquid and solid waste streams to be generated is vital in the evaluation of the hazard exposure in terms of the overall risk assessment and design engineered barriers and determination of the monitoring strategy. The footprint and volume size of the proposed minerals exploration activities may have an influence on the selection and operation of each site with respect to the land availability in the local areas.

(iii) Likely contaminants: The state (solid, gas, liquid, or vapour) of any likely contaminants that may be associated with the proposed minerals exploration activities including all the supporting infrastructure.

(iv) Ecological, habitats, ecosystems, fauna, flora, and local, regional, or global Climate Change influences: Namibia is home to several unique and protected habitats, ecosystems, fauna, and flora that are highly vital as they support other sectors of the national economy such as tourism, agriculture, conservation, food security and services. Understanding the likely level of sensitivity of the regional or local drilled sites was important to the successful development and determination of the monitoring and reporting strategy, and.

(v) Community considerations: Proposed minerals exploration activities including all the supporting infrastructure may influence or be influenced by local community issues and acceptability or lack of understanding of the proposed minerals exploration activities which are often confused with mining operations. Other key components of the community considerations included: Land ownership (state or private land), local social settings, labour, natural capital, human rights, public and workers health and safety, archaeological, cultural, political, and civil society influences.

As part of the data desktop and field-based collection, evaluation, influence / impact and risk assessments processes for the final sites-specific ranking and determination of the mitigation measures and monitoring and reporting strategies, conducted specialist studies provided additional specific subject matter such as flora, fauna, water, and archaeology assessment results, recommendations and mitigations measures.

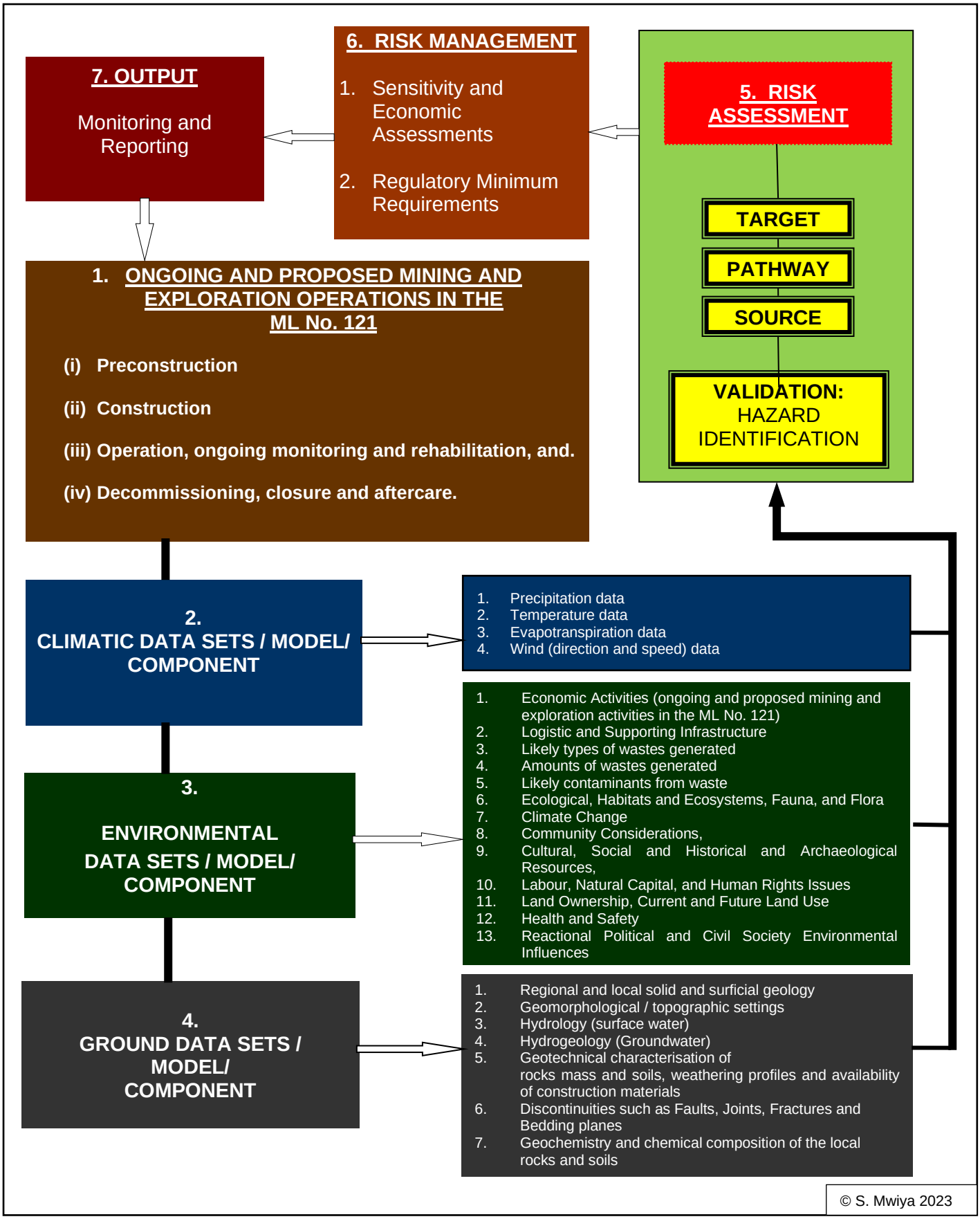

Figure 5.1: Detailed outline of the technical methodology based on a complete looped Knowledge-Based System Model Methodology (KBSMM) used during the EIA and EMP process desktop and field-based knowledge-based impact assessment, risk assessment and determination of the monitoring and reporting strategy. The system model methodology has a built-in looping that allows for the evaluation of a full ongoing and proposed project lifecycle.

5.2.3 Ground Model Data Sets

The ground data sets covered regional/local solid and surficial geology, geomorphological / topographic settings, hydrology (surface water), hydrogeology groundwater), geotechnical characterisation of rocks and soils, weathering profiles and availability of construction materials, and discontinuities such as faults, joints, fractures, and bedding planes of the drilled sites (Fig. 5.2). The geology (solid and superficial) and water (surface and groundwater) resources are all potential targets and pathways that are linked to the ongoing and proposed mining and exploration activities in the ML No. 121 including all the supporting infrastructure. Other ground components which include the local terrain (geomorphology and topographic features), discontinuities, geotechnical as well as the mineralogy will aid the influence of sources in causing or minimising the impacts to be controlled through favourable engineering designs fully supported by the ground components (Fig. 5.2). Regional/local solid and surficial geology, geomorphological and topographic settings also linked directly to the availability of local construction and operational materials in support of the ongoing and proposed mining and exploration activities in the ML No. 121 including all the supporting infrastructure project lifecycle (Fig. 5.2).

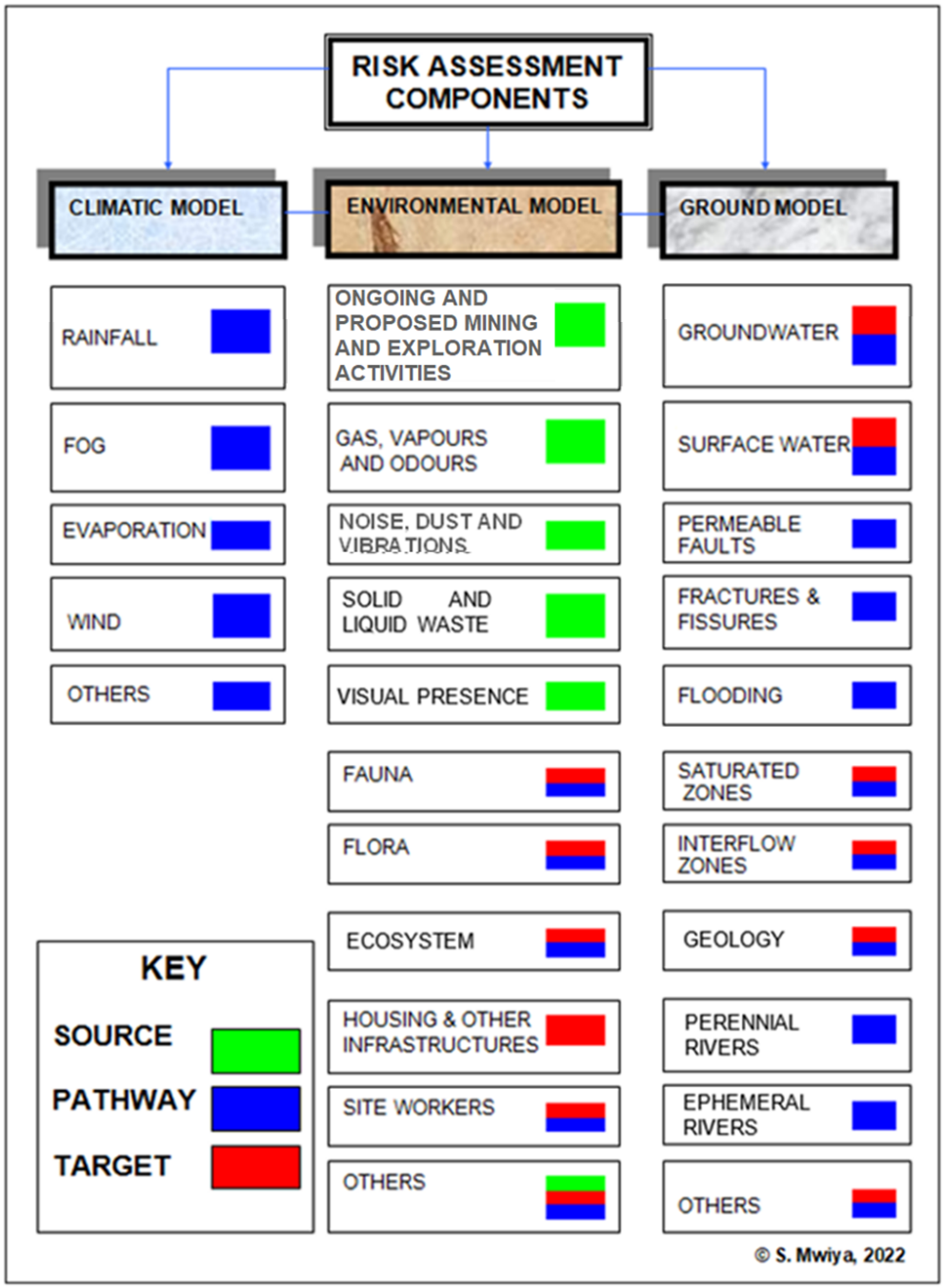

Figure 5.2: A KBSMM interactive characterised inputs risk assessment factors for in the ML No. 121.

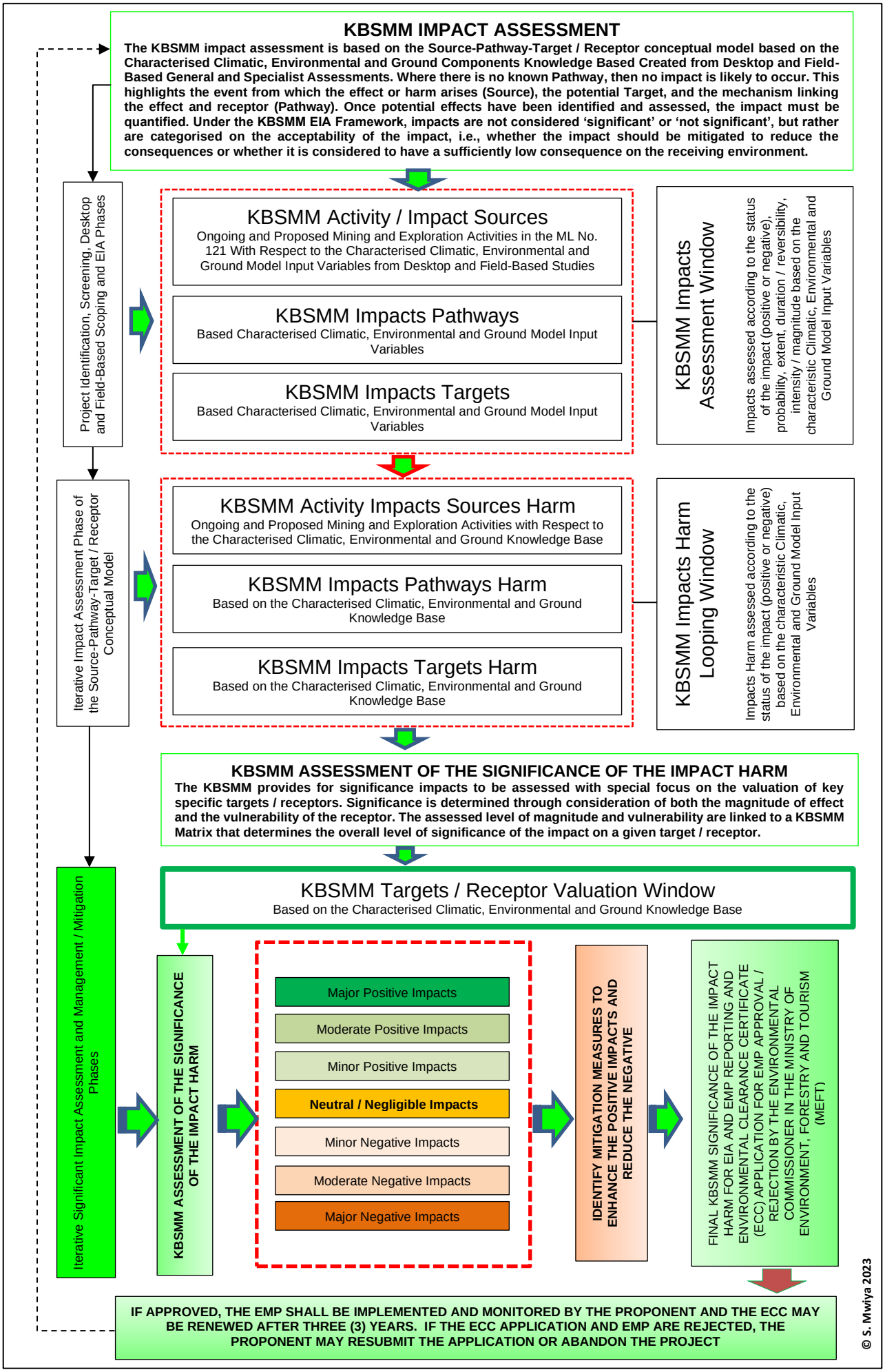

Figure 5.3: KBSMM logic interactive system framework used in the impact assessment and assessment of significance of the impact harm linked to the EMP.

