

# ENVIRONMENTAL IMPACT ASSESMENT (EIA) & ENVIRONMENTAL MANAGEMENT PLAN (EMP)

EPL 5625



---

**Prepared by:**

Centre for Geosciences Research cc  
128 A Bach street Windhoek  
Windhoek  
Cell: 0856419511

**Proponent:**

Erongo Marble and Granite  
(pty) Ltd  
P O Box 4883  
Swakopmund  
Namibia



## PROJECT DETAILS

---

**TITLE: Environmental Impact Assessment and Environmental Management Plan for the proposed small scale surface exploration for marble in EPL 5625 Karibib District, Erongo Region, Namibia.**

**AUTHORS:**

- Mr Siyambango Mulife (Centre for Geosciences Research cc)

**PROPONENT:**

Erongo Marble and Granite (pty) Ltd  
P O Box 4883  
Swakopmund  
Namibia

**CONSULTANCY:**

Centre for Geosciences Research Cc  
PO Box 31423  
Pioneerspark  
Windhoek, Namibia

Contact: Cell:0856419511

<b>NAME</b>	Mulife Siyambango
<b>RESPONSIBILITY</b>	Director of Centre for Geosciences Research cc: Project Director
<b>QUALIFICATIONS</b>	<i>B. Sc. in analytical, inorganic and physical chemistry, Geography &amp; Environmental studies.</i>  <i>M. Sc. in Industrial Rocks and Minerals, MBA in Banking, Accounting and Strategic Management.</i>
<b>PROFESSIONAL REGISTRATION</b>	<i>Pr.Sci.Nat</i>

**EXPERIENCE**

Mr Siyambango is the director and founder of Centre for Geosciences Research cc Mr Siyambango is a qualified geologist, and specialist in industrial minerals and rocks. Obtained an **MSc in Industrial Rocks and Minerals** with majors in Mineral Resource Assessment & Estimation; Mineral Extraction & Management Marketing of Industrial Rocks and Minerals, Geology and Technology of Industrial Rocks and Minerals. **Mr Siyambango** is a fully trained and qualified Chemist with a **BSc in analytical, inorganic and physical chemistry**. Extensively trained and experienced in analytical instruments that are essential for mineral exploration and mineral processing. Academically and experienced trained Manager, with an **MBA in Banking, Accounting and Strategic Management**. The qualification supplements the economic assessment of commerciality of mineral resources for assessment of the bankability.

## Table of Contents

LIST OF FIGURES.....	7
ABBREVIATIONS AND ACRONYMS.....	9
PART I: ENVIRONMENTAL IMPACT ASSESSMENT (EIA) REPORT.....	10
1. Introduction.....	11
1.1. Project Background.....	11
1.2. The objectives of the Environmental Assessment Process.....	14
1.3. Terms of Reference .....	14
1.4. Scope of the Environmental Impact Assessment (EIA) .....	15
2. Background to small scale surface exploration for dimension stone (i.e. Marble).....	16
2.1. What are dimension stones? .....	16
2.3. What is Marble dimension stone.....	19
2.4. Concluding remark on this section .....	19
3. Project description.....	20
3.1. Rationale for the proposed project .....	20
3.2. Proposed locality .....	20
3.3. Geology of the area .....	21
3.4. Climate.....	24
3.5. Infrastructure and Exploration equipment's requirement for the project.....	24
3.5.1. Exploration equipment's.....	24
3.5.2. On site Infrastructure requirements.....	25
3.6. Concluding remark on this section .....	26
4. Legal and regulatory framework review.....	27
4.1. Mineral Act of 1992 and the types of license it regulates.....	27

4.2.	Legal instrument relevant to this project .....	29
4.3.	Regulatory authorities and permitting .....	32
4.4.	Concluding remark on this section .....	33
5.	Affected environment.....	34
5.1.	General description of the project.....	34
5.2.	Social environment and archaeology .....	34
5.2.1.	Social environment.....	34
5.2.2.	Archaeology .....	36
5.3.	Biophysical Environment.....	36
5.3.1.	Biodiversity (fauna and flora).....	36
5.3.2.	Geology.....	38
	Local geology .....	40
	Geological units within EPL 5625.....	41
	Geology of EPL 5625.....	44
	Geological structural features.....	48
5.3.3.	Biodiversity (fauna and flora).....	50
5.3.4.	Groundwater and surface water hydrogeology.....	50
5.4.	Potential impact identified .....	54
5.5.	Concluding remark on this section .....	54
5.6.	Potential impact identified .....	54
5.7.	Concluding remark on this section .....	55
6.	Public consultation process .....	56
6.1.	Legal and policy requirement .....	56
6.2.	Consultation process followed during the EIA process .....	58
6.3.	Limitation of the public consultation process .....	60

6.4.	The interested and affected parties (I & AP's).....	60
6.5.	Outcome of the public engagement .....	60
6.6.	Key issues identified during the public engagement process .....	60
6.7.	Concluding remark on this section .....	61
7.	Impact assessment .....	62
7.1.	Identification of key issues .....	62
7.2.	Methodology used or adopted for the impact assessment .....	66
7.3.	Biophysical Environment.....	70
7.3.1.	Impact of oil spills on groundwater aquifer and surface water streams.....	70
7.3.2.	Loss of Fauna and Flora diversity.....	72
7.3.3.	Dust generation on site.....	73
7.4.	Social Economic Environment.....	78
7.4.1.	Job creation.....	78
7.4.2.	Potential spread of HIV/AIDS & COVID -19.....	80
7.4.3.	Disturbance or destruction of archaeological sites .....	82
7.5.	Solid waste: wires, drill bits, and human waste .....	83
7.5.1.	Descriptions.....	83
7.5.2.	Sensitivity of the affected environment .....	83
7.5.3.	Mitigation and enhancement measures.....	84
7.5.4.	Monitoring.....	84
7.6.	Land or soil disturbance: on site and the proposed 23km stretch road .....	84
7.6.1.	Descriptions.....	84
7.6.2.	Sensitivity of the affected environment .....	84
7.6.3.	Mitigation and enhancement measures.....	85
7.6.4.	Monitoring.....	85

7.7. Concluding remark on this section .....	85
8. Conclusion and recommendations .....	86
8.1. Conclusion.....	86
8.2. Recommendations .....	86
9. References .....	87
PART 2: ENVIRONMENTAL MANAGEMENT PLAN (EMP) .....	90
Appendix .....	92
- Newspaper advert .....	92
- Letter from Ministry of Mines and Energy.....	92
- Company Registration Documents.....	92
- Mine Geotechnical Report.....	92
- Reserve estimation .....	92
- mine planning.....	92
- Geology of the EPL 5625 area.....	92
- Financial feasibility studies .....	92
- CV of consultant .....	92

## LIST OF FIGURES

Figure 1: EPL 5625 site location in Karibib District, Erongo Region.....	13
Figure 2: Site location in relation to nearby towns, road and parks. ....	21
Figure 3: Geology of the proposed EPL 5625site.....	23
Figure 4: Geological map of EPL 5625, Karibib District.....	37
Fig 5, Marble outcrop hill within the licence.....	42
Fig 6, Targeted marble during the test cuts samples.....	43
Figure 7: Brown multi coloured marble within the EPL 5625.....	44
Figure 8: Brown multi-coloured marble with alternating white and grey bands in contact with the more homogeneous marble.....	46
Figure 9: Chemical weathering patterns produced by the marbles causing a rough karst surface.....	46
Figure 10: Marbles within the EPL 5625, showing structural joints.....	48



## LIST OF TABLES

Table 1: Dimension stone extraction methods and technologies.....	18
Table 2: The stratigraphy of the Swakop Group (Damara Sequence) based on Miller 2008.....	22
Table 3: Idealized Geology.....	23
Table 4: List of machines/equipment and quantity to be used during the exploration process.....	25
Table 5: Types of license regulated by the Mineral Act of 1992, activities and environmental requirements.....	28
Table 6: Legal instruments relevant to this project.....	29
Table 7: The regulatory authority and permitting.....	32
Table 9: The APV for the Karibib Marble Aquifer in EPL 5625.....	53
Table 11: Public consultation process.....	59
Table 12: Process of determining the key impacts resulting from certain aspects of the proposed small scale surface explorationfor marble.....	63
Table 13: Definition of criteria for assessing significant impact.....	67
Table 14: Definitions of various significant rating or sensitivity.....	69
Table 15: Expected significance of the project on liquid waste.....	71
Table 16: Expected significance of the project on Biodiversity: fauna and flora.....	73
Table 17: Expected significance of the project on dust generated on site.....	75
Table 18: Expected significance of the project on social economic implications.....	79
Table 19: Expected significance of the project on the spread of HIV/AIDS.....	81
Table 20: Expected significance of the project on archaeological sites.....	82
Table 21: Expected significance of the project on solid waste.....	83
Table 22: Expected significance of the project on soil or land disturbance.....	84

## ABBREVIATIONS AND ACRONYMS

<b>EMP</b>	Environmental Management Plan
<b>EIA</b>	Environmental Impact Assessment
<b>EC</b>	Environmental Commissioner
<b>SADC</b>	Southern African Democratic Country
<b>RSA</b>	Republic of South Africa
<b>MME</b>	Ministry of Mines and Energy
<b>MET</b>	Ministry of Environment and Tourism
<b>MAWF</b>	Ministry of Agriculture Water and Forestry
<b>DWA</b>	Department of Water Affairs
<b>OMDEL</b>	Omaruru Delta
<b>EPL</b>	Exclusive Prospecting License
<b>DEA</b>	Department of Environmental Affairs
<b>SM</b>	Site Manager
<b>ENC</b>	Environmental Coordinator
<b>SF</b>	Site Foreman
<b>PS</b>	Project Staff
<b>PP</b>	Project Proponent
<b>EIA-C</b>	Environmental Impact Assessment Consultant
<b>I&amp;Aps</b>	Interested and Affected Parties
<b>EAs</b>	Environmental Assessments

# **PART I: ENVIRONMENTAL IMPACT ASSESSMENT (EIA) REPORT**

## **1. Introduction**

---

### **1.1. Project Background**

Erongo Marble and Granite (pty) Ltd is proposing to continue carryout exploration of marble near the town of Karibib in the Erongo Region (Figure 1). The EPL 5625 relating to this undertaking is registered under Erongo Marble and Granite (pty) Ltd .

The Environmental Clearance Certificate was granted to Erongo Marble and Granite (pty) Ltd on 4<sup>th</sup> April 2018. And the ECC expired this year on 4<sup>th</sup> April 2021 as attached below. In these regard the Proponent has contracted CEGEOR to reapply for the ECC, and update the EMP to the exploration work that has been conducted in the licence area from April 2018 to April 2021. Hence these report details the photos of exploration activities and marble rock cuttings and trenching.



REPUBLIC OF NAMIBIA

MINISTRY OF ENVIRONMENT AND TOURISM

Tel: (00 26461) 284 2111  
Fax: (00 26461) 229 936

E-mail: [hiskia.mbura@met.gov.na](mailto:hiskia.mbura@met.gov.na)  
Enquiries: Mr. Hiskia Mbura

Cnr Robert Mugabe &  
Dr Kenneth Kaunda Street  
Private Bag 13306  
Windhoek  
Namibia

04 April 2018

OFFICE OF THE ENVIRONMENTAL COMMISSIONER

Dr Klaus Rheinschmidt  
Director  
Tidle Wave Investment 105 (Pty) Ltd  
P. O. Box 4883  
Vineta Swakopmund,  
Namibia

Dear Sir or Madam:

**SUBJECT: ENVIRONMENTAL CLEARANCE CERTIFICATE FOR THE PROPOSED EXPLORATION ACTIVITIES ON EXCLUSIVE PROSPECTING LICENSES (EPL) 5625 ON FARMS MON REPOS AND TSWAWICHAS WEST OF KARIBIB, ERONGO REGION**


The Environmental Scoping Report and Environmental Management Plan submitted are sufficient as it made provisions of the environmental management concerning the project's activities. From this perspective regular environmental monitoring and evaluations on environmental performance should be conducted. Targets for improvements should be established and monitored throughout this process.

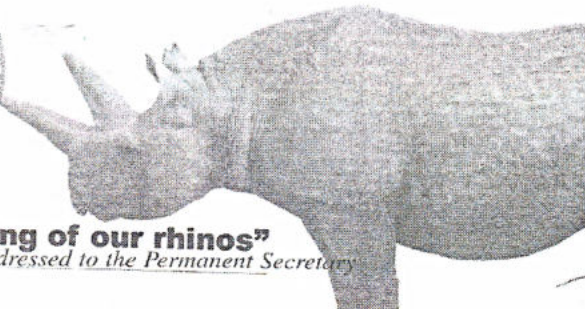
This Ministry reserves the right to attach further legislative and regulatory conditions during the operational phase of the project. In addition, the Environmental clearance certificate is issued with the condition that: all applicable and required permits are obtained and mitigations measures stipulated in the EMP are applied particularly with respect to management of ecological impacts.

On the basis of the above, this letter serves as an environmental clearance for the proposed exploration activities to proceed. However, this clearance letter does not in any way hold the Ministry of Environment and Tourism accountable for misleading information, nor any adverse effects that may arise from these activities. Instead, full accountability rests with the Tidle Wave Investment 105 (Pty) Ltd and its consultants.

This environmental clearance is valid for a period of 3 (three) years, effective from the date of issue unless withdrawn by this office.

Yours sincerely,

  
Teofilus Nghitila  
ENVIRONMENTAL COMMISSIONER



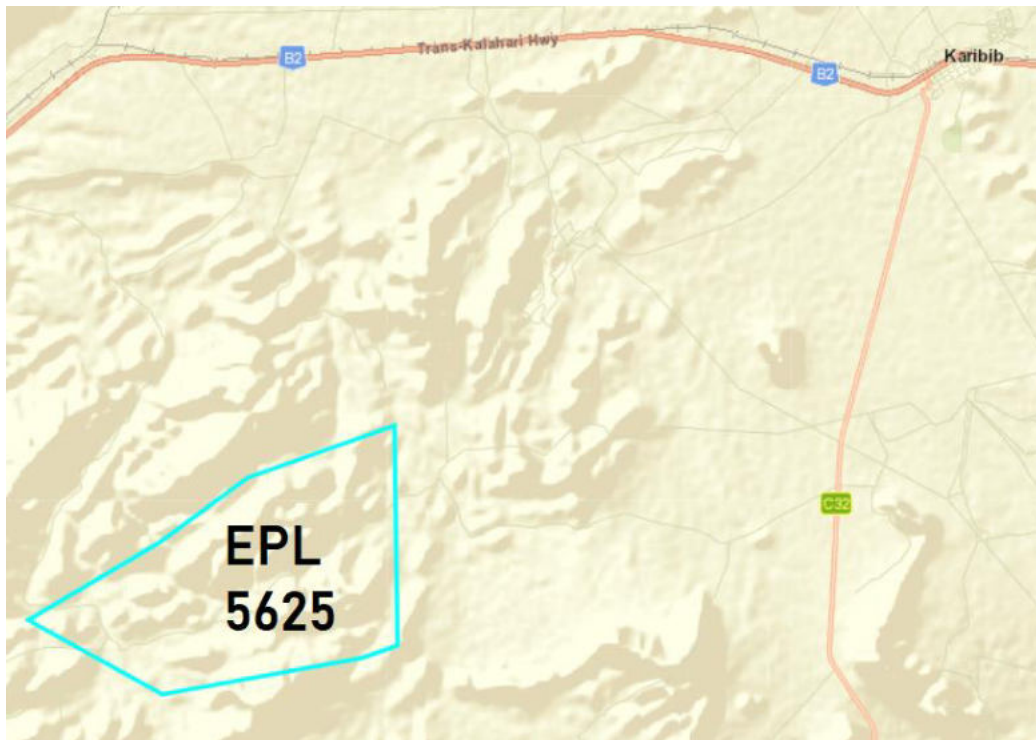
**"Stop the poaching of our rhinos"**

All official correspondence must be addressed to the Permanent Secretary

The EPL details are as follows below:

**(a) EPL 5625**

In line with the provisions of the Environmental Management Act (2007) and EIA Regulations (2012) an Environmental Impact Assessment (EIA) is required for “Prospecting Activities”.



**Figure 1:** Locality of EPL 5625 in Karibib District, Erongo Region

In that regard CENTRE FOR GEOSCIENCES RESEARCH has been appointed to conduct an Environmental Impact Assessment (EIA) and update the Environmental Management Plan (EMP) for the on going exploration project. Mulife Siyambango is the Environmental Assessment Practitioners that conducted the EIA and updated the EMP, with the CV attached in **Appendix A**).

### **1.2. The objectives of the Environmental Assessment Process**

The study is to involve the investigation and assessment of likely short and long-term positive and negative environmental impacts of the activities related to the proposed possible project with the following objectives:

- To prepare an Environmental Impact Assessment (EIA) report including details of the proposed small scale surface exploration or a quarrying;
- Develop an Environmental Management Plan (EMP) based on the outcomes of this study in support of the environmental management of the proposed small scale prospecting.

### **1.3. Terms of Reference**

Terms of reference” means a document which forms part of an EIA report and sets out how an assessment must be carried out. The term of reference for the proposed project was set out based on the requirement by the Environmental Management Act (2007) and its Regulation (2012). The steps which were followed are described as follows:

- a) a description of all tasks to be undertaken as part of the assessment process, including any specialist to be included if needed;
- b) an indication of the stages at which the Environmental Commissioner is to be consulted;
- c) a description of the proposed method of assessing the environmental issues and alternatives; and

- d) The nature and extent of the public consultation processes to be conducted during the assessment process.

#### **1.4. Scope of the Environmental Impact Assessment (EIA)**

The particular objectives of the EIA in line with the Terms of Reference are to:

- Comply with Namibia's Environmental Assessment Policy, Environmental Management Act (2007) and its Regulations (2012).
- Confirm the justification of the project and to consider all alternatives that would meet the need;
- Consult all Interested and Affected Parties (I&APs) to ensure that their inputs are taken into account;
- Review the legal and policy framework and their relevant requirements for this project;
- Describe the biophysical and socio-economic environment of the project and determine the associated sensitivities to and suitability of the prospecting, mining, and transportation activities.
- Identify and assess impacts related to the construction, operation and decommissioning of the small scale surface exploration and to propose suitable mitigation strategies;
- Compile an Environmental Management Plan for the construction; operation and decommissioning of the proposed small scale surface exploration for marble.



## **2. Background to small scale surface exploration for dimension stone (i.e. Marble)**

---

### **2.1. What are dimension stones?**

According to the provisions of Schedule 1, dimension stones are groups of Minerals, elements and rock (Section 1), Part 2 of the Minerals (Prospecting and Mining) Act, 1992, (Act No. 33, 1992), the dimension Stone Group includes all rock material occurring naturally in, on or under the earth. They are capable of being cut, shaped or used in blocks, slabs, sheets and tiles for the construction or cladding of buildings, paving, monuments and memorials. Exploration means any operations carried on in connection with investigations, including any accessing, extraction or incidental winning of any mineral or group of minerals for the purposes of mineralogical examination, assaying, test work or marketability surveys. While exploration area means the land to which an EPL 5625 license relates.

Dimension stone is one of the oldest and most durable building materials. The Egyptian pyramids were built from quarried stone in about 2800 B.C., and the Babylonians used cut stone in 600 B.C. to build the renowned Hanging Gardens, one of the Seven Wonders of the World. The Greeks and Romans also used cut and finished stone widely as construction, decorative, and statuary material.

The principal rock types used for dimension stone are marble, limestone, granite, sandstone, and slate. Of these, granite, limestone, and marble are the three main materials for construction, decorative and statuary. Physical properties, such as durability, strength, and the ability of the stone to hold a surface finish, are important in the industry. To the customer the esthetic properties such as color, texture and pattern, and surface finish are very important.

Besides meeting the desired physical and esthetic properties, the rock must be relatively free of fractures so that it can be split or cut from a quarry face in large

multi-tonne blocks and transported to the processing plant. Prospecting for, and mining and production of dimension stone are more sophisticated and require more care than the same processes or the methods used for natural stone aggregate or sand and gravel.

## **2.2. Dimension stone Exploration and Mining**

In exploration or mining dimension stone it is necessary to split or cut the stone into successively smaller pieces until the final desired block size is achieved, and saleable blocks are produced. The exploration methods utilized in the extraction of dimension stone range from relatively simple and low technology methods to some quite technologically advanced methods. In general, marble is extracted using relatively advanced *non-explosive* cutting technologies, and is even quarried in underground situations, while granite tends to utilize more low-tech drilling and splitting technologies, although this is changing. For this project marble will be extracted using non-explosive cutting technologies.

For most rocks, the exploration and mining stage of dimension stone extraction conforms to one of two general strategies. In the first of these, large volumes of rocks (usually in the 1000s of m<sup>3</sup> range) are loosened by means of primary cuts, and then divided stepwise into smaller pieces until commercial blocks are obtained, discarding waste material as the process is performed. The cutting technology is the main method employed in most granite and marble quarries.

There are three methods used in the extraction of dimension stone, such as cutting, splitting and cautious blasting. For this project a cutting method will be used as shown in the table 1 below. A summary of the different extraction methods for dimension stone and the technologies involved are given in table 1 below.

**Table 1: Dimension stone extraction methods and technologies**  
*(Ashmole and Motloun, 2008)*

Extraction methods	Cutting	Splitting	Cautious Blasting
<b>Methods of separating blocks/slabs</b>	Blocks separated by means of kerfs	Blocks separated by fractures induced in pre-determined planes	Blasting with minimal breakage
<b>Technology</b>	<ul style="list-style-type: none"> <li>• Sand wire (helicoidal wire) ;</li> <li>• Diamond wire</li> <li>• Chain saw</li> <li>• Disc cutter</li> <li>• Diamond belt cutter</li> <li>• Flame jet</li> <li>• Water jet</li> </ul>	Explosives: Detonating cord <ul style="list-style-type: none"> <li>• NG based explosives</li> <li>• Blasting gunpowder</li> <li>• Plug and feather</li> <li>• Expansive mortar</li> <li>• Hydraulic wedges</li> </ul>	Explosives
<b>Products</b>	Commercial blocks	Commercial blocks	<ul style="list-style-type: none"> <li>• Natural slabs</li> <li>• Kerbs</li> <li>• Paving stones</li> <li>• Cobbles</li> <li>• Building blocks</li> <li>• Tiles</li> </ul>

### **2.3. What is Marble dimension stone**

Marble is defined commercially as any crystalline rock composed predominantly of calcite, dolomite, or serpentine that is capable of taking a polish. Calcareous materials account for approximately 57%, siliceous materials for around 38% (of which granites account for probably over 95%), and slates for around 5% of total world production of around 93 million tons in 2007 (Ashmole and Motloun, 2008).

### **2.4. Concluding remark on this section**

In this section information was provided to explain different steps or phases that are involved in exploration of demission stone, as well as explanation of what marble is pertaining to the dimension stone industry. The following section provides information of what Erongo Marble and Granite (pty) Ltd proposes for this project.

### **3. Project description**

---

#### **3.1. Rationale for the proposed project**

The dimension stone industry in Namibia has been in existence for many years; however its potential has not yet been fully developed. Prospecting company should utilize this opportunity to take advantage of this development. The demand for demission stone is increasing in Namibia, SADC and the rest of the world.

Namibia's internal market for dimension stone is small, and is limited mainly to tomb stone manufacturing with occasional building cladding/flooring application. Regionally, Namibia exported 10,830 t and 41,456 t of its 2004 marble and granite production respectively to SADC countries, mainly South Africa.

Annual production of marble and granite has shown a rapid increase in tonnage since 2003. There has been an increase in the variety of dimension stone now available, which is mainly due to the upswing in dimension stone mining in Namibia, with 28 exploration licenses, 19 Mining Licences (2004) for dimension stone granted and several applications pending.

Against this background, Erongo Marble and Granite (pty) Ltd is proposing to carry out a quarry for Marble. If the quarry test will be successefully, employment will be created to people within the vicinity of the project area such as those residing near Karibib and Usakos.

#### **3.2. Proposed locality**

The EPL 5625 is located near Karibib Town. The distance to EPL 5625 is about 8km in the southwestern direction. From the B2 road, distance to EPL 5625 is 6km southward. Both B2 road and the Rail link are on the west side of the EPL area (**Figure 2**). Karibib is the major settlement found nearby EPL 5625; furthermore, the EPL 5625 is outside the Dorob National Park (**Figure 2**).



**Figure 2:** EPL 5625 site location in relation to nearby towns, road and parks.

### 3.3. Geology of the area

The general geology of the study area consists of crystalline marble, schist, amphibolite and quartzitic rocks of the Karibib Formation in the Swakop Group of the Damara Sequence. In some places, these lithologies are intruded by granite of the Salem Suite, consequently introducing secondary discontinuities and compartmentalizing lithological continuity.

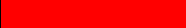


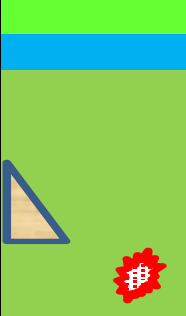





Since the Swakop Group is the main prevalent part of the Damara Supergroup in the study area, its complete stratigraphic column the Damara Supergroup is presented in **Table 2 and Figure 3**, whereas **Table 3** presents the idealized geology of the sites.