5.2.4 Source-Pathway-Receptor Risk Assessment Chain, Harm and Mitigation

The assessment of influence, risk, and harm that the ongoing and proposed mining and exploration activities in the ML No. 121 may have on the receiving environment has focused on the climatic, environmental, and ground model data set characterised into sources, pathways, and targets / receptors chains (Figs. 5.1 and 5.2). The overall system methodology has been based on the source-pathway-receptor risk assessment chain, harm and mitigation (Fig. 5.3). It is important to note that in the absence of any of the sources, pathways, or targets/ receptors there is no impact, harm, or risk to mitigate or monitor or manage (Figs. 5.1-5.4). The following is the summary of the key definitions of the KBSMM source-pathway-receptor risk assessment chain, and resultant harm requiring mitigation (Figs. 5.1-5.4):

(i) The risk source/s refers to knowledge-based identified potential impact hazards that may be present and can cause harm to the exposed target/s / receptors).

(ii) The risk pathway refers to the route direct or indirect through which the risk source/s may be transferred and exposed to a target/s of concern, and.

(iii) The risk target/s or receptor/s refers to the destination (area point of exposure) at which the source/s may cause harm to the various components of the receiving environment.

The characterisation of source/s, pathway/s and target/s chain has been undertaken for climatic, environmental and ground model data components with respect to the ongoing and proposed mining and exploration activities in the ML No. 121.

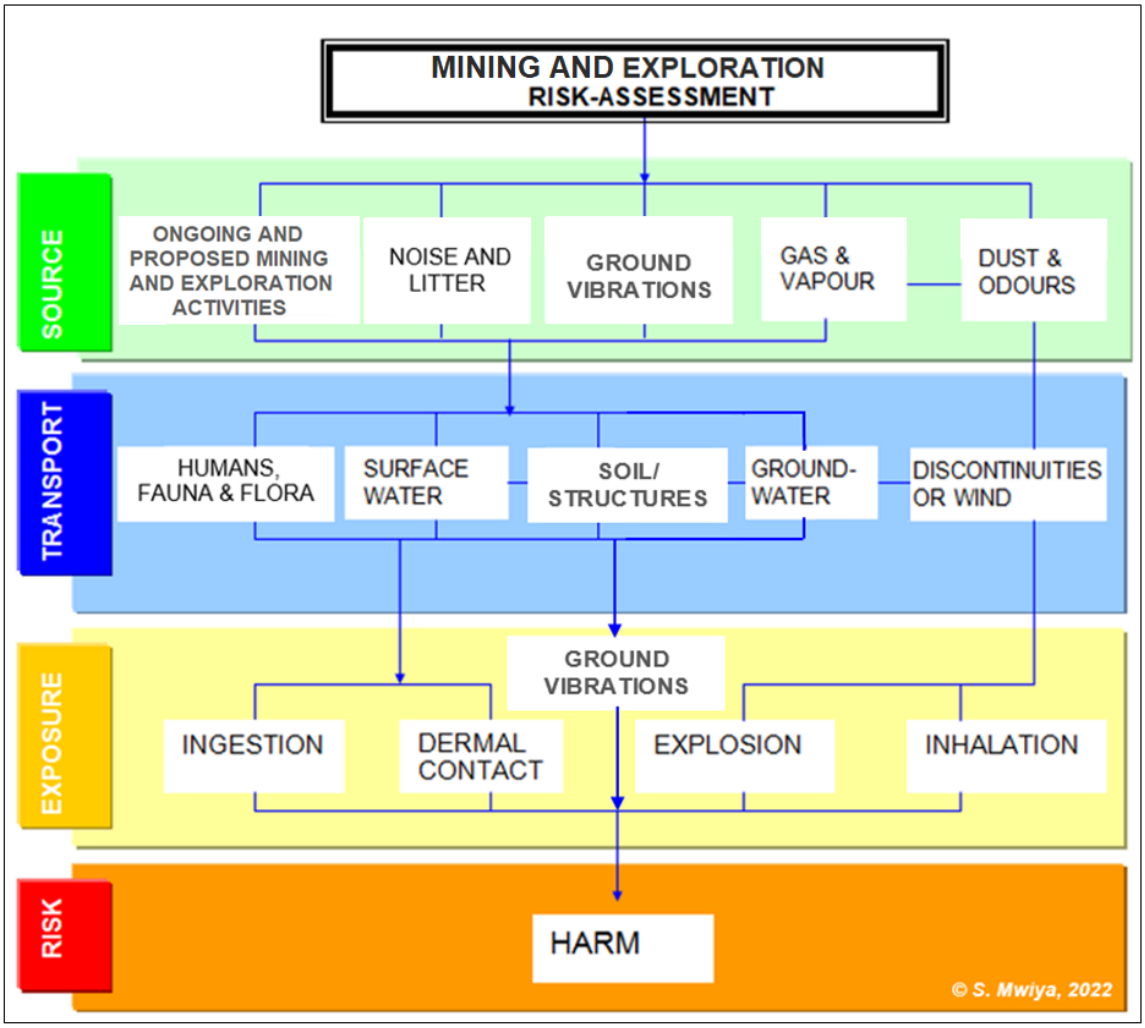

Figure 5.4: A KBSMM risk consequences (harm) pathway to the receiving target/receptors windows for with respect to the ongoing and proposed mining and exploration activities in the ML No. 121.

5.3 Identification and Characterisation of Likely Impacts

5.2.4 Likely Sources Positive Impacts

Not all activities of proposed and ongoing mining and exploration operations have negative impacts on the receiving environment. The following is summary of the positive socioeconomic impacts identified associated with the proposed project development:

- The contribution of taxes, royalties and dividends- These will contribute to the national economy. Namibian Government will benefit in the form of taxes, royalties and dividends. This also includes property and company income taxes to the Namibian Government.

- Employment – provision of work provides an income, with boosting the quality of life for employees and their families. which will also reduce unemployment and sustain the Namibian economy.

- Transfer of knowledge, skills and technology associated with different aspects of the Development – the use of new technologies will call for a new skills base which has to be transferred to employees.

- Investments in community development –The Company is committed in community development of the local infrastructure such roads and water supply. Furthermore, once in full operation, the company is also committed to support education (particularly in the area of science and technology), health, welfare and sustainable income-generating community projects in Namibia, and.

- Secondary economic boost – the development will aid in sustaining secondary industries in the Erongo Region and elsewhere in Namibia.

5.2.5 Likely Sources of Negative Impacts

Table 5.1 summarise the key sources of likely negative impacts associated with the proposed and ongoing mining and exploration operations in the ML No. 121 and it's inclusive of the supporting infrastructure such as roads and water supply services.

The impact assessment covering this EIA Report and the preparation of the EMP reports has been undertaken in line with the following ongoing and proposed mining and exploration activities in the ML No. 121 and supporting infrastructures (roads and water supply) developmental stages:

(i) Preconstruction.

(ii) Construction.

(iii) Operation, ongoing monitoring and rehabilitation, and.

(iv) Decommissioning, closure and aftercare.

Table 5.1: Summary sources of negative impacts associated with the proposed mining and exploration activities in the ML No. 121.

PROJECT PHASE	DEVELOPMENT ACTIVITIES FOR EACH PHASE	
PRE-CONSTRUCTION	1. Site investigations to inform the mine design and layout	
	2. Engineering design of the pit areas and the support facilities	
	3. General site clearing of the quarry areas, administration block, waste rock, supporting infrastructure	
	4. Access roads upgrading of existing tracks / creation of new routes as may be required	
	5. Implementation of the human resources, community and social programs for the operational phase of the project	
	6. Top soil removal and storage for the pit areas and supporting infrastructure	
	7. Development of the temporary construction camp	
	8. Installation of containerised offices, workshops, storage facilities.	
CONSTRUCTION	MINE SUPPORTING INFRASTRUCTURE	1. Transportation facilities, including access roads to the site and on-site roads
		2. Waste rock and mine blocks stockpiles
		3. Water supply systems
		4. Power infrastructure, including powerline and distribution systems (Generator and Solar)
		5. Administration blocks and warehouses
		6. Fuel supply and storage
		7. Workshop and equipment maintenance facilities
		8. Wastewater treatment systems
		9. Domestic solid waste disposal storage / transfer facility
		10. Storm water management in the pit and supporting infrastructure
	PIT AREA	1. Mining operations
		2. Actual and stripping of the overburden to create direct access to the fresh granite
		3. Ore production for test mining operations
		4. Test mining and commissioning
OPERATION, ONGOING MONITORING AND REHABILITATION	1. Mining operations (actual mining operations as maybe required)	
	2. Transportation of the mined blocks from pit to the sorting	
	3. Storage and transportation of granite blocks for further processing	
	4. Waste rock management / reprocessing / recovery	
	5. Ongoing exploration support	
	6. Ongoing rehabilitation and maintenance	
	7. Waste water management	
	8. Municipal solid waste management / transfer to Arandis	
	9. Environmental performance monitoring	
DECOMMISSIONING CLOSURE AND AFTERCARE	1. Implementation of sustainable socioeconomic plan	
	2. Closure of open pits	
	3. Closure of solid waste transfer station	
	4. Backfill all excavated areas	
	5. Closure of the mined blocks storage area	
	6. Decommissioning of water and electricity infrastructure	
	7. Overall land reclamation	
	8. Restoration of internal roads	
	9. Revegetation and aftercare as may be required	

5.3.2 Summary of Receptors Likely to be Negative Impacted

Based on the finding of this EIA Report, the following is the summary of the key environmental receptors that are may be negatively impacted by the proposed activities:

- **Physical environment:** Water quality, physical infrastructure and resources, air quality, noise and dust, landscape and topography, soil quality and, Climate change influences.
- **Biological environment:** Habitat, protected areas and resources, flora, fauna, and ecosystem functions, services, use values and non-use or passive use, and.
- **Socioeconomic, cultural and archaeological environment:** Local, regional and national socioeconomic settings, commercial and subsistence agriculture, community protection areas tourism and recreation cultural, biological and archaeological resources.

The environmental assessment process adopted for this project took into considerations the provisions of the provisions of the Minerals (Prospecting and Mining) Act, 1992, (No 33 of 1992), the Environmental Management Act, 2007, (Act No. 7 of 2007) and all other applicable national laws and Regulations.

The impact assessment process took into considerations the proposed activities, trade-offs, alternatives, and key issues all centred on knowledge-based system matrix risk assessment approach. Specialist consultants provided key specialist inputs and recommendations on the impact assessment outcomes and mitigation measures.

5.3.3 Alternatives and Ecosystem Assessments

The various project alternative has been assessed for the ongoing and proposed granite and other potential dimension stone mining operations in the ML No. 121 and will need to be continuously reviewed at various stages of the project development process. The following alternatives have been considered and evaluated with respect to the proposed project preconstruction, construction, operation and monitoring, rehabilitation and closure as well as the aftercare stages:

(i) **Location of the Granite Deposits/ Proposed Operations:** A number of the different granite deposits are known to exist in different parts of Namibia and some have been explored and mined by different companies over the years. The deposits found within the ML No. 121 isa have been explored and still being mined by different companies in the area. Based on the historical records available as well as the results of the comprehensive work covering desktop studies, field-base data collection process, including a field surface, drilling and sampling programmes undertaken, there is potential to develop a mining project in this area compared to other known deposits. More so, however, is that the deposit is located in an area with large-scale mining operations such as the Rössing and Husab Uranium Mines with very supporting good infrastructure required for development a dimension stone mining project including close to the town of Arandis and Port of Walvis Bay with good road and rail network connectivity to the ongoing and proposed mining operations in in the ML No. 121.

(ii) **Exploration Methods:** In general, an exploration programme covers four stages namely: desk study, scoping, pre-feasibility and feasibility. The type of exploration methods applied at each stage may be different and will depend on the various issues such as the type of the hosting rocks, depth, as well as the level of detail required. All different variables and alternatives have been considered in the evaluation of the influences likely to be posed by the ongoing exploration activities. Due to the availability of sufficient historical data sets, much of the exploration activities undertaken at each of the four stages (scoping, pre-feasibility and feasibility) comprised desk studies, surface field mapping, sampling, trenching in selected areas, sampling in selected areas, test mining and ore reserve assessments and evaluations. Other exploration techniques such as geophysical surveys have also been considered.

(iii) **Mining Methods**: The mining techniques will use open cast mining in the extraction of the granite blocks as the only safe and practical mining method for dimension stone operations. The blocks are cut-out using various techniques including diamond wire, giant saws and removed by a frontend loader for sorting and stockpiling.

(iv) **Transport:** Assessment of the transport alternatives are more of a major issue to the mining phase compared the exploration. During the exploration much of the transport mechanisms will utilise light 4 x 4 vehicles. Transport of granite blocks from the mining face to the stockpile will be done by the front-end loader. Transport from the mine stockpile / storage / sorting areas of sorted and granted materials to the customers or processing plant will be done by trucks or rail.

(v) **Processing:** A dimension stone ore body comprise block of rock from which certain shape and sized blocks can be taken out by sawing with a diamond cutter. These blocks are then cut, trimmed, processed and polished into a variety of finished products such as table tops, grave stones, cladding stones, tiles and bathing taps tops. All the granite blocks produced are

inspected and classified in terms of size, dimension colour, texture, fractures, veins and spots etc.

(vi) **Water Resources:** Limited poor quality groundwater is available in the area. Permission for the extraction of water (drilling of borehole to support the proposed mining operations) and the disposal of waste water will need to be obtained from the Ministry of Agriculture, Water and Land Reform. The main source of water in the area is the groundwater associated with the good secondary hydraulic properties with limited surficial covers. The strategies for the recycling and reuse of water are being implemented vigorously with additional drilling water being obtained from the greywater facility of the Arandis Town Council.

(vii) **Energy Sources:** The available sources of energy include electricity from the national grid connectivity, solar, diesel, Liquid Petroleum Gas (LPG) and petrol have been considered and available in Arandis and Swakopmund. Various alternative combinations will need to be considered as part of the ongoing development of this proposed granite project.

(viii) **The No-Action Alternative** - A comparative assessment of the environmental impacts of the 'no-action' alternative (a future in which the ongoing and proposed mining and exploration activities in the ML No. 121 do not take place) has been undertake. An assessment of the environmental impacts of a future, in which the ongoing and proposed mining and exploration activities do not take place, may be good for the receiving environment because there will be no negative environmental impacts due to the ongoing and proposed mining and exploration operation that may take place in the ML No. 121 isa. The environmental benefits will include: No negative environmental impact on the receiving environment. However, it is important to understand that even if the ongoing and proposed mining and exploration activities do not take place, to which the likely negative environmental impacts are likely to be low and localised (subject to the outcomes of the EIA and EMP Phases), the current and other future land uses such as agriculture will still have some negative impacts on the receiving environment. The likely negative environmental impacts of other current and future land use that may still happen in the absence of the ongoing and proposed mining and ongoing minerals exploration activities includes: Land degradation due to natural Climate Change, drought, poor land management practices, and natural erosion. Furthermore, it is also important to understand what benefits might be lost if the ongoing and proposed mining and exploration activities do not take place. Key loses that may never be realised if the proposed mining and ongoing project activities do not go-ahead include: Loess of investment that has been made in Namibia, loss of direct jobs that have been created, loss of potential added value to the unknown granite resources, loss of direct and indirect socioeconomic benefits derived from current and future mining and exploration activities, contracts, export earnings, future foreign direct investments, license rental fees, royalties and various other taxes payable to the Government during the mining operational stage.

(ix) **Other Alternative Land Uses:** The ongoing and proposed mining area fall within the ǂGaingu Communal Conservancy area (conservation), tourism and agriculture comprising cattle and small stock commercial / subsistence communal farming in the central and northern parts of the conservancy. Minerals exploration and mining activities are well known land uses options in Namibia and the surrounding ML area. Due to the limited and localised scope of the proposed mining and ongoing exploration within the ML No. 121 and the implementation of the EMP, it is likely that the ongoing and proposed mining and exploration activities can coexist with the current and future land uses within the ML No. 121.

(x) **Potential Land Use Conflicts:** Considering the current land use practices ǂGaingu Communal Conservancy area (conservation), tourism and agriculture only common in the central and northern parts of the conservancy, it is likely that the development of a mine in the ML No. 121 isa can still co-exist with the existing and potential future land uses of the area. The use of thematic mapping thereby delineating zones for specific uses such as conservation, mining or tourism etc, within the ML area will greatly improve the multiple land use practices and promote coexistence as may be required.

(xi) **Ecosystem Function** (**What the Ecosystem Does**)**:** There are wildlife habitats, carbon cycling or the trapping of nutrients and characterised by the physical, chemical, and biological processes or attributes that contribute to the self-maintenance of an ecosystem in this area. The ongoing and proposed mining and exploration activities will not affect the ecosystem function due to the limited and localised scope and the ecosystem of ML area is part of the larger local and regional ecosystems which are all interlinked.

(xii) **Ecosystem Services:** Food chain, harvesting of animals or plants, and the provision of clean water or scenic views are some of the local ecosystem services associated with the ML area. However, the ongoing and proposed mining and exploration activities will not affect the ecosystem services due to the limited scope, area of coverage and the ecosystem of ML area is part of the larger local and regional ecosystems which are all interlinked.

(xiii) **Use Values**: The ML area has direct use for other land uses such as agriculture, conservation and tourism as well as indirect include watching a television show about the general area and its wildlife, food chain linkages that sustains the complex life within this area and bequest value for future generations to enjoy. The ongoing and proposed mining and exploration activities will not destroy the current use values due to the limited and localised scope of the proposed mining and ongoing activities as well as the adherence to the provisions of the EMP, and.

(xiv) **Non-Use or Passive Use**: The ML area has an existence value that is not linked to the direct use / benefits to current or future generations. The ongoing and proposed mining and exploration activities will not affect ecosystem current or future none or passive uses due to the limited and localised scope that will leave much of the ML area untouched and the ecosystem of the ML area is part of the larger local and regional ecosystems which are all interlinked.

5.4 Knowledge-Based Impact Assessment Criteria

5.4.1 Individual Components Knowledge-Based Evaluation of Impacts

KBSMM characterised sources of potential positive or negative impacts and the sensitivity of the receiving environment have been evaluated as part of the EIA and EMP process for the ongoing and proposed mining and exploration activities in the ML No. 121.

Individual negative impacts ratings of high or medium significance, have had mitigation objectives set (i.e., ways of reducing negative impacts), and attainable management actions have been provided in the EMP Report.

Without mitigation, monitoring and impact management, these impacts would either breach statutory limits or be unacceptable to statutory authorities or to the local communities / stakeholders, as they would result in a significant deterioration of one or more environmental resources or component of the receiving regional or local receiving environment.

5.4.2 Knowledge-Based Environmental Impact Assessment Rankings

To ensure consistency in the evaluation of environmental impacts associated with the ongoing and proposed mining and exploration activities in the ML No. 121, the rating criteria for the impact assessment were standardised to include a set of definition applied in the qualitative and semi-quantitative risk assessment loop (Table 5.2).

To the extent possible, allocation to rank categories has been based on quantifiable criteria which can be measured as detailed in Table 5.2.

Furthermore, when evaluating impacts, the allocated ranks refer to the resultant *impact* (e.g., habitat area affected, or time that the result of the impact will last), and not of the *cause* thereof (e.g., time of active impact).

Each activity has been assessed with respect to the type of effect that the aspect will have on the relevant component of the receiving environment and included “what will be affected and how?”

The criteria used in the determination of the significance rating of the impact(s) is detailed in Table 5.3.

Table 5.2: Definition of impact categories and the KBSMM boundary conditions.

Rating	Definition of Rating
Status of the Impact – in terms of meeting the objective of maintaining a healthy environment.	
Positive	The impact benefits the environment
Negative	The impact results in a cost to the environment
Neutral	The impact has no effect
Probability – the likelihood of the impact occurring	
Negligible	Possibility negligible
Improbable	Possibility very low
Probable	Distinct possibility
Highly Probable	Most likely
Definite	Impact will occur regardless of preventive measures
Degree of confidence in predictions – in terms of basing the assessment on available information	
Low	Assessment based on extrapolated data
Medium	Information base available but lacking
High	Information base comparatively reliable
Extent – the area over which the impact will be experienced	
Site specific	Confined to within < 1 km of the project
Local	Confined to the study area or within 5 km of the project
Regional	Confined to the region, i.e. > 5 km but < National
National	Nationally
International	Beyond the borders of Namibia
Duration – the time frame for which the impact will be experienced	
Very short	Less than 2 years
Short-term	2 to 5 years
Medium-term	6 to 15 years
Long-term	More than 15 years
Permanent	Generations
Intensity – the magnitude of the impact in relation to the sensitivity of the receiving environment	
Negligible	Natural functions and processes are negligibly altered due to adaptation by the receptor(s) to high natural environmental variability
Mild	Natural functions and processes continue albeit in a modified way that **does not** appear to have a significant disruptive effect (i.e., changes are temporary)
Moderate	Natural functions and processes continue albeit in a modified way that **does** appear to have a noticeable disruptive effect (i.e., changes are permanent)
Severe	Natural functions or processes are altered to the extent that they temporarily cease resulting in severe deterioration of the impacted environment
Very Severe	Natural functions or processes permanently cease or are completely disrupted

Table 5.3: The criteria used to determine the significance rating of the impact(s) and the KBSMM boundary conditions.

Low	Where the impact will have a negligible influence on the environment and no modifications or mitigations are necessary for the given project description. This would be allocated to impacts of any severity/ magnitude, if at a local scale/ extent and of temporary duration/time.
Medium	Where the impact could have an influence on the environment, which will require modification of the project design and/or alternative mitigation. This would be allocated to impacts of moderate severity, locally to regionally, and in the short term.
High	Where the impact could have a significant influence on the environment and, in the event of a negative impact, the activity(ies) causing it should not be permitted without substantial mitigation and management, and pro-active rehabilitation commitments (i.e., there could be a ‘no-go’ implication for the project). This would be allocated to impacts of severe magnitude, locally over the medium-term, and/or of severe magnitude regionally and beyond.

5.4.3 Overall Component and Significant Impact Assessment Criteria

The overall component impact assessment took into considerations the proposed minerals exploration activities in the EPL No. 8115 as the overall source of impact. The various components of the receiving environment have been considered as the receptor / target that may be impacted positively or negatively by the proposed minerals exploration activities.

The components of the receiving environment encompassed the following:

- Physical Conditions / Natural Environment – Air, noise, water, green space, climate change, built environment – houses, roads, transport systems, buildings, infrastructure, etc.
- Biological Conditions: fauna, flora, habitats, and ecosystem - services, function, use values and non-use etc., and.
- Socioeconomic Conditions: Social, economic, labour, gender, human rights, natural and social capital, archaeological, cultural resources, and cultural issues

In evaluating the degree of potential negative impacts, the following factors have been taken into consideration:

- Impact Severity: The severity of an impact is a function of a range of considerations, and.
- Likelihood of Occurrence (Probability): How likely is the impact to occur?

In evaluating the severity of potential negative environmental impacts, the following factors have been taken into consideration:

- Receptor/ Resource Characteristics: The nature, importance, and sensitivity to change of the receptors / target or resources that could be affected.
- Impact Magnitude: The magnitude of the change that is induced.
- Impact Duration: The time over which the impact is expected to last.
- Impact Extent: The geographical extent of the induced change, and.
- Boundary Conditions in Forms of Regulations, Standards and Guidelines: The status of the impact in relation to regulations (e.g., discharge limits), standards (e.g., environmental quality criteria) and guidelines.

The overall impact severity has been categorised using a semi-quantitative KBSMM scale as shown in Table 5.4 for magnitude, Table 5.5 for duration and Table 5.6 for extent.

Table 5.4: KBSMM boundary conditions scored on a scale from 0 to 5 for impact magnitude.

SCALE (-) or (+)		DESCRIPTION
0		no observable effect
1		low effect
2		tolerable effect
3		medium high effect
4		high effect
5		very high effect (devastation)

Table 5.5: KBSMM boundary conditions scored time over which the impact is expected to last and its reversibility.

SCALE (-) or (+)		DESCRIPTION
T		Temporary
P		Permanent

Table 5.6: KBSMM boundary conditions scored geographical extent of the induced change.

SCALE (-) or (+)		DESCRIPTION
L		limited impact on location
O		impact of importance for municipality.
R		impact of regional character
N		impact of national character
M		impact of cross-border character

The likelihood (probability) of the pre-identified events occurring has been qualified using a qualitative scale of probability categories (in increasing order of likelihood) as shown in Table 5.7. Likelihood is estimated on the basis of experience and/ or evidence that such an outcome has previously occurred. Impacts resulting from routine/planned events are classified under category (E).

The overall individual components of the impact assessment with respect to the impact duration, geographical extent and probability of occurrence have been determined using a semi quantitative approach.

Table 5.7: KBSMM boundary conditions scored scale of probability categories (in increasing order of likelihood).

SCALE (-) or (+)		DESCRIPTION
A		Extremely unlikely (e.g., never heard of in the industry)
B		Unlikely (e.g., heard of in the industry but considered unlikely)
C		Low likelihood (e.g., such incidents/impacts have occurred but are uncommon)
D		Medium likelihood (e.g., such incidents/impacts occur several times per year within the industry)
E		High likelihood (e.g., such incidents/impacts occur several times per year at each location where such works are undertaken)

The results of the overall impacts assessment and evaluation has adopted a matrix assessment framework linked to the KBSMM framework (Figs. 5.1-5.4). Assessment results of the magnitude, duration, extent, and probability of the potential impacts due to the proposed project activities interacting with the receiving environment are presented in form of a matrix table as shown in Table 5.8.

The step progressional approach will allow the Proponent to evaluate the results of the ongoing and proposed mining and exploration success and the implementation of the next stages of activities.

It is important to note that the assessment of the likely impacts as shown in Table 5.8, will be considered without the implementation of mitigation measures as detailed in the separate EMP Report. The need for implementation of the appropriate mitigation measures as presented in the EMP Report will be determined based on the results of the individual and overall component impact assessments and the significant impacts.

Table 5.8: Impact assessment matrix used for assessing the overall likely impacts that the proposed project developmental stages and the associated activities on the receiving environment sensitivity (natural, built, socioeconomic, flora, fauna, habitat and ecosystem) with respect to duration, geographical extent and probability occurrence.

SCALE	DESCRIPTION
0	no observable effect
1	low effect
2	tolerable effect
3	medium high effect
4	high effect
5	very high effect (devastation)

SOURCES OF POTENTIAL IMPACT	PROJECT DEVELOPMENT PHASE	ACTIVITIES		RECEPTORS / TARGETS THAT MAY BE IMPACTED: PHYSICAL AND SOCIOECONOMIC ENVIRONMENT: Natural Environment – Air, Noise, Water, Green Space, Climate Change	Built Environment – Houses, Roads, Transport Systems, Buildings, Infrastructure	Socioeconomic- Human Rights, Natural and Social Capital Job, Investment, Taxes and Social Issues e.g. HIV Aids,	Archaeological Cultural, Historical and Spiritual Resources	BIOLOGICAL ENVIRONMENT: Flora	Fauna	Habitat	Ecosystem - Services, function, use values and non-use
	PRE-CONSTRUCTION	1. Site investigations to inform the mine design and layout									
		2. Engineering design of the pit areas and the support facilities									
		3. General site clearing of the quarry areas, administration block, waste rock, supporting infrastructure									
		4. Access roads upgrading of existing tracks / creation of new routes as may be required									
		5. Implementation of the human resources, community and social programs for the operational phase of the project									
	CONSTRUCTION	MINE SUPPORTING INFRASTRUCTURE	1. Transportation facilities, including access roads to the site and on-site roads								
			2. Waste rock and mine blocks stockpiles								
			3. Water supply systems								
			4. Power infrastructure, including powerline and distribution systems (Generator and Solar)								
			5. Administration blocks and warehouses								
			6. Fuel supply and storage								
			7. Workshop and equipment maintenance facilities								
			8. Wastewater treatment systems								
			9. Domestic solid waste disposal storage / transfer facility								
			10. Storm water management in the pit and supporting infrastructure								
		MINE WORKINGS	1. Mining operations								
			2. Actual and stripping of the overburden to create direct access to the fresh granite								
			3. Ore production for test mining operations								
			4. Test mining and commissioning								

Table 1.8: *Cont.*

SCALE		DESCRIPTION
0		no observable effect
1		low effect
2		tolerable effect
3		medium high effect
4		high effect
5		very high effect (devastation)

SOURCES OF POTENTIAL IMPACT	PROJECT DEVELOPMENT PHASE	ACTIVITIES	RECEPTORS / TARGETS THAT MAY BE IMPACTED							
			PHYSICAL AND SOCIOECONOMIC ENVIRONMENT				BIOLOGICAL ENVIRONMENT			
			Natural Environment – Air, Noise, Water, Green Space, Climate Change	Built Environment – Houses, Roads, Transport Systems, Buildings, Infrastructure	Socioeconomic- Human Rights, Natural and Social Capital Job, Investment, Taxes and Social Issues e.g. HIV Aids,	Archaeological Cultural, Historical and Spiritual Resources	Flora	Fauna	Habitat	Ecosystem - Services, function, use values and non-use
	OPERATION, ONGOING MONITORING AND REHABILITATION	1. Transportation facilities, including access roads to the site and on-site roads								
		2. Waste rock and mine blocks stockpiles								
		3. Water supply systems								
		4. Power infrastructure, including powerline and distribution systems (Generator and Solar)								
		5. Administration blocks and warehouses								
		6. Fuel supply and storage								
		7. Workshop and equipment maintenance facilities								
		8. Wastewater treatment systems								
		9. Domestic solid waste disposal storage / transfer facility								
	DECOMMISSIONING CLOSURE AND AFTERCARE	1. Storm water management in the pit and supporting infrastructure								
		2. Mining operations								
		3. Actual and stripping of the overburden to create direct access to the fresh granite								
		4. Ore production for test mining operations								
		5. Test mining and commissioning								
		6. Transportation facilities, including access roads to the site and on-site roads								
		7. Transportation facilities, including access roads to the site and on-site roads								
		8. Waste rock and mine blocks stockpiles								
		9. Water supply systems								

5.4.4 Evaluation of Significant Impacts

5.4.4.1 Overview

The significance of each impact has been determined by assessing the impact severity against the likelihood (probability) of the impact occurring as summarised in the impact significance assessment matrix provided in Table 5.9.