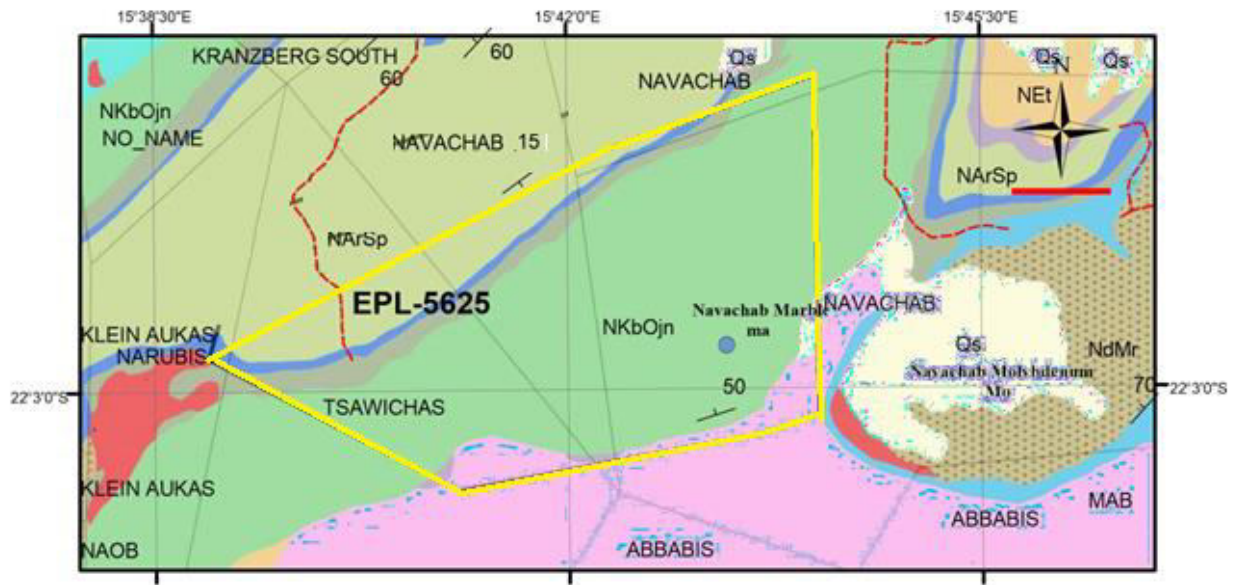
**Table 2: The stratigraphy of the Swakop Group (Damara Sequence) based on Miller 2008**

GROUP	FORMATION	MEMBER	LITHOLOGY	COMMENT	
<b>SWAKOP GROUP</b>	Damint Suite		Granite	Target Resource	
	Kuiseb		<i>Schist &amp; minor amphibolite</i>	Wide spread	
	Karibibi	Arises River		<i>Calc-silicate rock, calc marble</i>	
		Otjongeama		<i>Main marble member</i>	
	Arandis	Obserwasser		<i>Schist &amp; phyllitic schist, metagreywacke</i>	
		Okawayo		<i>Discontinuous marble, biotite schist, calc-silicate rocks</i>	
		Spes Bona		<i>Calc-silicate rock, metagreywacke, schist, quartzite</i>	

(Source: Muller, 2008)

**Table 3: Idealized Geology**

Depth (m)	IDEALIZED GEOLOGY	
100		Granite
300		Schist_KU
450		Marble_KA
1000		Schist_A
<b>LEGEND</b>		Phyllite
		Greywacke
		Arandis FM
		Kuiseb FM
		Karibib FM



**Figure 3: Geology of EPL 5625 site**



### **3.4. Climate**

Annual precipitation in the project area ranges from 150mm to 300mm. The average temperature for EPL 5625 site is between 21°C to 22°C. The area receives very little rainfall during wet season, and thus the possession of Marble potential. The relative humidity of the area range from 16% to 39% and the wind direction is predominantly dominated by southwest wind.

### **3.5. Infrastructure and Exploration equipment's requirement for the project**

The project is a small scale surface exploration and during the exploration process the following equipment or technology will be used:

- Sand wire (helicoidal wire) ;
- Diamond wire
- Chain saw
- Disc cutter
- Diamond belt cutter
- Flame jet
- Water jet

The collected bulk samples will be ship to the Republic of South Africa (RSA) for geotechnical and construction material tests. Besides cutting which induced shallow cracks into the Marble, and no blasting will be conducted.

#### **3.5.1. Exploration equipment's**

Table 4 below shows a summary of machines/equipment that will be used during the small scale surface exploration process.

**Table 4:** List of machines/equipment and quantity to be used during the exploration process

Item	Quantity
Disc cutter	2
Jack Hummer	2
Water jet	1
Diamond Wire Saw	1
Generator	1
Front End Loader	1
Water Tank	1
Diesel Tank	1

### **3.5.2. On site Infrastructure requirements**

#### **a. Waste disposal infrastructure**

Bins will be provided, and all litter will be disposed of at the nearest municipal dumping site (i.e. Karibib Town Council Dumping site). Industrial waste will be mainly wire, cable, drill bits, these items will be collected and removed from the sites. No unused machines, part will remain on site. Chemical Toilets (Mobi Loo) will be erected on sites for the use of the workers.

#### **b. Electrical requirements**

The area or sites have no access to the main electrical grid. Therefore during the exploration process, diesel generator will be used as a source of power. The diesel to be used on site will be purchased from the nearby towns such as Karibib.

#### **c. Road proposed**

The B2 will be used for transportation of equipments to and from the site and also the bulk samples collected for testing. To get to the site small stretches of roads will have to be made from the main road to the EPL 5625 site. The road length will be about +-23 km long to EPL 5625.

### **3.6. Concluding remark on this section**

In this section information on the rationale for the project, project location, geology of the project location, and climate of the area were provided. Moreover, infrastructure that will be needed for the project, and types and quantity of small scale exploration equipments were also described in this section. Human waste from the chemical toilets (Mobi loo) will be dumped at Karibib Town Council Dumping site.

#### **4. Legal and regulatory framework review**

---

The national regulations governing prospecting and mining for dimension stone activities in Namibia fall within the jurisdiction of the Ministry of Mines and Energy (MME). The Minerals (Prospecting and Mining) Act (No 33 of 1992) is the most important legal instrument governing the mining and prospecting industry in Namibia.

The Minerals (Prospecting and Mining) Act (No 33 of 1992) regulates reconnaissance license, prospecting license and mining of minerals and dimension stone or rocks. The Act details reporting requirements for monitoring of activities and compliance to environmental performance, such as disposal methods and rehabilitation. The Mining Commissioner, appointed by the Minister, is responsible for implementing the provisions of this Act as well as the associated regulations such as the Health and Safety Regulations. Several explicit references to the environment and its protection are contained in the Minerals Act, which provides for environmental impact assessments, rehabilitation of prospecting and mining areas and minimizing or preventing pollution.

##### **4.1. Mineral Act of 1992 and the types of license it regulates**

Below is an outline of the Mineral Act, linking the type of license it regulates, project activities at every license stage and the environmental requirements are (**Table 5**).

**Table 5: Types of license regulated by the Mineral Act of 1992, activities and environmental requirements**

Types of license	Activities	Environmental Requirements
<p><b>Exclusive Reconnaissance License (ERL)</b></p>	<p>1. Project Identification, 2. Reconnaissance</p>	<p>None Complete Environmental Questionnaire</p>
<p><b>Exclusive Prospecting License</b></p>	<p>Prospecting based on the following steps: Desktop study, Detailed Mapping, Geophysical Methods, Drilling and Bulk Sampling, Test a quarrying</p>	<p>Scoping Report, Environmental Impact Assessment (EIA)</p>
<p><b>Mining License</b></p>	<p>Preconstruction and Construction, Operation and, Ongoing Monitoring, Decommissioning, Closure, Restoration and Aftercare</p>	<p>Full Environmental Assessment ,covering, Scoping, Environmental Impact Assessment(EIA) and the development of and Environmental Management Plan (EMP)covering the complete project lifecycle including preconstruction, construction operation and ongoing, decommissioning and aftercare. Aspects of the Environmental Management Plan are usually incorporated into an Environmental Management Systems</p>

#### 4.2. Legal instrument relevant to this project

There are various legal instruments that advocates for the effects of small scale prospecting on the environment. Table 6 below shows the summaries of the legislation that are relevant to this project:

**Table 6: Legal instruments relevant to this project**

Topic	Legislation	Provisions	Regulatory Authority
Small scale Marble Mining	Mineral (Prospecting and Mining) Act of 1992	The Minerals Act of 1990 governs minerals prospecting and mining. The Act provides for the reconnaissance license, prospecting license and mining for, and disposal of, and the exercise of control over minerals in Namibia.	Ministry of Mines and Energy
Environmental Impact Assessment	Environmental Management Act of 2007 and EIA regulation of 2012	Provides list of activities that require an environmental assessment, including: exploration and Quarrying. Activities such as Mining or prospecting for minerals or dimension stone, mining for minerals or dimension stone. The Act also provides procedures for adequate public participation during the environmental assessment process for the interested and affected parties to voice and register their opinions and concern about a project.	Ministry of Environment and Tourism
Water Supply and Effluent Discharge	Water Resources Management Act 2004	<p>This Act provides provisions for the control, conservation and use of water for domestic, agricultural, urban and industrial purposes.</p> <p>The Act states that a license or permit is required to abstract and use water, and also discharge effluent.</p> <p>In accordance with the Act, and due to the nature of the project, abstraction and use permits won't be required for this project as on site water tank (500L) will be used. The capacity of the onsite tank is less than 20000m<sup>3</sup> bench mark for water work permit.</p> <p>Effluent (i.e. Human Waste) from the mobile toilet will be discharge at the karibib Municipality sewerage system. No effluent will be discharge in an water course. Waste water from dust suppression will be minimal and the water is expected to evaporate faster than it infiltrate. Therefore, no effluent discharge permits will be required for this project</p>	Ministry of Agriculture Water and Forestry

Topic	Legislation	Provisions	Regulatory Authority
Hazardous Substance such as used oil which (e.g. diesel)	Hazardous Substance Ordinance 14 of 1974	The Act 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”	Ministry of Health and Social Services
Fauna and flora	The Nature Conservation Ordinance, Ordinance of 1975,	In the course of 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. For this project, due to it areal extend and location outside a protected area a permit will not be required.	Ministry of Environment and Tourism (MET)

Topic	Legislation	Provisions	Regulatory Authority
Used oil	Petroleum Products and Energy Act 13 of 1990	The Act provides provisions for the 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. Used oil from this project will disposed at the Walvis Bay Municipality Hazardous Waste Site. Permission will be required from the facility owner prior to the dumping of the used oil.	Ministry of Mines and Energy
Employees	The Labour Act, 2007 (Act No. 11 of 2007)	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	Ministry of Labour and social welfare
Archaeological sites	National Heritage Act 27 of 2004 Ministry of Youth	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 exploration project will ensure that if any archaeological or paleontological objects, as described in the Act, are found in the course of its exploration operations or closure that such find be reported to the Ministry immediately. If necessary, the relevant permits must be obtained before disturbing or destroying any heritage.	National Service, Sport and Culture
Desertification	United Nation Convention to Combat Desertification 1992	The convention objective is to forge a global partnership to reverse and prevent desertification/land degradation and to mitigate the effects of drought in affected areas in order to support poverty reduction and environmental sustainability	United Nation Convention



Topic	Legislation	Provisions	Regulatory Authority
Biodiversity	Convention on Biological Diversity (CBD) 1992	This convention advocates for the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources.	United Nation Convention

### 4.3. Regulatory authorities and permitting

The environmental regulatory authorities responsible for environmental protection and management in relation to the proposed small scale prospecting project including their role in regulating environmental protection are listed in Table 7. Table 8 below shows an extract from the legal instruments of the regulating authorities with respect to the relevant permits/ licenses required for the proposed small scale surface exploration project.

**Table 7: The regulatory authority and permitting**

Activities list	Applicable Legislation	Permitting Authority	Current Status
Small Scale Mining Programme	Minerals (Prospecting and Mining) Act, 1992	Ministry of Mines and Energy	Field Work to follow on issue of Environmental Clearance
EIA Clearance for Exploration	Environmental Policy and Environmental Management Act, (Act No. 7 of 2007)	Ministry of Environment and Tourism (MET)	To be applied on completion of this EIA and EMP Report for Exploration
EIA Clearance for Exploration	Environmental Policy and Environmental Management Act, (Act No. 7 of 2007)	Ministry of Mines and Energy	To apply if Economic Resources are Discovered and Project Advances to Feasibility and if the Feasibility Proves Positive

Activities list	Applicable Legislation	Permitting Authority	Current Status
Construction, alteration of waterworks with capacity to hold in excess of 20,000L. Abstraction of water other than that provided by Nam Water. Discharge of effluents or construction of effluent facility or disposal site	Water Resources Management Act, 2004 (No. 284 of 2004).	Ministry of Agriculture, Water and Forestry	To Apply when Required
Removal, disturbances or destruction of bird eggs	Nature Conservation Ordinance 4, 1975.	Nature Conservation Ordinance 4, 1975.	To Apply when Required
Removal, destruction of indigenous trees, bushes or plants within 100 yards of stream or watercourse	Forestry Act, 12 of 2001	Ministry of Water Affairs and Forestry (MWAFF)	
Discarding or disposing of used oil	Petroleum Products and Energy Act 13 of 1990	Ministry of Mines and Energy (MME).	
Construction of waste Disposal sites.	Environmental Policy and Environmental Management Act, (Act No. 7 of 2007)	Ministry of Environment and Tourism (MET)	
License to Purchase, store and use of Explosive	Explosives Act 26 of 1956 (as amended in SA to	Ministry of Safety and Security in	
Magazines for Blasting	April 1978),	consultation with Ministry of Mines and Energy (MME).	

#### 4.4. Concluding remark on this section

In this section information on the relevant legislation to the project, the type of licenses required and the permits were presented. The regulatory authorities relevant to the project were also mentioned in this section.

## **5. Affected environment**

---

### **5.1. General description of the project**

The project under EPL 5625 involves undertaking a small scale surface exploration for dimension stone in particular Marble. The overall aim of the project is to evaluate for possible development of a viable quarry for Marble that may affect the environment. The mineral groups that are targeted in this exploration of dimension stones in particular Marble.

**Dimension Stone:** In accordance with the provisions of Schedule 1, Groups of Minerals, Elements and Rock (Section 1), Part 2 of the Minerals (Prospecting and Mining) Act, 1992, (Act No. 33, 1992), Dimension Stone Group include all rock material occurring naturally in, on or under the earth which is capable of being cut, shaped or used in blocks, slabs, sheets and tiles for the construction or cladding of buildings, paving, monuments and memorials.

### **5.2. Social environment and archaeology**

#### **5.2.1. Social environment**

According to Namibia Statistic agency, (2011), majority of the people in the area of Karibib are heavily depended on dimension stone (i.e. Marble) industry for their livelihood. The area (Karibib Town) has many small scale miners that operate mining for dimension stone at small scale. Most of the small scale miners are previous disadvantage people. Residents of Karibib Town are concerned about small miners selling their exploration or mining license to foreigner investor due to lack of startup capital for potential mining expansion. This could be seen as a threat and at the same time as an opportunity in the sense that local miners could negotiated for shareholding agreement instead of selling their licenses.

The report by Namibia Statistic agency, (2011) also revealed that the Karibib households depend mainly on wages and salaries, farming, business or non-farming activities, pension and cash remittance as their main income. About 58 % of the population depends on wages and salaries. Only a small percentage depends on farming, which is the lowest dependency in the area adding up to 6 % in the year 2011. About 9% of the population is depended on business or non-farming activities (Namibia Statistic agency, 2011). The dependency of the residents on pension only adds up 13% of the total population. The other 7% depends on the cash remittance (Namibia Statistic agency, 2011). Comparing to the Erongo region at large, the Karibib residence has the second highest unemployment rate in the region after the Daures constituency with an unemployment rate of 44% (Namibia Statistic agency, 2011). Karibib district is also one the constituency with a high rate of no proper sanitation, ranking in second after the Daures constituency. Therefore Karibib Town is in a crisis as far as employment, and thus development of the town is concern. However, any developmental activity that is needed should not take advantage of the unemployment situation in the Town at an expense of the environment and thus sustainable developmental project are needed for this town.

It should also be noted that, the population of the Karibib Town is about 13 320, and the town consist of only 9% of the Erongo Region population which is at 150 809 (Namibia Statistics Agency, 2011). The population growth rate is only 1%, depicting a slow growth rate which could be due to the little economic activities in the area to attract more inhabitants. According to the statistics the labor force participation rate is at 76.3% in Karibib, (Namibia Statistics Agency, 2011), were more men are economically active than women.

It anticipated that this project will have little adversely negative impacts on the communities living in Karibib and Usakos Towns, and nearby farms. Instead, the project poses a significantly positive impact to the people living in the area such Karibib and Usakos. The positive impacts are mainly, job creation, support to local retailers and payment of export tax and VAT to the government of Namibia. The little negative

impacts identified are on the issues of health and safety of the employees, and the potential spread of HIV/AIDS by the employees. Mitigation measures for the negatives impacts and enhancement measures for positive impacts are all addressed in Section 7.4 of this document and in the EMP.

### **5.2.2. Archaeology**

There are no archaeological sites within and outside the boundary of the EPL 5657 licence area (see attached report on Heritage). The available archaeological sites in Namibia are mainly rock arts. Rock arts are of historical importance to the people it belongs to and the nation at large. These arts are protected by laws in Namibia such as the National Heritage Act of 27 of 2004, hosted under the Ministry of Youth. It's widely spread that every project operating within an area where there are lots of archeological sites is obliged not to destroy or temper with the sites. Therefore, should their be existing rock arts located in the boundary where this project will be operating should not be destroyed or tempered with during the duration of the project. The mitigations measures for the protection of archeological sites are addressed in Sub-section 7.4.3 of this document and the EMP.

## **5.3. Biophysical Environment**

### **5.3.1. Biodiversity (fauna and flora)**

The EPL 5625 is situated in the Namib Karoo and Western Highlands Biomes Savanah. In the Namib Karoo Biome, tree cover is 2 to 10%, tree height is 2 to 5m, shrub height is 0.5 to 1m, grass cover is 0.1 to 1% and grass height is >1.5m. The dominant vegetation in this biome according to the ranking is *acacia montis-ustii*, *acacia robynasiana*, *cyhostemma currorii*, *strcutia africana*, and *calicorema capitiatia* and *orthanthyera albiadia*.

In the Western Highlands Biomes Savanah, tree cover is 2 to 10%, tree height is 2 to 5m, shrub cover is 2 to 10%, and grass height is >0.1m. The dominant vegetation type in this biome according to the ranking is *acacia reficiens*, *euphorbia geuerichiana*, *colophospermum mopane*, *maerua schinzii*, and *ademolobius garipensis* (Mendelson, 2002).

Species number for mammals in the project area is about 61 to 71 species and the area is ranked number 5 in terms of species sensitivity. The area has 75 species of biodiversity compare to Zambezi Region at 120 and the Namib Desert at 9 species. Bird's endemism is ranked number 5 with endemic species of 8 to 10.



**Types of vegetation and vegetation cover at Project Site**

### 5.3.2. Geology

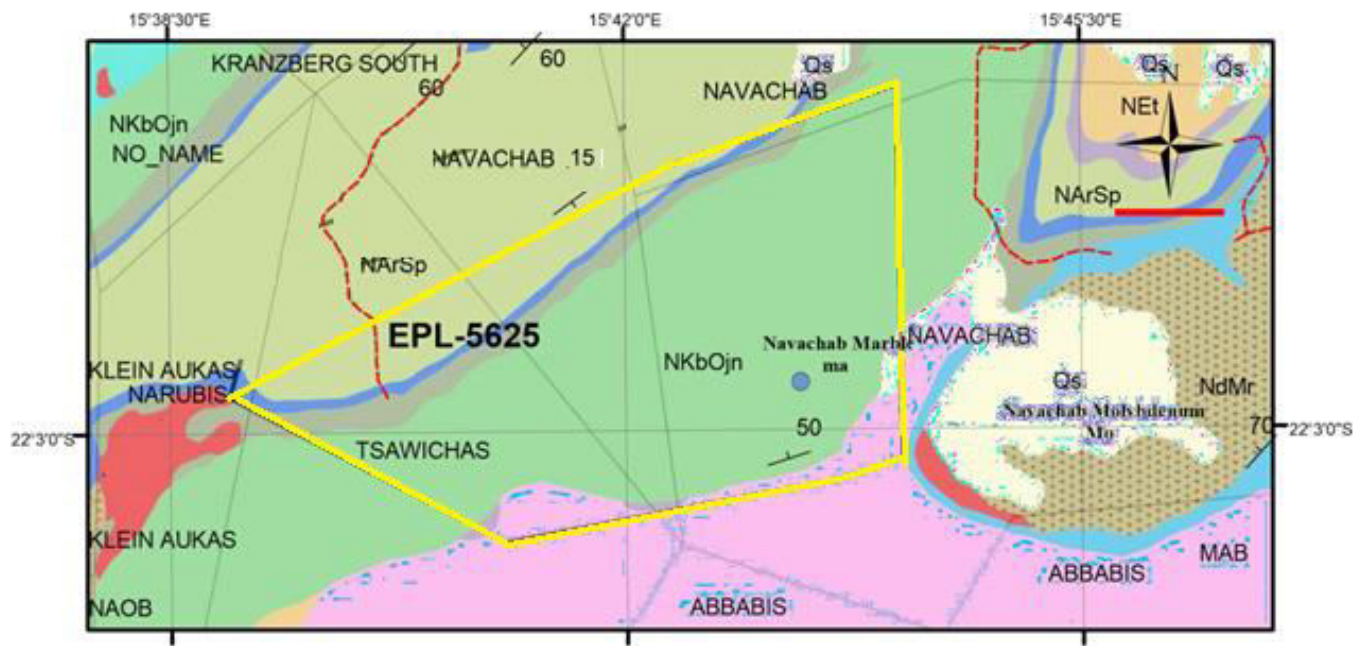
It is well known that the Karibib-usakos District which is part of the Erongo region in Namibia lies within the Damara Belt which is an ENE-trending belt that was formed during the Damara Orogen. The belt is a divergent orogen that formed during high-angle convergence between the Congo and Kalahari Craton (Miller, 1983). The belt is made up of fault – and shear zone bounded zones of varying structural style, ranging from north to south as a fold-thrust belt displaying complex fold interference, a granite dominated inner-zone with elongate, WNW-trending basement cored domes and Damara Sequence basins and in the south a transposed schist belt and another marginal fold-thrust zone with basement cored fold nappes (Gray, Foster, Meert, Goscombe, Armstrong, Trouw & Passchier, 2006).

The Karibib Marbles belong to the Swakop Group (739-650 Ma) which was formed during the Damara Orogen. The Swakop Group was deposited when limestone and dolomite were precipitated in the submerged deeper parts of the volcano-related graben. The basement on which the Swakop Group rocks rest is made up of rocks of the Abbabis Metamorphic Complex (De Kock, 2001). The Swakop facies are generally known to be deeper water turbidites within the ocean basins and they form part of the major geologic components of the Damara Orogen (Gray et. al., 2006).

The Abbabis Metamorphic Complex is a granitic gneiss basement found within the central zone. It is largely composed of quartzofeldspathic gneiss with minor amphiboles, schist, marble and calc-silicates (Kinnaird & Nex, 2007).

The marbles within the EPL Licence belong to the Karibib Formation which is found within the Khomas Subgroup of the Swakop Group. The formation extends from the Northern Zone (NZ) to the southern Central Zone (sCZ) of Namibia and despite a broad similarity across this region it does however show considerable

facies changes between each of the NZ, nCZ and sCZ (Miller, 2008). In terms of its composition, the Karibib formation consists chiefly of a thick succession of dolomite marble with very subordinate intercalations of biotite-quartz schist. The development of this formation varies considerably from place to place. It is therefore difficult to establish a complete and correct stratigraphic section for this unit (Porada & Hill, 1974).



**Figure 4:** Geological map of EPL 5625, Karibib District.



### Local geology

The Karibib marbles within the EPL 5625 occur in the Swakop Group which can be subdivided as follows:

**Table 8:** Subdivision of the Karibib marbles within the Swakop Group (Adapted from Porada & Hill, 1974)

Swakop Group	Khomas Subgroup	Mica-quartz schist
		Dolomitic marble (Karibib Formation)
		Diamictite (Chuosi Formation)
	Hakos Subgroup	Dolomitic marble

The stratigraphic position of the Karibib marbles as seen in Table 8 above indicate that they belong to the Karibib Formation of the Swakop Group. The above subdivision indicates that in an area of normal stratigraphic development this formation would be underlain by the Chuosi diamictite and overlain by schist of the Khomas Subgroup.

On the northern part of the EPL 5625 along the boundary on farms Ketelbank 66 and Graniet 67 there are rocks from the Karibib formation. The upper part of the EPL has abundant surficial deposits and minor rocks.

In the central parts of the EPL 5625 within the farm Ketelbank there are Namibian to Cambrian pegmatites which are surrounded by abundant surficial deposits and minor rocks from the Karibib Formation. Further there is also some Diorite which covers most of the area.

At the lower end of the EPL 5625 which is further south east there exist Cambrian red granites that are related to post tectonic events and they are intercalated with rocks from the Karibib Formation

### ***Geological units within EPL 5625.***

Below is a brief description of the geological units that are present within the EPL 5625.

#### ➤ **Cambrian red granites post tectonic**

According to Miller (2008) red homogeneous granite are extensively developed south east of Karibib. Most of these red granites have been mobilised and occurs as irregularly shaped intrusive bodies and veins at stratigraphic levels on either side of the Karibib Formation marbles in metasedimentary and older granitic host rocks. The granites also tend to become ponded immediately below the Karibib marbles.