5.4.4.2 Significance Criteria

Significance criteria for negative/adverse impacts (i.e., relative ranking of importance) are defined in Table 5.9. It is important to note that impacts have been considered without the implementation of mitigation measures. The need for appropriate mitigation measures as presented in the EMP report has been determined based on the basis of the impact assessment presented in this report.

Table 5.9: Scored impact significance criteria.

IMPACT SEVERITY (Magnitude, Duration, Extent, Probability)	**RECEPTOR CHARACTERISTICS (SENSITIVITY)**				
	Very High (5)	**High (4)**	**Medium (3)**	**Low (2)**	**Negligible (1)**
Very High (5)	Major [5/5]	Major [4/5[	Moderate [3/5]	Moderate [2 /5]	Minor 1/5
High (4)	Major [5/4]	Major [4/4]	Moderate [3/4]	Moderate [2/4]	Minor [1/4]
Medium (3)	Major [5/3]	Moderate [4/3]	Moderate [3/3]	Minor [2/3]	None [1/3]
Low (2)	Moderate [5/2]	Moderate [4/2]	Minor [3/2]	None [2/2]	None [1/2]
Negligible (1)	Minor [5/1]	Minor [4/1]	None [3/1]	None [2/1]	None [1/1]

5.4.4.3 Assessment Likely Significant Impacts

The assessment of significant impacts depended upon the degree to which the proposed project activities are likely to results in unwanted consequences on the receptor covering physical and biological environments. Overall, the assessment of significant impacts has focused on the ecosystem-based approach that considers potential impacts to the ecosystem. The main key sources of impacts that have been used in the determination of significant impacts posed by the proposed minerals exploration comprised activities. Each of the main areas of impact have been identified and assessed as follows:

- Positive Impacts are classified under a single category. they are then evaluated qualitatively with a view to their enhancement, if practical.
- Negligible or Low Impacts will require little or no additional management or mitigation measures (on the basis that the magnitude of the impact is sufficiently small, or that the receptor is of low sensitivity).
- Medium or High Impacts require the adoption of management or mitigation measures.
- High Impacts always require further management or mitigation measures to limit or reduce the impact to an acceptable level.

Overall, the results of the significant impact assessment matrix for the ongoing and proposed mining and exploration activities in the ML No. 121 on the physical and biological environments will be presented as shown in Tables 5.10.

Table 5.10: Assessment matrix used for assessing the likely significant impacts with respect to proposed project developmental stages and the associated activities on the receiving environment (natural, built, socioeconomic, flora, fauna, habitat, and ecosystem).

IMPACT SEVERITY	IMPACT LIKELIHOOD: Extremely Unlikely [0]	Unlikely [1]	Low Likelihood [2]	Medium Likelihood [3]	High Likelihood [4]
Slight [A]	[A0]	[A1]	[A2]	[A3]	[A4]
Low [B]	[B0]	[B1]	[B2]	[B3]	[B4]
Medium [C]	[C0]	[C1]	[C2]	[C3]	[C4]
High [D]	[D0]	[D1]	[D2]	[D3]	[D4]

				RECEPTORS / TARGETS THAT MAY BE IMPACTED							
				PHYSICAL AND SOCIOECONOMIC ENVIRONMENT				BIOLOGICAL ENVIRONMENT			
SOURCES OF POTENTIAL IMPACT	PROJECT DEVELOPMENT PHASE	ACTIVITIES		Natural Environment – Air, Noise, Water, Green Space, Climate Change	Built Environment – Houses, Roads, Transport Systems, Buildings, Infrastructure	Socioeconomic- Human Rights, Natural and Social Capital Job, Investment, Taxes and Social Issues e.g. HIV Aids,	Archaeological Cultural, Historical and Spiritual Resources	Flora	Fauna	Habitat	Ecosystem - Services, function, use values and non-use
	PRE-CONSTRUCTION	1. Site investigations to inform the mine design and layout									
		2. Engineering design of the pit areas and the support facilities									
		3. General site clearing of the quarry areas, administration block, waste rock, supporting infrastructure									
		4. Access roads upgrading of existing tracks / creation of new routes as may be required									
		5. Implementation of the human resources, community and social programs for the operational phase of the project									
	CONSTRUCTION	MINE SUPPORTING INFRASTRUCTURE	1. Transportation facilities, including access roads to the site and on-site roads								
			2. Waste rock and mine blocks stockpiles								
			3. Water supply systems								
			4. Power infrastructure, including powerline and distribution systems (Generator and Solar)								
			5. Administration blocks and warehouses								
			6. Fuel supply and storage								
			7. Workshop and equipment maintenance facilities								
			8. Wastewater treatment systems								
			9. Domestic solid waste disposal storage / transfer facility								
			10. Storm water management in the pit and supporting infrastructure								
		MINE WORKINGS	1. Mining operations								
			2. Actual and stripping of the overburden to create direct access to the fresh granite								
			3. Ore production for test mining operations								
			4. Test mining and commissioning								

Table 5.10: *Cont.*

IMPACT SEVERITY	IMPACT LIKELIHOOD				
	Extremely Unlikely [0]	Unlikely [1]	Low Likelihood [2]	Medium Likelihood [3]	High Likelihood [4]
Slight [A]	[A0]	[A1]	[A2]	[A3]	[A4]
Low [B]	[B0]	[B1]	[B2]	[B3]	[B4]
Medium [C]	[C0]	[C1]	[C2]	[C3]	[C4]
High [D]	[D0]	[D1]	[D2]	[D3]	[D4]

			RECEPTORS / TARGETS THAT MAY BE IMPACTED							
			PHYSICAL AND SOCIOECONOMIC ENVIRONMENT				BIOLOGICAL ENVIRONMENT			
SOURCES OF POTENTIAL IMPACT	PROJECT DEVELOPMENT PHASE	ACTIVITIES	Natural Environment – Air, Noise, Water, Green Space, Climate Change	Built Environment – Houses, Roads, Transport Systems, Buildings, Infrastructure	Socioeconomic- Human Rights, Natural and Social Capital Job, Investment, Taxes and Social Issues e.g. HIV Aids,	Archaeological Cultural, Historical and Spiritual Resources	Flora	Fauna	Habitat	Ecosystem - Services, function, use values and non-use
	OPERATION, ONGOING MONITORING AND REHABILITATION	1. Mining operations (actual mining operations as maybe required)								
		2. Transportation of the mined blocks from pit to the sorting								
		3. Storage and transportation of granite blocks for further processing								
		4. Waste rock management / reprocessing / recovery								
		5. Ongoing exploration support								
		6. Ongoing rehabilitation and maintenance								
		7. Waste water management								
		8. Municipal solid waste management / transfer to Arandis								
		9. Environmental performance monitoring								
	DECOMMISSIONING CLOSURE AND AFTERCARE	1. Implementation of sustainable socioeconomic plan								
		2. Closure of open pits								
		3. Closure of solid waste transfer station								
		4. Backfill all excavated areas								
		5. Closure of the mined blocks storage area								
		6. Decommissioning of water and electricity infrastructure								
		7. Overall land reclamation								
		8. Restoration of internal roads								
		9. Revegetation and aftercare as may be required								

5.5 Mitigation Measures for Significance Impacts

Based on the finding of this EIA Report, an EMP Report has been prepared detailing the mitigation measures that the Proponent shall implement in minimising and maximising the likely effects of negative and positive impacts respectively.

The following is the summary of the guiding principles with respect to the mitigation measures as presented in the EMP Report in order of preference and in addressing the impacts assessed to have likely significant adverse effects on the receiving environment:

(i) Enhancement, e.g., provision of new habitats

(ii) Avoidance, e.g., sensitive design to avoid effects on ecological receptors

(iii) Reduction, e.g., limitation of effects on receptors through design changes, and.

(iv) Compensation, e.g., community benefits.

5.6 Impact Assessment Results

5.6.1 Positive Impact Assessment Results

Tables 5.11 - 5.17 summarises the impact assessment results associated with positive impacts which are mainly linked socioeconomic issues covering payment of taxes / royalties, employment, improved local infrastructure, training and skills transfer, boost to local economies, development of technology and technological advancement.

Table 5.11: Payment of taxes / royalties.

Contribution to national economy through payment of taxes and royalties	*Status*	Positive
	Probability	Definite
	Confidence	High
	Extent	National: The Proponent may use international contractors are maybe required but the bulk of the support services will be reserved for Namibian companies / services providers
	Duration	Medium-term
	Intensity	Moderate
	Significance	High. The Proponent will make a marked contribution to the Namibian economy through payment of taxes and royalties throughout the life of the proposed mine

Table 5.12: Employment.

Provision of employment opportunities boosting the local economy	*Status*	Positive
	Probability	Definite
	Confidence	High
	Extent	National: Employees are mostly from Namibia
	Duration	Medium-term
	Intensity	High
	Significance	High. a significant number of especially Namibian families will be supported financially over the life of the proposed mining operations

Table 5.13: Improved local infrastructure.

Upgrade of the local infrastructure such as access road linking the mine to main national B2 Road	*Status*	Positive
	Probability	Definite
	Confidence	High
	Extent	Local
	Duration	Medium-term
	Intensity	Moderate
	Significance	Medium

Table 5.14: Training and skills transfer.

Provision of employee training and development of skills including high value beneficiation support	*Status*	Positive
	Probability	Definite
	Confidence	High
	Extent	International
	Duration	Long-term
	Intensity	High (=Severe)
	Significance	High

Table 5.15: Boost to local and reginal economies.

Use of Arandis or Swakopmund to house the mine workers and Walvis Bay as the logistics base and facilities, purchasing of local goods and services, use of local vendors, local employment and local economic boost.	*Status*	Positive
	Probability	Definite
	Confidence	High
	Extent	Local to Regional
	Duration	Long-term
	Intensity	High (=Severe)
	Significance	High

Table 5.16: Development of technology and technological advancement.

Research and design associated with minerals exploration, mining and processing techniques including high value beneficiation	*Status*	Positive
	Probability	Definite
	Confidence	High
	Extent	International
	Duration	Permanent
	Intensity	Moderate
	Significance	High

Table 5.17: Sponsorships of research, education and community projects.

Creation of opportunities for research and education Improved environmental knowledge/awareness with links to institutions of higher learning	*Status*	Positive
	Probability	Definite
	Confidence	High
	Extent	Regional
	Duration	Medium-term
	Intensity	Moderate
	Significance	Medium

5.6.2 Negative Impact Assessment Results

5.6.2.1 Preconstruction

The preconstruction is very important from an environmental perspective. The preconstruction phase will cover site preparation (clearing, stripping and grading) and construction of the supporting infrastructure.

The following is the summary of the key activities that have been assessed in the EIA with respect to the site preparation and construction of mine infrastructure phase:

(i) Site investigations to inform the mine design and layout.

(ii) Engineering design of the pit areas and the support facilities.

(iii) General site clearing of the quarry areas, administration block, waste rock, supporting infrastructure.

(iv) Access roads upgrading of existing tracks / creation of new routes as may be required

(v) Implementation of the human resources, community and social programs for the operational phase of the project.

(vi) Top soil removal and storage for the pit areas and supporting infrastructure, and.

(vii) Development of the temporary construction camp, and installation of campsites, offices, workshops, storage facilities.

All the above activities are likely to have potentially important environmental implications. Potential concerns are related to highly localised negative impacts on natural environment (air quality, noise, water, soil), built environment (roads, transport systems, buildings, infrastructure), socioeconomic, archaeological and cultural resources, flora, fauna, habitat and ecosystem (services, function, use values and non-use) (Tables 5.18 - 5.24).

Detailed mitigation measures are provided in the EMP Report. The preconstruction related activities are also associated with the air quality, risk of spills and accidents, which could result in the release of contaminants such as chemicals, reagents and other substances into the receiving environment and results in harm including Occupational Health and Safety (OHS).

Table 5.18: General site clearing of the pit area, administration block, waste rock and supporting infrastructure.

Preconstruction activities associated exploration, mining and supporting infrastructure	*Status*	Negative
	Probability	Definite
	Confidence	High
	Extent	Localised
	Duration	Very short
	Intensity	Low
	Significance	Medium

Table 5.19: Access roads clearing and upgrading the existing and creation of new road networks.

Preconstruction activities associated with the access road linking the ML area	*Status*	Negative
	Probability	Definite
	Confidence	High
	Extent	Localised
	Duration	Very short
	Intensity	Low
	Significance	Medium

Table 5.20: Development of the temporary construction facilities.