#### ➤ **Abbabis Metamorphic Complex**

Within the central zone a granitic gneissic basement, known as the Abbabis Complex, occurs as cores to several of the prominent domal structures, principally the Abbabis and Palmenhorst Domes. It is largely composed of quartzofeldspathic gneiss with minor amphiboles, schist, marble and calcsilicates. Geochronological studies of the gneisses have resulted in various ages including ~2 and ~1 Ga. with a Pan-African overprint at ~560 Ma (Kinnaird & Nex, 2007). The Swakop Group (Damara sediments) in which the Karibib marbles are found lies unconformably on the Abbabis Complex. Within the EPL 5625 there are very little outcrops of the complex that are exposed within the Karibib Townland as well as at Farm Okongava Ost.

#### ➤ **Namibian to Cambrian pegmatite**

In the area around Karibib an important pegmatite field can be found. The pegmatites are of late Damaran age; many are well mineralised and

important sources of Li, Cs, Be, Sn, Nb, Ta and Bi minerals, ceramic feldspar and quartz, and a few contain gem tourmalines. The majority however may be considered as Li pegmatites, but there are also Be and Sn pegmatites (Von Knorring, 1985).

➤ **Omusema Member**

This is a locally metamorphosed succession of continental, within-plate, alkaline tholeiitic basaltic rocks deposited subaqueously on or near the Okahandja Lineament. It post dates a period of post-Nosib, intra-Damara, synsedimentary deformation, overlies Etusis quartzites unconformably and extends laterally onto the Abbabis Metamorphic Complex gneisses. It forms dome-like accumulations that conformably underlie the Karibib Formation (Miller, 2008).

➤ **Karibib Formation**

The Karibib Formation consists of an interbedded succession of dark grey marble, ribbon marble that is made up of thin alternating layers of light and dark grey marble, sedimentary marble breccias, grey phyllitic dolomite and laminae of calc-silicate rock. White dolomite layers occur near the top of the succession. Layers are between a few centimetres and several metres thick and contacts between layers are gradational (Miller, 2008).

➤ **Otjongeama Member, Navachab Facies**

The Otjongeama Member has an average thickness of 500m but reaches a maximum of 1600m. It is made up of approximately 75% dolomitic calcite marble, calcitic marble and dolomite containing scattered grains of diopside, tremolite and quartz and 25% interbedded calc-silicate and biotite schist layers. Most of the marble weathers to a light brown colour and occurs in layers between a few mm and 6m thick but a few white layers are also present (Miller, 2008).

➤ **Okongava Diorite**

The Okongava Diorite is a dark grey, medium-grained, foliated, equigranular rock consisting mainly of hornblende and plagioclase with variable amounts of quartz and K-feldspar and minor to accessory titanite and biotite. Modally, it is a quartz monzodiorite that extends just into the field of granodiorite. This diorite also intrudes the Tinkas Formation where it has caused limited partial melting of the schist layers. Additional features in this diorite are short, narrow epidote-rich lenses and small trondhjemitic pegmatite veins that contain few mafic minerals (Miller, 2008)

➤ **Surficial deposits**

In general surficial deposits are known to be unconsolidated alluvial, residual or glacial deposits that overlie the bedrock or tend to occur near or on the surface of the Earth.

## Geology of EPL 5625

The geological set up within the EPL 5625 is fairly modern and this is evident from the sequence of geological units that are present and are an indication of the Swakop Group of the Damara Supergroup that was formed during the Damara Orogen. The area has a topographic essence to it and there exists a variation in altitude. According to Porada & Hill, (1974) this inselberg (Fig 2 & Fig 3) topography is associated with the fact that many of the residual hills and mountains are built by marble which is more resistant to weathering than the surrounding schist.



**Fig 5**, Marble outcrop hill within the licence after sample cut.



**Fig 6**, Targeted marble during the test cuts samples.

According to Porada & Hill, (1974) majority of the marble occurrences within the Karibib District are in favour of the white marble but there is also however the presence of “fancy” marble (i.e. the red white-veined, yellowish-pink, grey, greybanded marble) in some parts of the area. Thus it can be said that the rocks are either unicoloured or banded, folded, flamed or brecciated.

Within the EPL 5625 there is the presence of white homogeneous marble especially within the location of the target marble quarry and this is an indication that the rock consists of pure calcite and/or dolomite (Ref. to Fig. 4). There is however, also banded marble with alternating grey and white bands (Ref. to Fig 5). The grey colour can be associated with carbonaceous matter. The marbles show interesting intensive weathering patterns in some outcrops and thus rough karst surfaces can be found (Ref. to Fig. 6). According to Porada & Hill, (1974) the rate

of weathering of a marble depends upon its physical properties and on climatic conditions.



**Figure 7:** Brown multi coloured marble within the EPL 5625.



**Figure 8:** Brown multi-coloured marble with alternating white and grey bands in contact with the more homogeneous marble.



**Figure 9:** Chemical weathering patterns produced by the marbles causing a rough karst surface.



### ***Geological structural features***

In general the Swakop Group has been deformed by two phases of isoclinal folding and a third phase of doming. Southwest oriented, right-lateral strike-slip faulting has led to D4 folds being produced. The Swakop Group terrane has been metamorphosed to upper amphibolites facies (De Kock, 1992).

According to Porada & Hill, (1974) sufficient knowledge of the main structural features is a vital aspect in order to determine the stratigraphic position, thickness and attitude of the marble beds. A good knowledge of the type and extent of the jointing is also important and it helps to consider their spacing because when the joints in a marble deposit are closely spaced quarrying becomes almost impossible due to the lack of rock cohesion interruption.

Within the EPL 5625 there is a northerly trending dolerite dyke within the farm ketelbank 66 close to the boundary of the Farm springbockfotein 21 as well as Cambrian pegmatite dykes in association with the Namibian to Cambrian pegmatites. The presence of very few faults within the EPL 5625 is an indication that there has occurred very limited progressive deformation and the rocks within the area have not undergone intensive stress. Joints can also be observed on the marble deposits within the EPL 5625 area (Ref. to Fig. 7).



**Figure 10:** Marbles within the EPL 5625, showing structural joints.

### **5.3.3. Biodiversity (fauna and flora)**

The EPL 5625 is situated in the Namib Karoo and Western Highlands Savannah Biomes. In the Namib Karoo Biome, tree cover is 2 to 10%, tree height is 2 to 5m, shrub height is 0.5 to 1m, grass cover is 0.1 to 1% and grass height is >1.5m. The dominant vegetation in this biome according to the ranking is acacia montis-ustii, acacia robynasiana, cyhostemma currorii, strcutia africana, and calicorema capitatia and orthanthyera albiadia (Mendelson, 2002). The above mentioned vegetation hosted in the Namib Karoo Biomes are of medium values.

In the Western Highlands Savannah Biomes, tree cover is 2 to 10%, tree height is 2 to 5m, shrub cover is 2 to 10%, and grass height is >0.1m. The dominant vegetation type in this biome according to the ranking is acacia reficiens, euphorbia geuerichiana, colophospermum mopane, maerua schinzii, and ademolobius garipensis (Mendelson, 2002).

Species number for mammals in the project area is about 61 to 71 species and the area is ranked number 5 in terms of species sensitivity. The area has 75 species of biodiversity compare to Zambezi Region at 120 and the Namib Desert at 9 species. Bird's endemism is ranked number 5 with 8 to 10 endemic species. The species of mammals are medium sensitive in the project areas, therefore mitigation strategies are needed to protect these species during the whole project phases.

### **5.3.4. Groundwater and surface water hydrogeology**

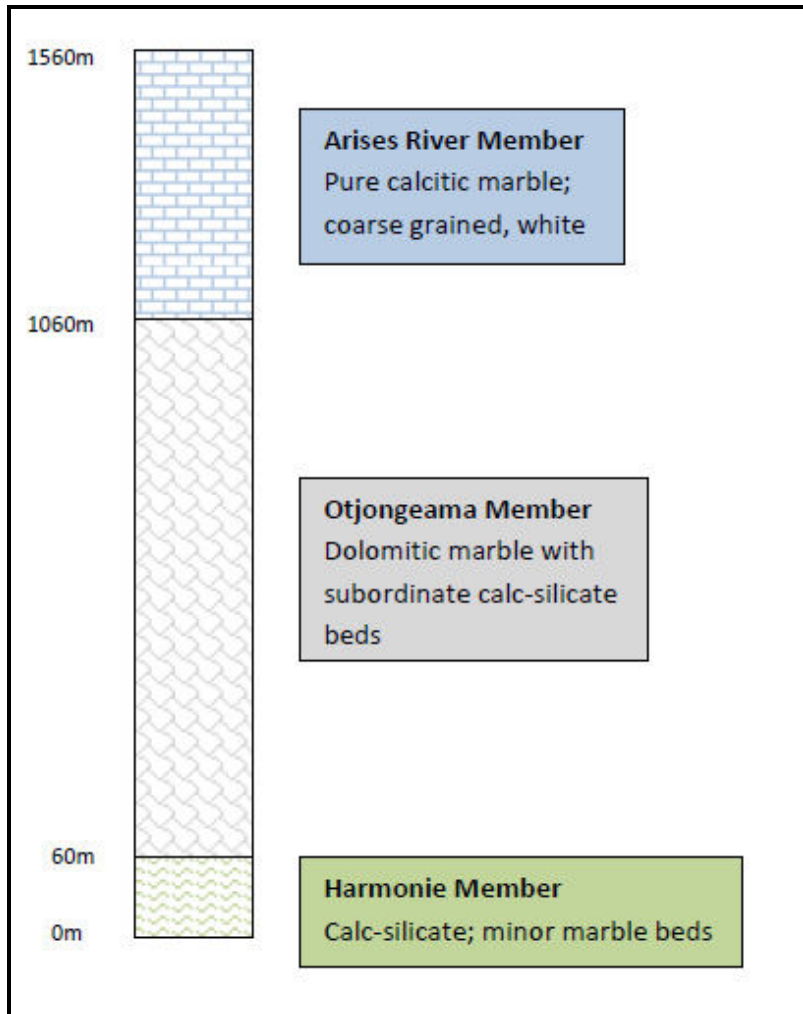
The EPL 5625 is geologically situated on rocks of the Swakop Group in the Damara Supergroup.

The metamorphic rocks of the Swakop Group largely consist of less porous crystalline schist and marble rock types. For that reason, the groundwater potential of the above referenced EPL 5625 site is closely associated with availability, nature, magnitude and on the persistence of secondary geological structures like joints and fractures.

Supplementary to secondary geological structures, ephemeral stream channels with alluvial deposits thicker than 15 m are important aquifers, particularly where the streams are in cross cutting geometrical relationships with fracture zones.

Therefore, it can be said that outside the major fracture zones, the Swakop Group is an aquitard – referring to a geological formation that does not store or/and transport groundwater. To illustrate this statement, Mukendwa (2013) rightfully concludes that the Karibib Formation is not worth considering as an aquifer in the absence of fracture, this is besides it being the most productive layer of the Swakop Group.

Locally, Karibib Formation (**Figure 11**) which consists of the Arises River Member (*coarse grained white calcitic marble beds*), the Otjongema Member (*Calc-silicate dolomitic marble beds*) and the Harmonie Member (*Calc-silicate minor marble beds*) is a source of water supply to local settlements and towns. However, the hydraulic yield of the aquifer is closely related to fracture storage, and is therefore highly variable and dependent on annual recharge.



**Figure 11:** The Karibib Formation (Tordiffe, 2013)

Due to its carbonate nature, the Karibib Formation maintains good quality water with a dominant calcium magnesium bicarbonate hydrochemical facie ( $\text{Ca-Mg-HCO}_3$ ).

### Aquifer pollution vulnerability (APV)

The Namibian legal framework advocates and places stewardship responsibility on all parties involved in activities which may have negative affect the environment, in this regard particular reference is made to both the Water Act, Act No. 12 of 1956 and the Environmental Act, Act No.7 of 2007 with respect to the cardinal responsibility of protecting, preserving and sustainable use of water resources.

In recognition of these legal frameworks, the consultant has adopted the **A**quifer confinement **O**verburden and **D**epth to water table (AOD) index scheme to evaluate the pollution vulnerability of the Karibib Formation Marble Aquifer. Developed by Forster (1987), the AOD index scheme attempts to find the likelihood that a contaminant loaded at the ground surface will reach the water table of an aquifer given the nature of the aquifer, the nature and thickness of the aquifer's overburden.

The AOD index presented in **Table 9** is based on scales 1 to 10 of the Aquifer confinement, the Overburden strata in the unsaturated zone of above the groundwater strikes, and Depth to the water table in unconfined aquifers.

**Table 9: The APV for the Karibib Marble Aquifer in EPL 5625**

Place	Borehole WWW	Coordinates		Aquifer Confinement		Overlaying Strata		Depth		AOD	APV
				(m) Rating	(m) Rating	(m) Rating	(m) Rating				
EPL 5625	21485			1	10	43	5	43	8	400	HIGH
EPL 5625	21488			1	10	47	6	47	7	420	HIGH
EPL 5625	21491			1	10	52	6	52	5	300	MOD

A primary appraisal of both the Karibib marble and the Omdel Aquifers for Aquifer Pollution Vulnerability (APV) using the AOD index framework indicates that both aquifers are highly vulnerable to pollution, therefore extra care, stewardship and site specific studies should be considered during the Environmental Impact Assessment (EIA).

#### **5.4. Potential impact identified**

##### **5.4.1. Positive impacts**

- Employment creation
- Support to local retailers shops
- Export taxes and VAT payment

##### **5.4.2. Negatives impacts**

- Effect of oil spillage on groundwater and surface water
- Solid waste: wires, drill bites, and human waste
- Land and soil disturbance: on site and the proposed road
- Loss of biodiversity: fauna and flora
- Effect of dust that will be generated on-site
- Effect of the spread of HIV/AIDS
- COVID-19 spread due to social distancing

#### **5.5. Concluding remark on this section**

In this section the affected environment was described. The social and the biophysical environmental information were provided and also the potential positive and negative impacts of the project were identified.

#### **5.6. Potential impact identified**

##### **5.6.1. Positive impacts**

- Employment creation
- Support to local retailers shops
- Export taxes and VAT payment

### **5.6.2. Negatives impacts**

- Effect of oil spillage on groundwater and surface water
- Solid waste: wires, drill bites, and human waste
- Land and soil disturbance: on site and the proposed road
- Loss of biodiversity: fauna and flora
- Effect of dust that will be generated on-site
- Effect of the spread of HIV/AIDS
- Effect of the spread of COVID-19
- 

### **5.7. Concluding remark on this section**

In this section the affected environment was described. The social and the biophysical environmental information were provided and also the potential positive and negative impacts of the project were identified.



## **6. Public consultation process**

---

### **6.1. Legal and policy requirement**

#### **6.1.1. Environmental management act (2007) and it EIA regulations (2012)**

Public consultation is a crucial part of the EIA process. This provides an opportunity to stakeholders or interested member of the public to find out more about what is being proposed, and to raise any issues or concerns. The Environmental Management Act 2007 and its EIA regulations of 2012 are the key documents governing environmental impact assessment in Namibia. One of the key objectives of the Act is to prevent and mitigate the significant effects of activities on the environment by:

Ensuring that there are opportunities for timeous participation of interested and affected parties throughout the assessment process; and ensuring that the findings of an assessment are taken into account before any decision is made in respect of activities.”

The key principle of the Environmental Management Act 2007 advocates for public participation. The principles states that *“the participation of all interested and affected parties must be promoted and decisions must take into account, the interest, needs and values of interested and affected parties”*.

Section 21 of the EIA Regulations outlines procedure on public participation process as follows:

“(2).The person conducting a public consultation process must give notice to all potential interested and affected parties of the application which is subjected to public consultation by:

- a) Fixing a notice board at a place conspicuous to the public at the boundary or on the fence of the site where the activity to which the application relates is or is to be undertaken;
- b) Giving written notice to:
  - i. The owners and occupiers of land adjacent to the site where the activity is or is to be undertaken or to any alternative site;

- ii. The local authority council, regional council and traditional authority, as the case may be, in which the site or alternative site is situated;
  - iii. Any other organ of state having jurisdiction in respect of any aspect of the activity; and
- c) Advertising the application once a week for two consecutive weeks in at least two newspapers circulated widely in Namibia.
- (3) A notice, notice board or advertisement referred to in sub regulation (2) must -
- a) Give details of the application which is subjected to public consultation; and
  - b) State:
    - i. That the application is to be submitted to the Environmental Commissioner in terms of these regulations;
    - ii. The nature and location of the activity to which the application relates;
    - iii. Where further information on the application or activity can be obtained: and
  - c) The manner in which and the person to whom representations in respect of the application may be made.

(6) When complying with this regulation, the person conducting the public consultation process must ensure that a) information containing all relevant facts in respect of the application is made available to potential interested and affected parties; and b) consultation by potential interested and affected parties is facilitated in such a manner that all potential interested and affected parties are provided with a reasonable opportunity to comment on the application.

For the purpose of the Act and these regulations a notice is given to a person or a person is informed of a decision, if a document to that effect is:

- (a) Delivered personally to that person;
- (b) Sent by registered post to the persons last known address;
- (c) Left with an adult individual apparently residing at or occupying or employed at the person's last known address; or

(d) In the case of a business-

- (i) Delivered to the public officer of the business;
- (ii) Left with an adult individual apparently residing at or occupying or employed at its registered address;
- (iii) Sent by registered post addressed to the business or its public officer at their last known addresses; or
- (iv) Transmitted by means of a facsimile transmission to the person concerned at the registered office of the business.”

## **6.2. Consultation process followed during the EIA process**

Communication with stakeholders about the proposed small scale surface exploration project was facilitated through the following ways

- Identification of stakeholders
- Newspaper adverts
- Written notices
- Information documents
- Stakeholder meetings
- Reasonable opportunity for the public to register and comment on the project

Table 10, below explains how the communication process was facilitate using the above mentioned ways.

**Table 10: Public consultation process**

Steps	Description of the process	Time allowed
<b>Identification of stakeholders</b>	Keys stakeholders were identified and included in the register. Contact details for I&APs were obtained from their offices. ( <b>Appendix B</b> )	The registration process was maintained throughout the EIA process
<b>Newspapers adverts</b>	Notices were placed in the press, briefly explaining the development and its locality, inviting the public to register as stakeholders and informing them of the time and venue of the public meeting ( <b>Appendix C</b> ).	On the 6 <sup>th</sup> , 13 <sup>th</sup> , 8 <sup>th</sup> and 15 <sup>th</sup> of July 2021 in The New Era and Confidante Newspaper.
<b>Written Notices:</b>	Written notices were provided to relevant the immediate affected farmers. <b>Appendix D</b>	The emails where sent via the office of the PROPONENT.
<b>Notice boards:</b>	NON	NON
<b>Background Documents</b> <b>Information</b>	A Background Information Document (BID) was compiled. The BID contained the information of the project ( <b>Appendix F</b> ). The BID was forwarded to all authorities and registered stakeholders.	Continued throughout the process every time someone registered.
<b>Meetings:</b>	NO meeting took place	

### **6.3. Limitation of the public consultation process**

The following factors limited the public participation process:

- Delivery of letters, Notice Board Posters and BID by hand is timing consuming.
- Due to COVID-19 restriction at the time of advert on inter region travel, this had hampered the effectiveness of people to be reached.
- Some stakeholders don't have access to email.

### **6.4. The interested and affected parties (I & AP's)**

There I&APs for this project were identified using information from the existing CENTRE FOR GEOSCIENCES RESEARCH stakeholder database. Notices were placed in various newspapers inviting the public to register as interested and affected parties. Organizations were also selected whom the consultant considered to be interested in or affected by this particular project. An I&APS can be defined as '(a) any person, group of persons or organization interested in or affected by an activity; and (b) any organ of state that may have jurisdiction over any aspect of the activity.

### **6.5. Outcome of the public engagement**

The main issue that is drawn from the public participation is that the public were interested in the project regardless of its magnitude, duration and the number of people to be employed.

### **6.6. Key issues identified during the public engagement process**

During the public participation process the following keys issues were identified:

- Rehabilitation of the site after exploration trenching
- Number of people to be employed in the project
- The duration of the EIA process
- The start of the exploration stage
- Management of waste both solid and liquid waste
- Safety measures in place for employees

The identified keys issues during the public participation process together with the issues identified in section 5.5 above were assess for potential impacts in section 7 below.

#### **6.7. Concluding remark on this section**

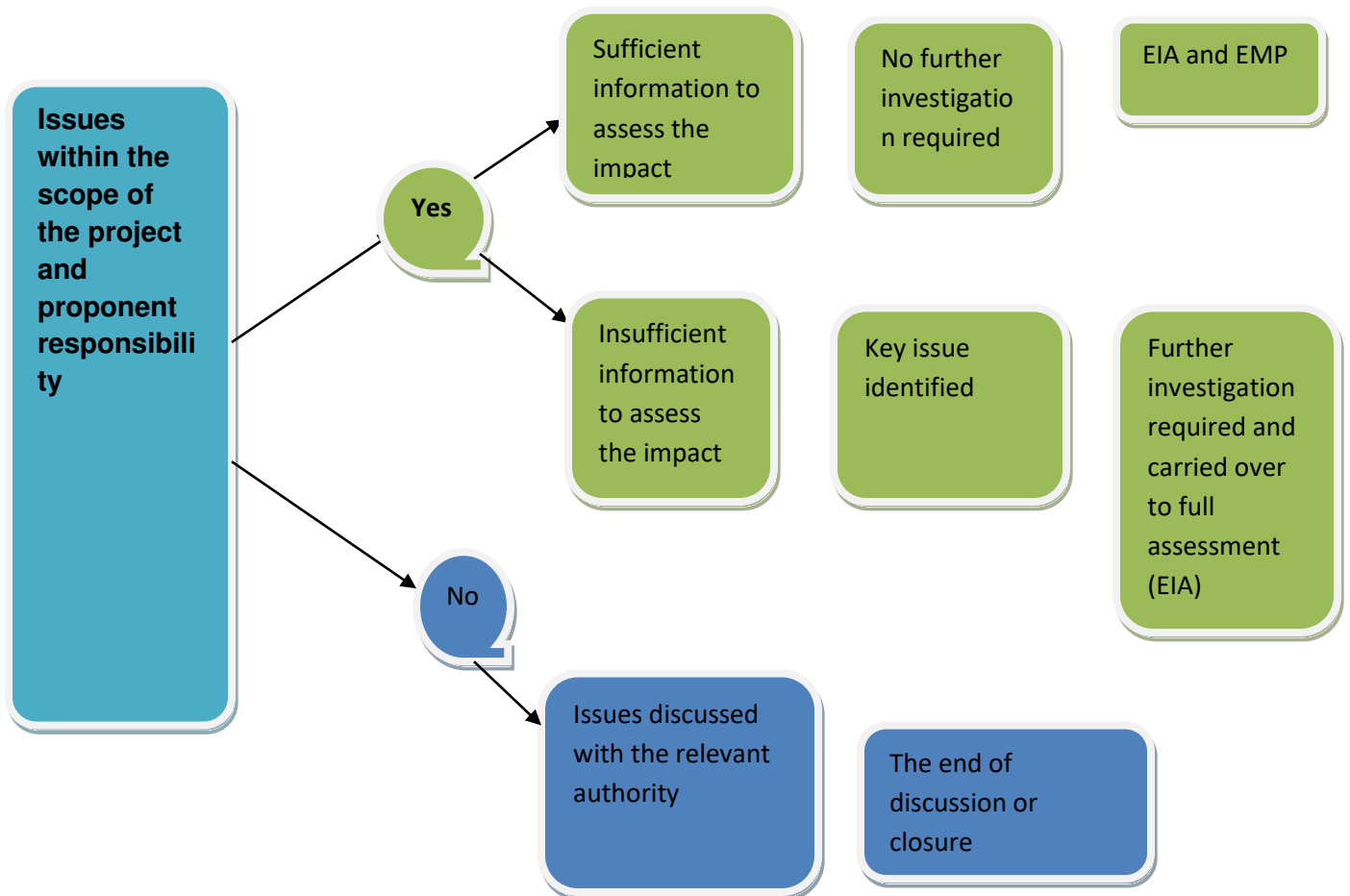
In this section, issues on public participation process such as steps or methods that were followed, process, the outcome of the public participation process, and key issues identified were presented. Moreover the legality patterning to public participation was also presented.

## 7. Impact assessment

---

### 7.1. Identification of key issues

Potentially significant impact identified from the baseline conditions, legal requirement, and public participation process were screened to obtain issues that require further investigation or assessment and those that doesn't required further investigation. The process shown in the flow chart below was used for the screening of potential issues. Table 12 below, shows the screening of the identified impact using the flow chart.