Preconstruction activities associated with the development of the temporary construction facilities	*Status*	Negative
	Probability	Definite
	Confidence	High
	Extent	Localised
	Duration	Very short
	Intensity	Low
	Significance	Medium

Table 5.21: Installation of campsites, offices, workshops, storage facilities

Preconstruction activities associated with the installation of campsites, offices, workshops, storage facilities by upgrading the existing and creation of new structures	*Status*	Negative
	Probability	Definite
	Confidence	High
	Extent	Localised
	Duration	Very short
	Intensity	Low
	Significance	Medium

Table 5.22: Air quality and noise related potential environmental concerns during site preparation and the construction of mine infrastructure.

Potential Sources of Concern	Nature of Potential Concern	Assessment of Impacts
1. Operation and maintenance of vehicles and any on-site power generation facilities	❖ Potential releases of particulate matter, carbon monoxide, oxides of nitrogen, sulphur dioxide, and volatile organic compounds	(i) **Extent:** Localised (ii) **Duration:** Short term (iii) **Intensity:** Medium and can be reduced to negligible with mitigation measures (iv) **Probability**: Highly probably and can be reduced low with mitigation (v) **Confidence**: High (vi) **Significance:** Medium to low with mitigation
2. Fuel and chemical transportation, handling and storage	❖ Potential releases of volatile organic compounds and other harmful substances	
3. Site preparation and construction activities	❖ Potential releases of particulate matter	
4. Noise from preconstruction activities, including vehicle operations and drilling	❖ Noise may affect local wildlife populations, and well as workers	

Table 5.23: Water quality and aquatic ecosystems related potential environmental concerns during site preparation.

Potential Sources of Concern	Nature of Potential Concern	Assessment of Impacts
1. Operation and maintenance of vehicles and any on-site power generation facilities	❖ Potential releases of substances such as suspended solids, trace metals, oil, degreasers, and detergents and other harmful substances that could affect water quality and aquatic ecosystems	(i) **Extent:** Localised (ii) **Duration:** Short term (iii) **Intensity:** Medium and can be reduced to negligible with mitigation measures (iv) **Probability**: Highly probably and can be reduced low with mitigation (v) **Confidence**: High (vi) **Significance:** Medium to low with mitigation
2. Fuel and chemical transportation, handling and storage	❖ In the event of spills, potential releases of petroleum products or chemicals that could affect surface waters or groundwater as well as aquatic ecosystems	
3. Site preparation and construction activities	❖ Potential release of sediments, increasing concentrations of total suspended solids in receiving waters	
4. Sewage and wastewater disposal	❖ Potential releases of nutrients and other contaminants	
5. Construction of site access roads and power lines	❖ Potential release of sediments along the routes, increasing total suspended solids in receiving waters ❖ Potential for acidic drainage if sulphide-bearing minerals are exposed during construction ❖ Stream crossings for access roads may affect aquatic ecosystems ❖ Increased road access in remote areas may lead to increased land degradation	

Table 5.24: Soil quality and terrestrial ecosystems related potential environmental concerns during site preparation.

Potential Sources of Concern	Nature of Potential Concern	Assessment of Impacts
1. Fuel and chemical transportation, handling and storage	❖ In the event of spills, potential releases of petroleum products or chemicals that could affect soils, vegetation and wildlife	(i) **Extent:** Localised (ii) **Duration:** Short term (iii) **Intensity:** Medium and can be reduced to negligible with mitigation measures (iv) **Probability**: Highly probably and can be reduced low with mitigation (v) **Confidence**: High (vi) **Significance:** Medium to low with mitigation
2. Operation of vehicles	❖ Vehicle operations may result in collisions with wildlife	
3. Site preparation and construction activities	❖ Clearing of vegetation on site may have impacts on biodiversity, particularly if any rare, threatened or keystone species are present ❖ Activities on site may disrupt and dislocate local wildlife and any migratory wildlife in the area ❖ Some animals may be drawn to the site as a result of improper waste disposal or kitchen odours, which could lead to potential hazards for both workers and the animals	
4. Construction of site access roads and power lines	❖ Construction activities may disrupt and dislocate wildlife and any migratory wildlife in the area ❖ Increased road access in remote areas may lead to increased hunting, stressing wildlife populations ❖ Vehicle operations may result in collisions with wildlife	

5.6.2.2 Construction Stage

The construction stage of the proposed mining development and ongoing exploration activities in the ML No. 121 will cover the mine supporting infrastructure and the actual mine workings. These activities will last for periods ranging from six (6) months and one (1) year. The following are the key activities that have been assessed:

1. **Mine Supporting Infrastructure:**

   (i) Transportation facilities, including access roads to the site and on-site roads.

   (ii) Supporting site infrastructure including foundations and fencing.

   (iii) Waste rock stockpiles.

   (iv) Groundwater water supply systems.

   (v) Local generator areas for power infrastructure.

   (vi) Administration blocks.

   (vii) Fuel supply and storage / yard.

   (viii) Workshop and equipment maintenance facilities.

   (ix) Wastewater treatment system.

   (x) Solid waste transfer facility (No Municipal Waste disposal shall be developed on Site), and.

   (xi) Storm water management around the pit, waste rock and supporting infrastructure.

2. **Mine workings**:

   (i) Excavation as maybe required to create direct access to the granite.

   (ii) Actual pit excavation and stripping of the overburden to create direct access to fresh granite.

   (iii) Granite production for test mining operations, and.

   (iv) Test mining and commissioning.

Tables 5.25 – 5.35 summarises impacts of the proposed construction of the mine supporting infrastructure and workings with respect to the natural environment (air quality, noise, water, soil), built environment (houses, roads, transport systems, buildings, infrastructure), socioeconomic, archaeological and cultural resources, flora, fauna, habitat and ecosystem (services, function, use values and non-use).

The construction related activities are also associated with the air quality, risk of spills and accidents, which could result in the release of contaminants such as chemicals, reagents and other substances into the receiving environment and results in harm including Occupational Health and Safety (OHS).

Table 5.25: Transportation facilities, including access road linking the mine site to the main national road network and on-site roads linking various operational areas.

Construction of the transportation facilities, including access roads to the site and on-site roads	*Status*	Negative
	Probability	Definite
	Confidence	High
	Extent	Localised
	Duration	Very short
	Intensity	Low
	Significance	Low (Will involve upgrading of existing roads)

Table 5.26: Supporting site infrastructure including foundations and fencing.

Construction of supporting site infrastructure including foundations and fencing	*Status*	Negative
	Probability	Definite
	Confidence	High
	Extent	Localised
	Duration	Very short
	Intensity	Low
	Significance	Low (Use already disturbed areas)

Table 5.27: Waste rock stockpiles.

Construction of waste rock stockpiles	*Status*	Negative
	Probability	Definite
	Confidence	High
	Extent	Localised
	Duration	Very short
	Intensity	Low
	Significance	Medium (Use already disturbed areas)

Table 5.28: Water supply systems.

Construction of water supply systems	*Status*	Negative
	Probability	Definite
	Confidence	High
	Extent	Localised
	Duration	Very short
	Intensity	Low
	Significance	Low (Use already disturbed areas)

Table 5.29: Local generator areas for power infrastructure.

Construction / preparation of areas for generator / power infrastructure	*Status*	Negative
	Probability	Definite
	Confidence	High
	Extent	Localised
	Duration	Very short
	Intensity	Low
	Significance	Moderate to High

Table 5.30: Administration blocks and warehouses.

Construction of new administration blocks and warehouses	*Status*	Negative
	Probability	Definite
	Confidence	High
	Extent	Localised
	Duration	Very short
	Intensity	Low
	Significance	Moderate (Use already disturbed areas)

Table 5.31: Fuel supply and storage / yard.

Construction of fuel supply and storage	*Status*	Negative
	Probability	Definite
	Confidence	High
	Extent	Localised
	Duration	Very short
	Intensity	Low
	Significance	Moderate

Table 5.32: Workshop and equipment maintenance facilities.

Construction of workshop and equipment maintenance facilities	*Status*	Negative
	Probability	Definite
	Confidence	High
	Extent	Localised
	Duration	Very short
	Intensity	Low
	Significance	Moderate (Use already disturbed areas)

Table 5.33: Solid waste transfer facility.

Construction of new solid waste disposal storage / transfer facility. No burial of municipal / hazardous waste is allowed to be buried within the ML Area	*Status*	Negative
	Probability	Definite
	Confidence	High
	Extent	Localised
	Duration	Very short
	Intensity	Low
	Significance	Low (Use already disturbed areas / old mine compound)

Table 5.34: Wastewater treatment systems.

Construction of wastewater treatment system (French Drains Systems to be used)	*Status*	Negative
	Probability	Definite
	Confidence	High
	Extent	Localised
	Duration	Very short
	Intensity	Low
	Significance	Moderate (Use already disturbed areas)

Table 5.35: Storm water management around the pit, waste rock and supporting infrastructure.

Construction of peripheral storm water management around the quarry, waste rock and supporting infrastructure such yard and workshop in order to prevent leachate from entering the local ephemeral rivers	*Status*	Negative
	Probability	Definite
	Confidence	High
	Extent	Localised
	Duration	Very short
	Intensity	Low
	Significance	Moderate

5.6.2.3 Mine Operations and Ongoing Exploration

5.6.2.3.1 Overview

The following is the summary of the key component of the proposed mining operations stage that has been assessed with respect to the natural environment (air quality, noise, water, soil), built environment (houses and roads,), socioeconomic, archaeological and cultural resources, flora, fauna, habitat and ecosystem services, function, use values and non-use:

(i) Mining operations (actual mining operations including excavation as maybe required).

(ii) Transportation of the mined materials from pit to the yard for sorting.

(iii) Transportation of the 5m^3 mined granite blocks to the sorting yard / storage facility and later to be further transported for processing.

(iv) Operations of the waste rock.

(v) Ongoing exploration support.

(vi) Ongoing rehabilitation and maintenance.

(vii) Waste water and sludge management, and.

(viii) Environmental Monitoring on the overall receiving environment.

Mining operations and ongoing explorations activities are also associated with the air quality, risk of spills and accidents, which could result in the release of contaminants such as chemicals, reagents and other substances into the receiving environment and results in harm including Occupational Health and Safety (OHS).

5.6.2.3.2 Actual Mining Operations

The primary environmental concerns associated with granite extraction activities are the disposal of waste rock and the release of mine water. Waste rock disposal and water management and treatment are further discussed below. Ore extraction activities can also affect the environment as a result of dust, noise and vibration. The impact assessment of the proposed mining operation with respect to the receiving environment is shown in Table 5.36.

Table 5.36: Actual mining operations.

Mining operations (actual mining operations including excavation as maybe required	*Status*	Negative
	Probability	Definite
	Confidence	High
	Extent	Localised
	Duration	Very short
	Intensity	Low
	Significance	Moderate - High

5.6.2.3.3 Transportation of the Mined / Recovered Granite 5m^3 Blocks

The primary environmental concerns associated with the transportation of the mined / recovered granite 5m^3 blocks to the sorting yard / storage facility and later to be further transported for processing relates to the air quality, disposal of waste rock / offcuts and the management and treatment of wastewater as well as all other associated components of the receiving environment.

The impact assessments for all forms of ore transportation activities and storage with respect to the receiving environment are shown in Tables 5.37 and 5.38.

Table 5.37: Transportation of the mined granite blocks to the sorting yard / storage facility and later to be further transported for processing.

Transportation of the 5m^3 mined granite blocks to the sorting yard / storage facility and later to be further transported for processing	*Status*	Negative
	Probability	Definite
	Confidence	High
	Extent	Localised
	Duration	Very short
	Intensity	Low
	Significance	Low

Table 5.38: Storage and transportation of recovered minerals for further high value addition beneficiation and export through the Port of Walvis Bay.

Storage and transportation of recovered minerals for further high value addition beneficiation and export through the Port of Walvis Bay	*Status*	Negative
	Probability	Definite
	Confidence	High
	Extent	Localised
	Duration	Very short
	Intensity	Low
	Significance	Low

5.6.2.3.4 Operations of a New Waste Rock

The production of granite blocks will always result in unwanted poor-quality materials as well as offcuts from the operations. The poor quality and offcuts will be deposited on the waste rock dump. The key concern in the management of mine waste is the prevention or control of the release of contaminants that could have significant environmental impacts. Groundwater seepage is also a concern for waste rock facilities, in that seepage into the groundwater could result in the release of contaminants through a permeable foundation layer or other instability. The impact assessment results for operating a new waste rock dump as part of the mining operations with respect to the receiving environment are shown in Table 5.39.

Table 5.39: Operations of the waste rock.

Operation of new waste rock	*Status*	Negative
	Probability	Definite
	Confidence	High
	Extent	Localised
	Duration	Very short
	Intensity	Low
	Significance	Moderate - High

5.6.2.3.5 Ongoing Exploration Ongoing Rehabilitation and Maintenance

In order to extend the life of the proposed mining operations, there will be a need to continue undertaking exploration activities. At the same time, there will be a need to continuously undertake ongoing rehabilitation and maintenance of the mined-out areas in order to make sure that the overall environmental liabilities for final rehabilitation are minimised during the mine closure. The environmental impacts assessment for the ongoing exploration, rehabilitation and maintenance activities in support mining operations are shown in Tables 5.40 and 5.41.

Table 5.40: Ongoing exploration.

Ongoing exploration to support the mining operations	*Status*	Negative
	Probability	Definite
	Confidence	High
	Extent	Localised
	Duration	Very short
	Intensity	Low
	Significance	Moderate - High

Table 5.41: Ongoing rehabilitation and maintenance.

Ongoing rehabilitation and maintenance to support for the mining operations	*Status*	Negative
	Probability	Definite
	Confidence	High
	Extent	Localised
	Duration	Very short
	Intensity	Low
	Significance	Moderate - High

5.6.2.3.6 Waste Water and Sludge Management

The management of waste water from the proposed mining operations is key potential source of pollution. According to the preliminary design of the proposed mining operations precautionary measures have been incorporated in the management of waste water and sludge from the proposed operations. The composition of waste water and sludge varies, and sludge may contain a wide range of metals.

The volumes of waste water and sludge likely to be produced from the proposed mining operations will be limited and will not exceed the designs over the life of the proposed operations mine. Any produced waste water and sludge will be disposed on site with water evaporating from any sludge naturally. Although there may be some uncertainties about the long-term chemical stability of waste water and sludge there are however, minor risks that they are likely to become sources metals beyond the final mine closure stage of the proposed mining operations.