**Table 11: Process of determining the key impacts resulting from certain aspects of the proposed small scale surface exploration for marble.**

<b>Environmental feature</b>	<b>Potential impacts of project feature</b>	<b>Key impact</b>	<b>Degree of sensitivity</b>	<b>Issue addressed in</b>
Surface water and ground water	Contaminants of construction process (e.g. oil spills etc)	Deterioration of groundwater quality	Medium sensitivity	Addressed in sub-section:7.3.1. and EMP
	Effluent discharge from mobile toilet		Low sensitivity	Addressed in EMP
	Contaminants resulting from the presence of construction workers		Low sensitivity	Addressed in EMP
Fauna	Destruction of flora (vegetation) could result in the loss of faunal biodiversity	Loss of faunal biodiversity	Medium to Low sensitivity	Addressed in sub-section:7.3.2. and EMP
Flora	Removal or damage to vegetation could result in loss of biodiversity and habitat destruction	Loss of biodiversity Habitat destruction	Medium to Low sensitivity	Addressed in sub-section:7.3.2. and EMP
	Damage or destruction of protected or high use value trees, shrubs or	Loss of protected or high use value flora	Medium to Low sensitivity	Addressed in sub-section:7.3.2. and EMP



<b>Environmental feature</b>	<b>Potential impacts of project feature</b>	<b>Key impact</b>	<b>Degree of sensitivity</b>	<b>Issue addressed in</b>
Social Economic Environment	Employment or job creation	Permanent job creation for local people	Medium sensitivity	Addressed in sub-section:7.4.1. and EMP
	Support to local retailers shops and Export taxes and VAT payment	Contribute to the Karibib Town economic growth and the nation at large	Low sensitivity	Addressed in sub-section:7.4.1. and EMP
	Potential spread of HIV/AIDS & COVID-19	Spread	High sensitivity	Addressed in sub-section:7.4.2. and EMP
Archaeology	Disturbance or destruction of archaeological sites as a result of earthmoving operations (construction) and accelerated soil erosion (operation).	Damage to existing or undiscovered archaeological sites in the area	High sensitivity	Addressed in sub-section:7.4.3. and EMP
Solid waste	Exploration solid waste such as drill bites, plastic, and wire will be generated on site	Damage to the surrounding environment	Medium sensitivity	Addressed in sub-section:7.5 and EMP
Dust on site and gravel road	Exploration or removal of marble block dust will be generated	Effect the employees and wellbeing	Medium sensitivity	Addressed in sub-section:7.3.3 and EMP

Environmental feature	Potential impacts of project feature	Key impact	Degree of sensitivity	Issue addressed in
Disturbance on soil or land	During Exploration top soil will be removed to access the marble	Losses of top soil that support vegetation growth	High sensitivity	Addressed in sub-section:7.6. and EMP

## **7.2. Methodology used or adopted for the impact assessment**

The assessment process that was developed by CENTRE FOR GEOSCIENCES RESEARCH was formulated based on the collection and interpretation of the available literature pertaining to the dimension stone field in particular marble. The process included the review of previous EIA's and EMP's done in the surrounding areas and those about dimension stone in Namibia. Other relevant documents were identified and collected including:

- Environmental regulations covering environment, water, energy, health and safety as well as all the related policies and guidelines;
- Mining regulations and all the related introductory information obtained from the Office of the Mining Commissioner in the Ministry of Mines and Energy;
- Topographic maps, information and data sets about the location and characteristics of EPL 5625.
- Information and data sets about the environmental regulation, biodiversity, social economic and natural environment around the EPL 5625 obtained from the Directorate of Environmental Affairs in the Ministry of Environment and Tourism; Namibia Statistic agency.
- Information and data sets about the regional and local geology, geological maps and all the related data sets, published materials and open file documents have all been located in the Directorate of the Geological Survey in the Ministry of Mines and Energy;

The following methods were used by all specialists to determine the significance rating of impacts identified:

### **7.2.1. Description of Impact**

The specialists identified potential impacts of the proposed project on the receiving environment. They were tasked to consider the following:

- The type of effect that the proposed activity will have on the environment;
- What will be affected; and
- How will it be affected?

The sources of risk are, where possible, based on accepted scientific techniques. Failing this, the specialists made a professional judgment based on expertise and experience. All potential impacts that result from the proposed project have been evaluated for the full life-cycle of the project, namely, construction, operations, and decommissioning phases.

The impact assessment methodology is contained in table 12 below:

**Table12: Definition of criteria for assessing significant impact**

<b>Criteria</b>	<b>Description</b>
<b>Nature</b>	Reviews the type of effect that the proposed activity will have on the relevant component of the environment and includes “what will be affected and how?”
<b>Extent</b>	Indicates whether the impact will be site specific; local (limited to within 15 Km of the area); regional (limited to ~100 Km of the area); national (limited to the coastline of Namibia); or international (extending beyond Namibia’s borders).
<b>Duration</b>	Reviews the lifetime of the impact, as being short (days, <1 month), medium (months, <1 year), long (years, <10 years), or permanent (generations, or >10 years).
<b>Intensity</b>	Establishes whether the magnitude of the impact is destructive or innocuous and whether or not it exceeds set standards, and is described as none (no impact); low (where natural/ social environmental functions and processes are negligibly affected); medium (where the environment continues to function but in a noticeably modified manner); or high (where environmental functions and processes are altered such that they temporarily or permanently cease and/or exceed legal standards/requirements).
<b>Probability</b>	Considers the likelihood of the impact occurring and is described as improbable (low likelihood), probable (distinct possibility), highly probable (most likely) or definite (impact will occur regardless of prevention measures).
<b>Degree of Confidence in Predictions</b>	Is based on the availability of specialist knowledge and other information.

The application of the above criteria (Table 12) to determine the significance of potential impacts uses a balanced combination of nature, extent, duration, and

intensity/magnitude, modified by probability, cumulative effects, and confidence. Significance is described as follows as shown in table 13:

### 7.2.2. Sensitivity of the Affected Environment

In the description of the affected environment, specialists provided an indication of the sensitivity of the affected environment. Sensitivity, in this instance, refers to the ‘ability’ of an affected environment to tolerate disturbance (given existing cumulative impacts). For example, if very little disturbance results in the permanent loss of the biodiversity of a habitat, the affected environment could be categorized as having a low tolerance to disturbance and can consequently be described as being a ‘high sensitivity’ habitat. If, on the other hand, a habitat is able to withstand significant disturbance without a marked impact on its biodiversity the affected environment could be categorized as having a high tolerance to disturbance (i.e. ‘low sensitivity’ habitat).

Based on the above considerations, the specialists provided an overall evaluation of the significance of the potential impact, which is described as follows

**Table13: Definitions of various significant rating or sensitivity**

SIGNIFICANCE RATING	CRITERIA
Low	Where the impact will have a negligible influence on the environment and no modifications or mitigations are necessary for the given development 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 development design and/or alternative mitigation. This would be allocated to impacts of moderate severity/magnitude, 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(i.e.) causing it, should not be permitted (i.e. there could be a ‘no-go’ implication for the development, regardless of any possible mitigation). This would be allocated to impacts of high magnitude, locally for longer than a month, and/or of high magnitude regionally and beyond.

### **7.2.3. Mitigation and Enhancement Measures**

Where negative impacts are identified, mitigation objectives have been set, and practical, attainable mitigation measures must be recommended that will minimise or eliminate the impacts. Where mitigation is not feasible, this has been stated and reasons given. In the case of positive impacts, enhancement measures are recommended for optimizing the benefit to be derived.

### **7.2.4. Monitoring**

Monitoring requirements with quantifiable standards to assess the effectiveness of mitigation actions have been recommended where appropriate. These must indicate what actions are required, by whom, and the timing and frequency thereof. If further investigations must be undertaken and monitoring programmes implemented before, during and after operations, these have been recommended.

## **7.3. Biophysical Environment**

### **7.3.1. Impact of oil spills on groundwater aquifer and surface water streams**

#### **7.3.1.1. Description**

The dimension stone mining industry or quarrying is a clean industry from a pollution point of view. Various environmental impact assessments conducted identified petrochemical pollution emanating from this industry as the most serious threat in this regard, and in order to maintain the record as a clean industry, this threat is taken very seriously.

There are various waste disposal methods used worldwide in mining industry or dimension stone in particular marble. Management of used oil at a large scale is reported to be a challenge as more significant maintenance is required to minimise the losses of the oil into the environment (Richards, 2009). Used oil once it spill, it causes

detrimental effect to both living and none living things and more especially to groundwater because it's chemical constituents are poisonous. The oil coats and clings to every rock and grain of sand. Sometimes if the oil washes into coastal marshes, mangrove forests or other wetlands, fibrous plants and grasses absorb the oil, which can damage the plants and make the whole area unsuitable as wildlife habitat.

### 7.3.1.2. Sensitivity of the affected environment

**Table 14: Expected significance of the project on liquid waste**

Criteria	Impact of oil spills on groundwater aquifer and surface water streams
Extent	<i>local</i>
Duration	<i>permanent</i>
Intensity	<i>high</i>
Probability	<i>definite</i>
Significance before mitigation	<i>High</i>
Significance after mitigation	<i>Medium</i>
Degree of confidence in predictions	<i>high</i>

### 7.3.1.3. Mitigation and enhancement measures

- Train and supervise staff to ensure minimal spillage of oil.
- Routine inspections before the start of every work schedule involving potential spillage.
- Old oil is collected and stored, and is sold to recycling companies.
- Equip the quarry site with emergency petrochemical spillage kits which are used such events as hydraulic pipes bursting in service and spilling oil.



- Bio-remediate contaminated soil using proprietary products kept on sites for the purpose. The process of bio-remediation involves loosening the contaminated soil to allow for oxygen penetration. Transported contaminated soil to a specific impervious site for treatment to avoid compaction during the process, and adding agricultural fertilizer and the proprietary products containing appropriate microbes to break down the hydrocarbons.

#### **7.3.1.4. Monitoring**

- Daily visual monitoring by site manager.
- Weekly spot checks by environmental manager

### **7.3.2. Loss of Fauna and Flora diversity**

#### **7.3.2.1. Description**

Biodiversity (i.e. fauna and flora) is likely to be affected by the project during the exploration process. But due to the size and duration of the project, the impact is manageable.

The types of vegetation found in this area are classified in medium value category. In addition to vegetation various invertebrates also host the area. Regardless of the low value of the existing vegetation on site and along the road, activities that will be undertaken during the exporation process is likely to have an effect on the vegetation and the invertebrates thereof. Therefore management measures will be considered to minimize the above impacts.

### 7.3.2.2. Sensitivity of the affected environment

**Table 15: Expected significance of the project on Biodiversity: fauna and flora**

<b>Criteria</b>	<b>Biodiversity: fauna and flora</b>
Extent	<i>local</i>
Duration	<i>long</i>
Intensity	<i>medium</i>
Probability	<i>definite</i>
Significance before mitigation	<i>high</i>
Significance after mitigation	<i>medium</i>
Degree of confidence in predictions	<i>high</i>

### 7.3.2.3. Mitigation and enhancement measures

- Avoid damage to protected or high use value trees exploration and usage of heavy machines.
- Disturbance of marginal vegetation at the mountains should be limited.
- Avoid disturbance on invertebrate on site and along the gravel road stretch.
- During operation avoid the creation of multiples roads strips, which could result in the disturbance of breeding sites for various mammals.

### 7.3.2.4. Monitoring

An ENC for Erongo Marble and Granite (pty) Ltd should accompany drivers or heavy machine operator so that the avoidance of trees and vegetation can be optimized. Other rules in the EMP to avoid vegetation destruction should be monitored monthly.

## 7.3.3. Dust generation on site

### 7.3.3.1. Description

During the quarrying process dust will be generated onsite by earth moving equipment and also on the gravel road by trucks and vehicles. On site, marble blocks will be cut into smaller blocks in order to give them the desired smooth shape. During the cutting

process about 25% the original marble mass is lost in the form of dust. In addition, processing of marble results in the formation of marble dust, which is suspended in the air and which could be inhaled by the workers. Epidemiological studies indicates that workers exposed to marble dust stand an increased risk of suffering from asthma symptoms, chronic bronchitis, nasal inflammation and impairment of lung function (Camici et al., 1978; Angotzi et al., 2005; Leikin et al., 2009). In their study they found out that, the affected workers were having body problems like headache, backache and stressed due tounder- payment (Dagli et al., 2008). Individuals who were having papilloma have faced problem at work like noise, dust or fumes and poor maintenance of equipment (Dagli et al., 2008). Moreover, their data also demonstrated that long period of chronic exposure to dust induced progressive atrophic changes in the alveoli (Gammal et al, 2011). Therefore, there are some potential risk of dimension stone industry on the environmental, which requires attention, mitigations, and management to protect the existing human and animal health.

It is globally known that the generated dust exploration operations of marble may affect human, plant and animal growth at the surrounding environment (Kirjoitettu, 2014). Exposure between 10 and 15 years is associated with the long term complication, while the short term complication can cause difficulty in breathing” (Kirjoitettu, 2014). The reaction depends on the particle inhaled, as the lung is too exposed to expel particles beyond 10 micro meters (Haruna, 2014). With the inherent natural mechanism of its defence, the lung is supposed to be able to expel such amount of particles but sizes below one to 10 millimeter (mm) can go down to the terminal end of the lung and the macrophages may not be able to expel that (Haruna, 2014). To avoid respiratory or other problems caused by exposure to dust, engineering control methods such as those highlighted in the mitigation measures below and the use of tools that minimized the generation of dust should be introduced.

7.3.3.2. Sensitivity of the affected environment

Table 16: Expected significance of the project on dust generated on site

<b>Criteria</b>	<b>Soil or land disturbance:</b>
Extent	<i>local</i>
Duration	<i>long to permanent</i>
Intensity	<i>medium</i>
Probability	<i>definite</i>
Significance before mitigation	<i>high</i>
Significance after mitigation	<i>medium</i>
Degree of confidence in predictions	<i>high</i>

### **7.3.3.3. Mitigations and enhancement measures**

- Measures such as the use of wet processes enclosure of dust-producing processes under negative air pressure (slight vacuum compared to the air pressure outside the enclosure),
- Exhausting air containing dust through a collection system before emission to the atmosphere, and exhaust ventilation should be used in the workplace.
- Use of personal protective equipment for proper dust control for respiratory protection and should be used only where dust control methods are not yet effective or are inadequate.
- Direct skin contact should be prevented by gloves, wearing respiratory protection during cleanup,
- Educational awareness programs for workers should be instituted about hazard of exposure to marble dust and on the use and maintenance of exhaust ventilation systems, and the use and maintenance of personal protective equipment to avoid risk of dust and noise.
- All gravel roads in quarry areas should have a speed limit of 60km/h for light vehicles and 30km/h for heavy vehicles in order to minimise the amount of dust generated by vehicles.
- In addition, where available water allows, roads should be sprayed with water on a regular basis in order to prevent dust creation.