Waste water and sludge disposal for both the mining operations impact assessment results with respect to the receiving environment covering the complete lifecycle of the proposed project are shown in Table 5.42.

Table 5.42: Waste water and sludge disposal.

Waste water and sludge and sludge management	*Status*	Negative
	Probability	Definite
	Confidence	High
	Extent	Localised
	Duration	Very short
	Intensity	Low
	Significance	Low (Less volumes and dry conditions)

5.6.2.3.7 Exploration, Mining, Supporting Infrastructure and Impacts on Water

Freshwater management constitute the primary environmental concern for the proposed mine. An effective water management program must incorporate the following cleaner production measures to:

- Segregate clean and contaminated water flows in order to help reduce the requirement for the treatment of effluent.
- Control and address seepage losses, and.
- Reduce water usage by recycling water for further process use.

Measures that can be used in water management include drainage ditches to divert off-site water and drainage ditches and diversions to control the flow of on-site water and prevent contamination in order to prevent contaminated waters from leaving the site before treatment.

The impact assessment results of exploration and mining inclusive of all the supporting infrastructure activities on the receiving environment, covering the complete lifecycle of the proposed project are shown in Table 5.43.

Table 5.43: Exploration, mining, supporting infrastructure and Impacts on water.

Overall likely impacts of mining and exploration operations including supporting infrastructure activities on water	*Status*	Negative
	Probability	Definite
	Confidence	High
	Extent	Localised
	Duration	Very short
	Intensity	Low
	Significance	Moderate - High

5.6.2.3.8 Exploration, Mining, Supporting Infrastructure and Impacts on Air Quality

Air quality impacts from exploration, mining, supporting infrastructure are mainly associated with the releases of airborne particulate matter.

Operation of vehicles and generators can also lead to releases of greenhouse gases and various air contaminants, including sulphur oxides, nitrogen oxides, carbon monoxide and particulate matter. Releases of airborne particulate matter can result from various activities.

Climatic components have a direct linkage to the air quality. Overall, the proposed project activities will have low significant impacts on the air quality. The impact assessment results of the exploration, mining, supporting infrastructure on the receiving environment, covering the complete lifecycle of the proposed project are shown in Table 5.44.

Table 5.44: Mining, processing and minerals recovery impacts on air quality.

Overall likely impacts on air quality during mining and exploration operations including excavation, drilling, blasting as maybe required for all activities	*Status*	Negative
	Probability	Definite
	Confidence	High
	Extent	Localised
	Duration	Very short
	Intensity	Low
	Significance	Low

5.6.2.3.9 Exploration, Mining, Supporting infrastructure and Impacts on Flora

The stripping of outcrops during mine construction and operation thereof, can have significant local effects on resident plant communities. These communities also represent wildlife habitat, and destroying habitat can lead to the loss of local breeding grounds and wildlife movement corridors or other locally important features.

Mining activity may also contaminate terrestrial plants. Metals may be transported into terrestrial ecosystems adjacent to mine sites as a result of releases of airborne particulate matter and seepage of groundwater or surface water. In some cases, the uptake of contaminants from the soil in mining areas can lead to stressed vegetation. In such cases, the vegetation could be stunted or dwarfed.

Overall, the proposed mining project will have flora disturbance that will be localised and will not affect Ephemeral River Channels and topographically low-laying areas that may have rich flora diversities. Table 5.45 indicates the potential/envisaged impacts expected regarding floral disturbance (which is obviously closely linked to habitat destruction. Detailed information about the type of flora found in and around the proposed mining area and the protection status are provided in this report.

Table 5.45: Summary of the potential/envisaged impacts expected regarding floral disturbance as a result of the proposed activities linked to habitat destruction.

Description	Floral disturbance will vary depending on the scale/intensity of the development operation and associated and inevitable infrastructure.
Extent	**1.** Access routes - Localised disruption/destruction of the habitat and thus consequently flora associated directly with the actual routes. This however, would be a relatively small area(s) with localised implications. **2.** Mining / Prospecting sites - Localised disruption/destruction of the habitat and thus consequently flora associated directly with the actual sites. This however, would be relatively small area(s) – depending on scale of operations – with localised implications. **3.** Infrastructure - Localised disruption/destruction of the habitat and thus consequently flora associated directly with the actual sites. This however, would be relatively small area(s) – especially if the existing infrastructure areas are used rather than affecting new sites – with localised implications.
Duration	**1.** Access route(s) - The duration of the impact is expected to be permanent along the route(s). This however, would be relatively small area(s) with localised implications. **2.** Mining / Prospecting sites - The duration of the impact is expected to be permanent at the site(s). This however, would be relatively small area(s) with localised implications. **3.** Infrastructure - The duration of the impact is expected to be permanent at the site(s). This however, would be relatively small area(s) with localised implications.
Intensity	**1.** Access route(s) - The actual sites where construction of the route(s) would be located would be permanently altered. This however, would be relatively small area(s) with localised implications. **2.** Mining / Prospecting sites - The actual mining/prospecting site(s) would be permanently altered. This however, would be relatively small area(s) with localised implications. **3.** Infrastructure - The actual construction sites associated with the various mining infrastructures would be permanently altered. This however, would be relatively small area(s) with localised implications. The areas adjacent the mining/prospecting site(s) and other associated infrastructure should not be significantly affected. This however, would depend on control over the contractors during the road building, construction phase(s) & mining/prospecting phase(s), but should be limited to localised implications. Areas not directly affected by the mining/prospecting and associated infrastructure although within the immediate area would be affected minimally. This would include dust & other associated disturbances in the area, but is limited to the mining/prospecting & construction periods.
Frequency of occurrence	Expected to be a "once off" issue affecting the selected site(s). Further prospecting & associated road construction (should this become necessary/evident during the mining operations) throughout the area would however increase the frequency of occurrence.
Probability	Definite (100%) negative impact on flora is expected in the actual mining/prospecting area(s) as well as the access route(s) and infrastructure development sites. This however, would be much localised and cover only a small area and should avoid sensitive areas. Precautionary principle (e.g. avoid unique habitat features as well as adhering to the proposed mitigating measures would minimise this) would decrease the significance of these potential impacts. Highly Probable (75%) negative impact on flora is expected in the general areas especially with large scale extraction of groundwater for prospecting/mining activities. Probable (50%) negative impact on flora is expected from the infrastructure (roads/tracks/buildings, etc.). Precautionary principle (e.g. avoid unique habitat features as well as adhering to the proposed mitigating measures would minimise this) would decrease the significance of these potential impacts.
Significance	Before mitigation: **High** and After mitigation: **Medium** to **Low**
Status of the impact	Negative: Localised unique habitats. mountainous areas & drainage lines) with associated flora would bear the brunt of this proposed development, but be limited in extent and only permanent at the actual mining site and access routes and infrastructure sites.
Legal requirements	Flora related: Forest Act No. 12 of 2001, Nature Conservation Ordinance No. 4 of 1975, CITES, IUCN
Degree of confidence in predictions	As an ecologist I am sure of the above-mentioned predictions made and would suggest that the mitigation measures be implemented to minimise potentially negative aspects regarding the local flora in the area.

5.6.2.3.11 Exploration, Mining, Supporting infrastructure and Impacts on Fauna

Mining and exploration activities can affect fauna as a result of habitat loss and habitat degradation. For example, mining activity may affect migration routes, breeding grounds, or nesting areas. Conversely, some wildlife species may be attracted to mine sites, particularly if food wastes and other wastes that may attract wildlife are not properly managed. Food sources for animals may become contaminated and some contaminants, particularly metals, can magnify up the food chain. This may

lead to increased interactions between humans and wildlife and it could result in animals that pose a risk to persons on site having to be relocated or destroyed. Table 5.46 indicates the potential / envisaged impacts expected regarding fauna disturbance which is obviously closely linked to habitat destruction. Detailed information about the type of fauna found around the proposed mining area and the protection status are provided in this report.

Table 5.46: Summary of the potential/envisaged impacts expected regarding fauna disturbance as a result of the proposed mining project to habitat destruction.

Description	Faunal disturbance will vary depending on the scale/intensity of the development operation and associated and inevitable infrastructure.
Extent	**1.** Access routes - Localised disruption/destruction of the habitat and thus consequently fauna associated directly with the actual routes. This however, would be a relatively small area with localised implications. **2.** Mining/Prospecting sites - Localised disruption/destruction of the habitat and thus consequently fauna associated directly with the actual sites. This however, would be a relatively small area – depending on scale of operations – with localised implications. **3.** Infrastructure - Localised disruption/destruction of the habitat and thus consequently fauna associated directly with the actual sites. This however, would be a relatively small area – especially if the existing infrastructure areas are used rather than affecting new sites – with localised implications.
Duration	**1.** Access route(s) - The duration of the impact is expected to be permanent along the route(s). This however, would be a relatively small area(s) with localised implications. **2.** Mining/Prospecting sites - The duration of the impact is expected to be permanent at the site. This however, would be relatively small area(s) with localised implications. **3.** Infrastructure - The duration of the impact is expected to be permanent at the site(s). This however, would be relatively small area(s) with localised implications.
Intensity	**1.** Access route(s) - The actual sites where construction of the route(s) would be located would be permanently altered. This however, would be relatively small area(s) with localised implications. **2.** Mining/Prospecting - The actual prospecting/mining site(s) would be permanently altered. This however, would be relatively small area(s) with localised implications. **3.** Infrastructure - The actual construction sites associated with the various mining infrastructures would be permanently altered. This however, would be relatively small area(s) with localised implications. The areas adjacent the mining site(s) and other associated infrastructure should not be significantly affected. This however, would depend on control over the contractors during the road building, construction phase(s) & prospecting/mining phase(s), but should be limited to localised implications. Areas not directly affected by the prospecting/mining and associated infrastructure although within the immediate area would be affected minimally. This would include dust, noise, light & other associated disturbances in the area, but be limited to the prospecting/mining & construction periods.
Frequency of occurrence	Expected to be a "once off" issue affecting the selected site(s). Further prospecting & associated road construction (should this become necessary/evident during the mining operations) throughout the area would however increase the frequency of occurrence.
Probability	Definite (100%) negative impact on fauna is expected in the actual mining areas as well as the access route(s) and infrastructure development sites. This however, would be much localised and cover only a small area(s) and should avoid sensitive areas. Highly Probable (75%) negative impact on fauna is expected in the general areas especially during the construction and mining phase(s) as a result of noise, increased activities, etc. Probable (50%) negative impact on fauna is expected from the infrastructure (roads/tracks/buildings, etc.). Precautionary principle (e.g. avoid unique habitat features as well as adhering to the proposed mitigating measures would minimise this) would decrease the significance of these potential impacts.
Significance	Before mitigation: **High** and After mitigation: **Medium** to **Low**
Status of the impact	Negative: Localised unique habitats (e.g. hills, mountainous areas & drainage lines) with associated fauna would bear the brunt of this proposed development, but be limited in extent and only permanent at the actual mining site(s) and access routes and infrastructure sites.
Legal requirements	Fauna related: Nature Conservation Ordinance No. 4 of 1975, CITES, IUCN and SARDB Habitat – Flora related: Forest Act No. 12 of 2001, Nature Conservation Ordinance No. 4 of 1975, CITES
Degree of confidence in predictions	As an ecologist I am sure of the above-mentioned predictions made and would suggest that the mitigation measures be implemented to minimise potentially negative aspects regarding the local fauna in the area.

5.6.2.3.12 Exploration, Mining, Supporting infrastructure and Archaeology

The likely type of archaeological resources will comprise pre-colonial sites that are likely to be small and widely scattered, probably comprising the remains of hutted encampments and including some burial sites. The impact assessment results of the mining and exploration operations inclusive of all the supporting infrastructure activities on the receiving archaeological resource, covering the complete lifecycle of the proposed project are shown in Table 5.47.

Table 5.47: Exploration, mining, supporting infrastructure and impacts likely impacts on archaeology.

Likely impacts on archaeological resource during the mining and exploration operations including excavation as may be required for all activities	*Status*	Negative
	Probability	Probable (already disturbed areas)
	Confidence	High
	Extent	Localised
	Duration	Very short
	Intensity	Low
	Significance	Low

5.6.2.3.13 Exploration, Mining, Supporting Infrastructure on Socioeconomic

The proposed mining, minerals processing and recovery activities are likely to be associated with negative socioeconomic impacts including the increase in prevalence of HIV / AIDs. The impact assessment results of the proposed mining and exploration operations inclusive of all the supporting infrastructure activities on the overall socioeconomic environment including any likely increase on the HIV / AIDs prevalence, covering the complete lifecycle of the proposed project are shown in Table 5.48.

Table 5.48: Mining and exploration likely impacts on socioeconomic environment.

Likely impacts on socioeconomic environment including HIV/AIDs during the mining and exploration operations including excavation, drilling, blasting as maybe required for all activities	*Status*	Negative
	Probability	Definite
	Confidence	High
	Extent	Localised
	Duration	Very short
	Intensity	Low
	Significance	Low

5.6.2.4 Progressive and Final Mine Closure

5.6.2.4.1 Progressive Mine Closure Activities During Mine Operations

In additional to the currently already disturbed land targeted for mining and exploration operations, additional disturbed areas of land may be disturbed during the ongoing and proposed mining and exploration activities. Disturbed areas that are not stabilised can be susceptible to erosion caused by both wind and water. Erosion can lead to problems with dust as well as water quality problems related to sedimentation.

During the mine operations phase, it's important for the operator to start with ongoing landscape rehabilitation which may include the reshaping and restructuring of the landscape and erosion control measures. In addition to reshaping or recontouring, landscape restructuring activities can include the use of stockpiled soils to reconstruct soil structure in preparation for revegetation during the final restoration and closure stages. These activities are also associated with the air quality, risk of spills and accidents, which could result in the release of contaminants such as chemicals, reagents and other substances into the receiving environment and results in harm including Occupational Health and Safety (OHS). Assessment of the overall likely negative impacts associated with the progressive mine closure activities during mine operations are shown in Table 5.49.

Table 5.49: Progressive mine closure activities during mine operations.

Assessment of likely negative impacts associated with the progressive mine closure activities during mine operations	*Status*	Negative
	Probability	Definite
	Confidence	High
	Extent	Localised
	Duration	Very short
	Intensity	Low
	Significance	Moderate - High

5.6.2.4.2 Final Mine Closure Activities

The objectives of final mine closure are to:

- ❖ Ensure public and wildlife safety and preventing inadvertent access to mine openings and other infrastructure.
- ❖ Provide for the stable, long-term storage of waste rock.
- ❖ Ensure that the site is self-sustaining and to prevent or minimise environmental impacts, and.
- ❖ Rehabilitate disturbed areas for a specified land use (e.g., return of disturbed areas to a natural state or other acceptable land use).

The final closure of all the activities of the proposed mine operations will results in both negative socioeconomic impacts such as loss of jobs and positive impacts. Tables 5.50 – 5.53 summarises the impact assessment results associated with the final closure of the proposed mining operations. Table 5.50 provided a summary of components to be addressed in the final mine closure phase linked to the ongoing mine closure activities undertaken during mine operational stage.

Table 5.50: Implementation of sustainable socioeconomic closure plan.

Use of non-renewable resources, closure company operations and the termination of all contributions to the economy including taxes, employment, support to secondary industries	*Status*	Positive
	Probability	Definite
	Confidence	High
	Extent	Regional
	Duration	Long-term
	Intensity	Moderate
	Significance	Medium to High

Table 5.51: Closure of mining and exploration operations and removal of all infrastructure.

Closure of mining and exploration operations and removal of all supporting infrastructure covering: 1. Closure of open pits 2. Closure of solid waste piles at transfer facility 3. Backfill waste dump sites 4. Closure of storage sites	*Status*	Positive
	Probability	Definite
	Confidence	High
	Extent	Regional
	Duration	Long-term
	Intensity	Moderate
	Significance	Medium

Table 5.52: Overall land reclamation and revegetation and aftercare as may be required.

Land reclamation and revegetation of mined out and disturbed areas as part of the implementation of the final mine closure and aftercare stage	*Status*	Negative
	Probability	Definite
	Confidence	High
	Extent	International
	Duration	Permanent
	Intensity	Low
	Significance	Low

Table 5.53: Mine components to be addressed in the ongoing and final mine closure plan.

Components	Aspects to be Addressed
Open Pit Mines	• Slope and bench stability • Groundwater and rainwater management • Security and unauthorized access • Wildlife entrapment • Effects of drainage into and from the pit
Yard, Storage / workshop / Sorting Facilities	• Removal of buildings and foundations • Clean-up of workshops, fuel and reagent • Disposal of scrap and waste materials • Re-profiling and revegetation of site
Waste Rock Waste	• Slope stability • Effects of leaching and seepage on surface and groundwater • Dust generation • Visual impact • Special considerations for some types of mines such as uranium mines
Water Management Facilities	• Restoration or removal of dams, reservoirs, settling ponds, culverts, pipelines, spillways or culverts which are no longer needed • Surface drainage of the site and discharge of drainage waters • Maintenance of water management facilities
Solid Waste Transfer Station / and Waste Water Management Facilities	• Disposal or removal from site of hazardous wastes • Disposal and stability of treatment sludge • Removal of sewage treatment plant • Prevention of groundwater contamination • Prevention of illegal dumping • Security and unauthorized access
Infrastructure	• Removal of power and water supply • Removal of haul and access roads • Reuse of transportation and supply depots

5.6.2.5 Accidents and Emergencies

All the developmental activities of the proposed mine operations in the ML No. 121 covering the preconstruction, construction, operation, ongoing monitoring and rehabilitation and decommissioning, closure and aftercare stages are associated with the air quality, risk of spills and accidents, which could result in the release of contaminants such as chemicals, reagents and other substances into the receiving environment and results in harm including Occupational Health and Safety (OHS).

Tables 5.54 – 5.58 summarises the impact assessment results associated with fire, hydraulic fluid spills, re-fuelling, accidents and related operational emergencies.

Table 5.54: Wild fire.

Fire emergency associated with the mining, processing, minerals recovery, exploration or use of any supporting infrastructure such in any area	*Status*	Negative
	Probability	Improbable. based on standards and procedures implemented and long track record
	Confidence	Medium
	Extent	Site specific (<1 km)
	Duration	Very Short. fires likely to be rapidly extinguished
	Intensity	Mild
	Significance	Low

Table 5.55: Hydraulic fluid spills.

Leakage of hydraulic fluid spill due to rupture of pipes /failure of hydraulic sampling / mining equipment which cannot be contained easily	*Status*	Negative
	Probability	Improbable. based on standards and procedures implemented and long track record
	Confidence	High
	Extent	Site specific (<1 km)
	Duration	Very Short. dispersal of low volume spills will be rapid
	Intensity	Mild
	Significance	Low

Table 5.56: Re-fuelling accidents.

Accidental spillage of fuel during refuelling operations due to rupture of pipes or valve failure	*Status*	Negative
	Probability	Improbable. based on standards and procedures implemented and long track record.
	Confidence	Medium
	Extent	Local
	Duration	Very Short to Short-term
	Intensity	Mild
	Significance	Low

Table 5.57: Mining and exploration or use of any supporting infrastructure emergency including car crush.

Emergency caused by mining and exploration or use of any supporting infrastructure including car crush	*Status*	Negative
	Probability	Improbable, based on strict operational standard and speed limits at all times
	Confidence	High
	Extent	Local
	Duration	Very Short
	Intensity	Moderate
	Significance	Low

Table 5.58: Exposure to potential radioactive sources.

Detrimental effects on the health of personnel as a result of exposure to high natural radiation from the country rocks or radiation related to the operational equipment	*Status*	Negative
	Probability	Improbable (Country rocks will be analysed as part of the exploration programme and no mining and processing equipment will use radiation sources).
	Confidence	High
	Extent	Site specific.
	Duration	Very Short
	Intensity	Very low
	Significance	Very Low

5.7 Results of the Overall Component and Significant Impact Assessments

5.7.1 Results of the Overall Component Impacts Assessment

The results of the overall impacts and key issues associated with the proposed activities / sources (mining, exploration and supporting infrastructure activities) of potential impacts with respect to the receiving environment that could potentially be affected, resulting in key issues are presented in Table 5.59.

Table 5.59: Matrix impact assessment results of the proposed mining, exploration and supporting infrastructure activities.

SCALE		DESCRIPTION
0		no observable effect
1		low effect
2		tolerable effect
3		medium high effect
4		high effect
5		very high effect (devastation)

SOURCES OF POTENTIAL IMPACT	PROJECT DEVELOPMENT PHASE	ACTIVITIES		RECEPTORS / TARGETS THAT MAY BE IMPACTED: PHYSICAL AND SOCIOECONOMIC ENVIRONMENT – Natural Environment – Air, Noise, Water, Green Space, Climate Change	Built Environment – Houses, Roads, Transport Systems, Buildings, Infrastructure	Socioeconomic- Human Rights, Natural and Social Capital Job, Investment, Taxes and Social Issues e.g. HIV Aids,	Archaeological Cultural, Historical and Spiritual Resources	BIOLOGICAL ENVIRONMENT – Flora	Fauna	Habitat	Ecosystem - Services, function, use values and non-use
	PRE-CONSTRUCTION	1. Site investigations to inform the mine design and layout		3 (-)	1 (-)	3 (+)	3 (-)	3 (-)	3 (-)	3 (-)	3 (-)
		2. Engineering design of the pit areas and the support facilities		3 (-)	1 (-)	3 (-)	3 (-)	3 (-)	3 (-)	3 (-)	3 (-)
		3. General site clearing of the quarry areas, administration block, waste rock, supporting infrastructure		3 (-)	1 (-)	3 (+)	1 (-)	3 (-)	3 (-)	3 (-)	3 (-)
		4. Access roads upgrading of existing tracks / creation of new routes as may be required		3 (-)	1 (-)	3 (+)	1 (-)	2(-)	2(-)	2(-)	2(-)
		5. Implementation of the human resources, community and social programs for the operational phase of the project		3 (-)	1 (-)	3 (+)	1 (-)	2(-)	2(-)	2(-)	2(-)
	CONSTRUCTION	MINE SUPPORTING INFRASTRUCTURE	1. Transportation facilities, including access roads to the site and on-site roads	3 (-)	1 (-)	3 (+)	1 (-)	3 (-)	3 (-)	3 (-)	3 (-)
			2. Waste rock and mine blocks stockpiles	3 (-)	1 (-)	3 (+)	1 (-)	3 (-)	3 (-)	3 (-)	3 (-)
			3. Water supply systems	3 (-)	1 (-)	3 (+)	1 (-)	3 (-)	3 (-)	3 (-)	3 (-)
			4. Power infrastructure, including powerline and distribution systems (Generator and Solar)	3 (-)	1 (-)	3 (+)	1 (-)	3 (-)	3 (-)	3 (-)	3 (-)
			5. Administration blocks and warehouses	3 (-)	1 (-)	3 (+)	1 (-)	2(-)	2(-)	2(-)	2(-)
			6. Fuel supply and storage	3 (-)	1 (-)	3 (+)	1 (-)	2(-)	2(-)	2(-)	2(-)
			7. Workshop and equipment maintenance facilities	3 (-)	1 (-)	3 (+)	1 (-)	2(-)	2(-)	2(-)	2(-)
			8. Wastewater treatment systems	3 (-)	1 (-)	3 (+)	1 (-)	2(-)	2(-)	2(-)	2(-)
			9. Domestic solid waste disposal storage / transfer facility	3 (-)	1 (-)	3 (+)	1 (-)	2(-)	2(-)	2(-)	2(-)
			10. Storm water management in the pit and supporting infrastructure	3 (-)	1 (-)	3 (+)	1 (-)	2(-)	2(-)	2(-)	2(-)
		MINE WORKINGS	1. Mining operations	3 (-)	1 (-)	3 (+)	1 (-)	3 (-)	3 (-)	3 (-)	3 (-)
			2. Actual and stripping of the overburden to create direct access to the fresh granite	3 (-)	1 (-)	3 (+)	1 (-)	3 (-)	3 (-)	3 (-)	3 (-)
			3. Ore production for test mining operations	3 (-)	1 (-)	3 (+)	1 (-)	2(-)	2(-)	2(-)	2(-)
			4. Test mining and commissioning	3 (-)	1 (-)	3 (+)	1 (-)	2(-)	2(-)	2(-)	2(-)

Table 5.59: *Cont.*

SCALE		DESCRIPTION
0		no observable effect
1		low effect
2		tolerable effect
3		medium high effect
4		high effect
5		very high effect (devastation)

SOURCES OF POTENTIAL IMPACT	PROJECT DEVELOPMENT PHASE	ACTIVITIES	RECEPTORS / TARGETS THAT MAY BE IMPACTED: PHYSICAL AND SOCIOECONOMIC ENVIRONMENT: Natural Environment – Air, Noise, Water, Green Space, Climate Change	Built Environment – Houses, Roads, Transport Systems, Buildings, Infrastructure	Socioeconomic- Human Rights, Natural and Social Capital Job, Investment, Taxes and Social Issues e.g. HIV Aids,	Archaeological Cultural, Historical and Spiritual Resources	BIOLOGICAL ENVIRONMENT: Flora	Fauna	Habitat	Ecosystem - Services, function, use values and non-use
	OPERATION, ONGOING MONITORING AND REHABILITATION	1. Transportation facilities, including access roads to the site and on-site roads	3(-)	0(-)	3(+)	1 (-)	1(-)	2(-)	1(-)	1(-)
		2. Waste rock and mine blocks stockpiles	3(-)	1(-)	3(+)	1 (-)	1(-)	2(-)	1(-)	1(-)
		3. Water supply systems	3(-)	1(-)	3(+)	1 (-)	1(-)	2(-)	1(-)	1(-)
		4. Power infrastructure, including powerline and distribution systems (Generator and Solar)	3(-)	0(-)	3(+)	1 (-)	1(-)	2(-)	1(-)	1(-)
		5. Administration blocks and warehouses	3(-)	0(-)	3(+)	1 (-)	1(-)	2(-)	1(-)	1(-)
		6. Fuel supply and storage	2(-)	0(-)	3(+)	1 (-)	1(-)	2(-)	1(-)	1(-)
		7. Workshop and equipment maintenance facilities	2(-)	0(-)	3(+)	1 (-)	1(-)	2(-)	1(-)	1(-)
		8. Wastewater treatment systems	1(-)	0(-)	3(+)	1 (-)	1(-)	2(-)	1(-)	1(-)
		9. Domestic solid waste disposal storage / transfer facility	1(-)	0(-)	3(+)	1 (-)	1(-)	2(-)	1(-)	1(-)
	DECOMMISSIONING CLOSURE AND AFTERCARE	1. Storm water management in the pit and supporting infrastructure	0(-)	0(-)	3(+)	1 (-)	2(-)	2(-)	2(-)	2(-)
		2. Mining operations	3(-)	0(-)	3(+)	1 (-)	2(-)	2(-)	2(-)	2(-)
		3. Actual and stripping of the overburden to create direct access to the fresh granite	3(-)	0(-)	3(+)	1 (-)	2(-)	2(-)	2(-)	2(-)
		4. Ore production for test mining operations	3(-)	0(-)	3(+)	1 (-)	2(-)	2(-)	2(-)	2(-)
		5. Test mining and commissioning	2(-)	0(-)	3(+)	1 (-)	2(-)	2(-)	2(-)	2(-)
		6. Transportation facilities, including access roads to the site and on-site roads	2(-)	0(-)	3(+)	1 (-)	2(-)	2(-)	2(-)	2(-)
		7. Transportation facilities, including access roads to the site and on-site roads	2(+)	0(-)	3(+)	1 (-)	2(-)	2(-)	2(-)	2(-)
		8. Waste rock and mine blocks stockpiles	2(-)	0(-)	3(+)	1 (-)	2(-)	2(-)	2(-)	2(-)
		9. Water supply systems	2(-)	0(-)	3(+)	1 (-)	2(-)	2(-)	2(-)	2(-)

5.7.2 Results of the Overall Significant Impacts Assessment

5.7.3.1 Overview

The determination of the significance of the negative impacts of the sources was undertaken based on the environmental baseline results and the intensity of the likely negative impact. The assessment was depending upon the degree to which the proposed development activities are likely to results in unwanted consequences on the receptor covering the natural environment such as the physical and biological environments.

Overall, the assessment of significant impacts was focused on the ecosystem-based approach that considers potential impacts to the ecosystem as part of the receiving environment.

5.7.3.2 Summary of the Sources of Impacts

The main key sources of impacts that have been used to determine significant impact posed by the proposed mine comprised all the activities associated with the preconstruction, construction, operation and decommissioning stages. Each of the main sources of impacts have been evaluated against the receiving environment (receptor / pathways).

5.7.3.3 Determination of the Overall Likely Significant Impacts

In order to determine the overall significant impact of individual sources associated with the proposed mine development, an impact identification and assessment process was undertaken as part of the EIA. The results of the overall likely significant impacts and key issues associated with the proposed activities / sources (mining, exploration and supporting infrastructure related activities) of potential impacts with respect to the receiving environment that could potentially be affected, resulting in key issues.

The EIA impact identification and assessment processes has focused on the receiving environment (Physical, Biological and Socioeconomic) interaction approach with respect to the proposed project activities, the pathways and the likely targets or receptor. In this process, components of the project activities that are likely to impact the receiving environment were broken down into individual development stages and activities (Table 5.60).

Table 5.60: Significant matrix impact assessment results for mining, exploration and supporting infrastructure activities.

IMPACT SEVERITY	IMPACT LIKELIHOOD: Extremely Unlikely [0]	Unlikely [1]	Low Likelihood [2]	Medium Likelihood [3]	High Likelihood [4]
Slight [A]	[A0]	[A1]	[A2]	[A3]	[A4]
Low [B]	[B0]	[B1]	[B2]	[B3]	[B4]
Medium [C]	[C0]	[C1]	[C2]	[C3]	[C4]
High [D]	[D0]	[D1]	[D2]	[D3]	[D4]

SOURCES OF POTENTIAL IMPACT	PROJECT DEVELOPMENT PHASE	ACTIVITIES		RECEPTORS / TARGETS THAT MAY BE IMPACTED: PHYSICAL AND SOCIOECONOMIC ENVIRONMENT: Natural Environment – Air, Noise, Water, Green Space, Climate Change	Built Environment – Houses, Roads, Transport Systems, Buildings, Infrastructure	Socioeconomic-Human Rights, Natural and Social Capital Job, Investment, Taxes and Social Issues e.g. HIV Aids,	Archaeological Cultural, Historical and Spiritual Resources	BIOLOGICAL ENVIRONMENT: Flora	Fauna	Habitat	Ecosystem - Services, function, use values and non-use
	PRE-CONSTRUCTION	1.	Site investigations to inform the mine design and layout	B4 (-)	A1(-)	D3 (+)	A1(-)	B4 (-)	B4 (-)	B4 (-)	B4 (-)
		2.	Engineering design of the pit areas and the support facilities	B4 (-)	A1(-)	D3 (+)	A1(-)	B4 (-)	B4 (-)	B4 (-)	B4 (-)
		3.	General site clearing of the quarry areas, administration block, waste rock, supporting infrastructure	B4 (-)	A1(-)	D3 (+)	A1(-)	B4 (-)	B4 (-)	B4 (-)	B4 (-)
		4.	Access roads upgrading of existing tracks / creation of new routes as may be required	B4 (-)	A1(-)	D3 (+)	A1(-)	B3(-)	B3(-)	B3(-)	B3(-)
		5.	Implementation of the human resources, community and social programs for the operational phase of the project	B4 (-)	A1(-)	D3 (+)	A1(-)	B3(-)	B3(-)	B3(-)	B3(-)
	CONSTRUCTION	MINE SUPPORTING INFRASTRUCTURE	1. Transportation facilities, including access roads to the site and on-site roads	B4 (-)	A1(-)	D3 (+)	A1(-)	B3(-)	B3(-)	B3(-)	B3(-)
			2. Waste rock and mine blocks stockpiles	B4 (-)	A1(-)	D3 (+)	A1(-)	B3(-)	B3(-)	B3(-)	B3(-)
			3. Water supply systems	B4 (-)	A1(-)	D3 (+)	A1(-)	B3(-)	B3(-)	B3(-)	B3(-)
			4. Power infrastructure, including powerline and distribution systems (Generator and Solar)	B4 (-)	A1(-)	D3 (+)	A1(-)	B3(-)	B3(-)	B3(-)	B3(-)
			5. Administration blocks and warehouses	B4 (-)	A1(-)	D3 (+)	A1(-)	B3(-)	B3(-)	B3(-)	B3(-)
			6. Fuel supply and storage	B4 (-)	A1(-)	D3 (+)	A1(-)	B3(-)	B3(-)	B3(-)	B3(-)
			7. Workshop and equipment maintenance facilities	B4 (-)	A1(-)	D3 (+)	A1(-)	B3(-)	B3(-)	B3(-)	B3(-)
			8. Wastewater treatment systems	B4 (-)	A1(-)	D3 (+)	A1(-)	B3(-)	B3(-)	B3(-)	B3(-)
			9. Domestic solid waste disposal storage / transfer facility	B4 (-)	A1(-)	D3 (+)	A1(-)	B3(-)	B3(-)	B3(-)	B3(-)
			10. Storm water management in the pit and supporting infrastructure	B4 (-)	A1(-)	D3 (+)	A1(-)	B3(-)	B3(-)	B3(-)	B3(-)
		MINE WORKINGS	1. Mining operations	B4 (-)	A1(-)	D3 (+)	A1(-)	B4 (-)	B4 (-)	B4 (-)	B4 (-)
			2. Actual and stripping of the overburden to create direct access to the fresh granite	B4 (-)	A1(-)	D3 (+)	A1(-)	B4 (-)	B4 (-)	B4 (-)	B4 (-)
			3. Ore production for test mining operations	B4 (-)	A1(-)	D3 (+)	A1(-)	B4 (-)	B4 (-)	B4 (-)	B4 (-)
			4. Test mining and commissioning	B4 (-)	A1(-)	D3 (+)	A1(-)	B4 (-)	B4 (-)	B4 (-)	B4 (-)

Table 5.60: *Cont.*

IMPACT SEVERITY	IMPACT LIKELIHOOD				
	Extremely Unlikely [0]	Unlikely [1]	Low Likelihood [2]	Medium Likelihood [3]	High Likelihood [4]
Slight [A]	[A0]	[A1]	[A2]	[A3]	[A4]
Low [B]	[B0]	[B1]	[B2]	[B3]	[B4]
Medium [C]	[C0]	[C1]	[C2]	[C3]	[C4]
High [D]	[D0]	[D1]	[D2]	[D3]	[D4]

SOURCES OF POTENTIAL IMPACT	PROJECT DEVELOPMENT PHASE	ACTIVITIES	RECEPTORS / TARGETS THAT MAY BE IMPACTED: PHYSICAL AND SOCIOECONOMIC ENVIRONMENT				BIOLOGICAL ENVIRONMENT			
			Natural Environment – Air, Noise, Water, Green Space, Climate Change	Built Environment – Houses, Roads, Transport Systems, Buildings, Infrastructure	Socioeconomic-Human Rights, Natural and Social Capital Job, Investment, Taxes and Social Issues e.g. HIV Aids,	Archaeological Cultural, Historical and Spiritual Resources	Flora	Fauna	Habitat	Ecosystem - Services, function, use values and non-use
	OPERATION, ONGOING MONITORING AND REHABILITATION	1. Mining operations (actual mining operations as maybe required)	C3(-)	A1(-)	D3 (+)	A1(-)	A1(-)	A1(-)	A1(-)	A1(-)
		2. Transportation of the mined blocks from pit to the sorting	C3(-)	A1(-)	D3 (+)	A1(-)	A1(-)	A1(-)	A1(-)	A1(-)
		3. Storage and transportation of granite blocks to for further processing	C3(-)	A1(-)	D3 (+)	A1(-)	A1(-)	A1(-)	A1(-)	A1(-)
		4. Waste rock management / reprocessing / recovery	C3(-)	A1(-)	D3 (+)	A1(-)	A1(-)	A1(-)	A1(-)	A1(-)
		5. Ongoing exploration support	C3(-)	A1(-)	D3 (+)	A1(-)	A1(-)	A1(-)	A1(-)	A1(-)
		6. Ongoing rehabilitation and maintenance	B2 (-)	A1(-)	D3 (+)	A1(-)	A1(-)	A1(-)	A1(-)	A1(-)
		7. Waste water management	B2 (-)	A1(-)	D3 (+)	A1(-)	A1(-)	A1(-)	A1(-)	A1(-)
		8. Municipal solid waste management / transfer to Arandis	A1(-)	A1(-)	D3 (+)	A1(-)	A1(-)	A1(-)	A1(-)	A1(-)
		9. Environmental performance monitoring	A1(-)	A1(-)	D3 (+)	A1(-)	A1(-)	A1(-)	A1(-)	A1(-)
	DECOMMISSIONING CLOSURE AND AFTERCARE	1. Implementation of sustainable socioeconomic plan	C3(-)	A1(-)	D3 (+)	A1(-)	A1(-)	A1(-)	A1(-)	A1(-)
		2. Closure of open pits	C3(-)	A1(-)	D3 (+)	A1(-)	A1(-)	A1(-)	A1(-)	A1(-)
		3. Closure of solid waste transfer station	B4 (-)	A1(-)	D3 (+)	A1(-)	A1(-)	A1(-)	A1(-)	A1(-)
		4. Backfill all excavated areas	B4 (-)	A1(-)	D3 (+)	A1(-)	A1(-)	A1(-)	A1(-)	A1(-)
		5. Closure of the mined blocks storage area	B4 (-)	A1(-)	D3 (+)	A1(-)	A1(-)	A1(-)	A1(-)	A1(-)
		6. Decommissioning of water and electricity infrastructure	B4 (-)	A1(-)	D3 (+)	A1(-)	A1(-)	A1(-)	A1(-)	A1(-)
		7. Overall land reclamation	A1(-)	A1(-)	D3 (+)	A1(-)	A1(-)	A1(-)	A1(-)	A1(-)
		8. Restoration of internal roads	C3(-)	A1(-)	D3 (+)	A1(-)	A1(-)	A1(-)	A1(-)	A1(-)
		9. Revegetation and aftercare as may be required	C3(-)	A1(-)	D3 (+)	A1(-)	A1(-)	A1(-)	A1(-)	A1(-)

6. EIA CONCLUSIONS AND RECOMMENDATIONS

6.1 Development Opportunities

This updated EIA Report forms a part of the comprehensive feasibility work programme that has been implemented in accordance with the environmental requirements with respect to the ongoing and proposed granite mine and exploration activities in the ML No. 121. With high regard to good environmental performances, the overall objective of the ongoing and proposed development is to operate a medium to large size granite and other potential dimension stone quarrying operations in the ML No. 121.

Based on all the data collected and analysed at different stages of this Environmental Assessment process, including all the findings and recommendations of the previous assessments undertaken in 2015, there are opportunities to continue with the ongoing mining and exploration operations and to implement the proposed new mine developments with higher considerations to good environmental performances. The ongoing and proposed granite mine and exploration operations within the ML No. 121 will greatly support the socioeconomic development of the local area of Arandis and Erongo Region and will coexist with the other current and future land uses within the local and surrounding areas.

6.2 Summary of EIA Conclusions

This updated EIA Report has been undertaken in accordance with the Terms of Reference (ToR), provisions of the Environmental Impact Assessment Regulations, 2012 and the Environmental Management Act, 2007, (Act No. 7 of 2007). The review of all the key specialist assessments with respect to the ongoing and proposed development have been undertaken with the findings and recommendations incorporated and presented in this updated EIA report. The impact assessment covering this updated EIA Report and the preparation of the updated EMP Report has been undertaken in line with the following ongoing and proposed mine operations and supporting infrastructures (roads and water supply) developmental stages (proposed project lifecycle): Preconstruction, construction, operation, ongoing monitoring and rehabilitation, and decommissioning, closure and aftercare.

Based on the results of the impact assessment as detailed in this updated EIA report, the following is summary of the key issues that have been assessed to have likely impacts on the receiving environment throughout the proposed project lifecycle:

1. Pollution from routine operations and accidental incidences.
2. Waste management.
3. Stripping and stockpiling soils.
4. Tracks and roads management.
5. Water abstraction and supply.
6. Flora, habitat and ecosystem.
7. Fauna habitat and ecosystem
8. Noise.
9. Dust.
10. Visual.
11. Neighbouring communities and or the general public.
12. Archaeological, historical, and cultural heritage resources.

13. Office, workshop and all related sanitation.

14. Final mine, exploration and supporting infrastructure rehabilitation, closure and aftercare, and.

15. Mine components to be addressed in the ongoing and final mine closure plan.

Mitigation measures for each of the above (1) to 15) key issues have been prepared and presented in the updated EMP Report (Tables 3.1-3.15) for implementation by the Proponent.

6.3 Summary of EIA Recommendations

This Updated EIA Report only provides for mining of dimension stones currently being undertaken in the ML No. 121. If there is a need for new modifications that may require regulatory approvals such as mining of new commodity as granted under the ML 121 other than dimension stones, an increase in the size or additional new land to the ML area, the Proponent will be required to apply for a new / amended ECC before such modifications may be implemented.

The development of the ongoing and proposed granite and other potential dimension stone and minerals resources in the ML No. 121 must always focus on utilising disturbed areas first as may be required for all the supporting infrastructures, pit area, storage / stockpile areas in order to protect pristine / undisturbed area.

Focusing on developing and utilising the already disturbed and contaminated areas from previous exploration or / and mining operations will greatly be beneficial to the future rehabilitation process of the proposed and ongoing mining and exploration operations in the ML No. 121.

It is hereby recommended that the ongoing and proposed granite mining and exploration operations in the ML No. 121 with all the supporting infrastructure shall be issued with an Environmental Clearance Certificate (ECC) with the following key conditions:

(i) The Proponent shall notify the local community through the Erongo Reginal Council, local Councillor/s, ≠Gaingu Communal Conservancy Management Committee and the !Oe-≠Gân Traditional Authority on the implementation of the proposed project once the ECC has been granted. Such communications shall be maintained throughout the lifecycle of the proposed project.

(ii) The Proponent shall prepare a detailed EMP Report in order to address all the identified medium and high rated impacts.

(iii) The Proponent shall negotiate land access agreement with the owner/s / land rights holders covering the ML No. 121 isa.

(iv) The Proponent must implement and adhere to all the provisions of the EMP report, and.

(v) Environmental monitoring shall be implemented as provided for the in EMP and Environmental Clearance Certificate (ECC) that may be granted by the Environmental Commissioner in the MEFT.

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Annex 1: BID