### **7.3.3.4. Monitoring**

- Daily inspection by the ENC of the gravel roads and quarry site on possible dust creation that requires attention.

- Daily inspection on site by the ENC to ensure that all workers are wearing their protective clothes at all time during the exploration process and the dry skin contact with gloves is prevented.

## **7.4. Social Economic Environment**

### **7.4.1. Job creation**

#### **7.4.1.1. Description**

According to the Social Impact Assessment study by Anna, (2014), the employment rate in Karibib has reduced from 71% in 2001 to 59% in 2011 while the unemployment increased from 29% in 2001 to 41% in 2011. Comparing to the Erongo region at large, the Karibib residence has the second highest unemployment rate in the region after the Daures constituency with an unemployment rate of 44%. Karibib district is also one of the constituencies with a high rate of no proper sanitation, ranking in second after the Daures constituency.

It is clear that unemployment is big challenge in the Town of Karibib; hence the necessity of this project which will employ about 12 to 15 people during the exploration phase. The employment will be conducted in the company's offices which will be opened in the Town of Karibib exploration has begun, the local authority will be contacted if assistance is needed during the employment process in order to ensure that the local inhabitants can get the full benefit.

It should be noted that the use of manual labour instead of mechanized construction methods, does pose some advantages and disadvantages:

#### **Advantages:**

- If locals are used, housing will be available nearby,
- Contribution to local economy – reducing unemployment,
- Development of local skills,
- Smaller ecological footprint.

**Disadvantages:**

- It might increase the costs of the project impacting on the affordability of water;
- It will take longer to complete than if the processed in mechanized;
- The safety risk resulting from open trenches will become bigger;
- It will require a greater management of workforce, quality of work.

**7.4.1.2. Sensitivity of the affected Environment**

By implementing exploration the socioeconomic significance of Erongo Marble and Granite (pty) Ltd can be summarized as follows:

**Table 17: Expected significance of the project on social economic implications**

<b>Criteria</b>	<b>Social economics implications</b>
Extent	<i>local</i>
Duration	<i>long to permanent</i>
Intensity	<i>medium</i>
Probability	<i>definite</i>
Significance before mitigation	<i>high</i>
Significance after mitigation	<i>low</i>
Degree of confidence in predictions	<i>high</i>



#### **7.4.1.3. Mitigation and enhancement measures**

- Where unskilled labour can be used, a 'locals first' policy should be considered.
- It is proposed that local people, meaning the community members from Karibib Town, should be employed as far as possible, especially where no specific skills are required.
- The Karibib Town Councilor could be requested to assist with the recruitment of construction workers.
- Both men and women should be granted the opportunity to be employed by this project.

#### **7.4.1.4. Monitoring**

It is recommended that Erongo Marble and Granite (pty) Ltd Exploration Manager should employ workers to be obtained from the potentially affected communities in particular Karibib Town. Erongo Marble and Granite (pty) Ltd in consultation with the Karibib Town Councilor will then be responsible to supervise the employment process when implementing this 'local's first' recommendation.

### **7.4.2. Potential spread of HIV/AIDS & COVID -19**

#### **7.4.2.1. Description**

In the proposed project area, it is estimated that one out of every four people are HIV positive. (Anna, 2014) Previous experience has shown that workers residing in a construction camp may engage in risky sexual behaviour with members of the community. This can contribute to the spread of HIV & COVID-19 both in the project area and beyond to other region.

#### 7.4.2.2. Sensitivity of the affected environment

**Table 18: Expected significance of the project on the spread of HIV/AIDS**

<b>Criteria</b>	<b>Contribution to the spread of HIV/AIDS</b>
Extent	<i>national</i>
Duration	<i>permanent</i>
Intensity	<i>serious effect</i>
Probability	<i>definite</i>
Significance before mitigation	<i>high</i>
Significance after mitigation	<i>medium</i>
Degree of confidence in predictions	<i>high</i>

#### 7.4.2.3. Mitigation and enhancement measures

Erongo Marble and Granite (pty) Ltd , ENC should sensitize the risks of sexual behaviour, and also the effects of HIV/AIDS to its employees. Workers should be prohibited to engage in such activities with especially minors. Mitigation measures as outlined in the EMP should be adhered to.

#### 7.4.2.4. Monitoring

The ENC should report back to Erongo Marble and Granite (pty) Ltd as to when and how the workers received HIV training. Also, how workers were informed about the mitigation measures of the EMP.

### 7.4.3. Disturbance or destruction of archaeological sites

#### 7.4.3.1. Descriptions

The exploration activities may partially or completely destroy some small archaeological sites found within and outside the boundary of the EPL. These archaeological sites are rock arts and are associated with the san people tribe. Their archaeological significance is low to medium. It is also likely that some damage will occur outside the immediate project area through the establishment of access roads and contractor's lay-down areas. Some cumulative impacts can be expected during operation and decommissioning.

#### 7.4.3.2. Sensitivity of the affected environment

**Table 19: Expected significance of the project on archaeological sites**

<b>Criteria</b>	<b>Contribution to the spread of HIV/AIDS</b>
Extent	<i>local</i>
Duration	<i>permanent</i>
Intensity	<i>serious effect</i>
Probability	<i>definite</i>
Significance before mitigation	<i>medium</i>
Significance after mitigation	<i>Low</i>
Degree of confidence in predictions	<i>high</i>

#### 7.4.3.3. Mitigation and enhancement measures

- The records obtained during this fieldwork are considered adequate and no further work is needed.

## 7.5. Solid waste: wires, drill bits, and human waste

### 7.5.1. Descriptions

Solid waste management is a problem in the exploration and mining industry or quarrying industry, and sometimes this problems extent beyond the mining industry. In the mining industry, different types of solid waste are generated and some of these wastes contain toxic substance that can affect living and non-living things. Therefore proper handling and management of these wastes is critical for the protection of the environment.

Solid waste that will be generated from this project if not managed will have an effect on the environment. The effect will mainly be at the project site. Human waste that will be generated during the exploration process, if not managed will have an effect on the environment although at a small scale.

### 7.5.2. Sensitivity of the affected environment

The significance of the identified problem to the study can summaries as follows:

**Table 20: Expected significance of the project on solid waste**

Criteria	Solid waste :
Extent	<i>local</i>
Duration	<i>short</i>
Intensity	<i>low</i>
Probability	<i>definite</i>
Significance before mitigation	<i>medium</i>
Significance after mitigation	<i>low</i>
Degree of confidence in predictions	<i>high</i>

### 7.5.3. Mitigation and enhancement measures

Waste disposal sites should be established on site where paper, plastic and wire should be kept. The collected solid waste should be disposed at the Town of Karibib soil waste disposal site. For human waste, mobile toilet should be made available on site for workers and once these facilities are full, the collected human waste should be disposed at the Karibib Town human waste disposal site. Prior to the disposal of the above mentioned wastes Erongo Marble and Granite (pty) Ltd must enter into agreement with the Karibib Town for permission to use their facility.

### 7.5.4. Monitoring

- Weekly inspection by the ENC, to collect and empty the plastic bag that are full and also the mobile toilet.

7.6. Land or soil disturbance: on site and the proposed 23km stretch road

#### 7.6.1. Descriptions

During the exploration process, land or soil will be disturbed both on site and along the proposed stretch road of about 23km linking the project site to the D1918 road. Top soil will be removed on the surface rocks during the drilling to recover the slabs needed for testing. The removed top soil during drilling if not properly managed will affect the growth of vegetation and the development biodiversity hiding or resting spots.

#### 7.6.2. Sensitivity of the affected environment

The significance of the identified problem to the study can be summarized as follows:

**Table 21: Expected significance of the project on soil or land disturbance**

Criteria	Soil or land disturbance:
Extent	<i>local</i>
Duration	<i>permanent</i>
Intensity	<i>serious affected</i>
Probability	<i>definite</i>

<b>Criteria</b>	<b>Soil or land disturbance:</b>
Significance before mitigation	<i>high</i>
Significance after mitigation	<i>medium</i>
Degree of confidence in predictions	<i>high</i>

### **7.6.3. Mitigation and enhancement measures**

The top soil from 0 to 30cm to removed and stockpile and to be used during the rehabilitation process. The stockpile will seeded with seeds of grasses and shrubs to keep organic activity alive, as well as ensure a fertile seed bank in the topsoil when it is finally used. It is recommended that top soil to be removed down to the subsoil, where it is significantly thicker than 0.5m, as topsoil is always a scarce resource, and even if this lower material does not contain seed and is poorer in soil organisms, it has been found to be useful in reclamation. Where top soil is less than 150mm thick the unconsolidated material beneath should also be removed and treated as topsoil.

### **7.6.4. Monitoring**

- Daily inspection by ENC to ensure that top soil is removed and stock pile on site.

### **7.7. Concluding remark on this section**

In this section the identified impact were screened and assessed. The mitigation measures of the identified impact will be addressed in the Environmental Management Plan (EMP) report.

## **8. Conclusion and recommendations**

---

### **8.1. Conclusion**

The EPL 5625 is in the Karibib District in Erongo Region. The EPL lies outside the Dorob National Park. The implementation of the proposed small scale surface exploration project by Erongo Marble and Granite (pty) Ltd will be undertaken with provisions of the EIA regulation of 2012. Based on the assessment of both negative and positive impacts undertaken for the proposed small scale surface exploration project, a number of high positive and negative impacts have been identified. Overall, positive impacts of the proposed small scale surface exploration project activities outweigh the negative ones at local, regional, nation and global levels.

It is therefore concluded that all significant impacts identified during this Environmental Impact Assessment can be mitigated through management actions implemented during construction and operation. It is important that the Environmental Management Plan developed for the project be implemented during construction and operation otherwise the impacts identified will remain unacceptable.

### **8.2. Recommendations**

Based on the findings of this Environmental Assessment Study, it is recommended that the proposed small scale surface exploration project receive an Environmental Clearance provided that an Environmental Plan be implemented.

## 9. References

---

- Ashmole, I., (2004). "Dimension Stone: The Small Scale Mining Potential in South Africa", Paper presented at Small Scale Mining, Johannesburg.
- Barnard, P. (1998). Under protected habitats. In: Barnard, P. (ed.). Biological diversity in Namibia: a country study. Windhoek: Namibian National Biodiversity Task Force.
- Bester, B. (1996). Bush encroachment – A thorny problem. *Namibia Environment* 1: 175-177.
- Bethune, S., Shaw, D. & Roberts, K.S. (2007). *Wetlands of Namibia*. John Meinert Printing, Windhoek.
- Biological diversity in Namibia: a country study. Windhoek: Namibian National Biodiversity Task Force.
- Boycott, R.C. & Bourquin, O. (2000). *The Southern African Tortoise Book*. O Bourquin, Hilton, RSA.
- Branch, B. (1998). *Field guide to snakes and other reptiles of southern Africa*. Struik Publishers, Cape Town, RSA.
- Branch, B. (2008). *Tortoises, terrapins & turtles of Africa*. Struik Publishers, Cape Town RSA.
- Broadley, D.G. (1983). *Fitzsimons' Snakes of southern Africa*. Jonathan Ball & AD. Donker Publishers, Parklands, RSA.
- Brown, C.J., Jarvis, A., Robertson, T. & Simmons, R. (1998). Bird diversity. In: Barnard, P. (ed.). *Biological diversity in Namibia: a country study*. Windhoek: Namibian National Biodiversity Task Force.
- Burke, A. (1998). Vegetation zones. In: Barnard, P. (ed.). *Biological diversity in Namibia: a country study*. Windhoek: Namibian National Biodiversity Task Force.
- Burke, A. (2003). *Wild flowers of the Central Namib*. Namibia Scientific Society, Windhoek.
- Buys, P.J. & Buys, P.J.C. (1983). *Snakes of Namibia*. Gamsberg Macmillan Publishers, Windhoek, Namibia.
- Carruthers, V.C. (2001). *Frogs and frogging in southern Africa*. Struik Publishers, Cape Town, RSA.
- Carvalho, J.F., Henriques, P., Fale, P., Luis, G., (2008). "Decision criteria for the exploration of ornamental-stone deposits: Application to the marbles of the Portuguese Estremoz Anticline", *International Journal of Rock Mechanics and Mining Sciences*.
- Channing, A. & Griffin, M. (1993). An annotated checklist of the frogs of Namibia. *Madoqua* 18(2): 101-116.
- Channing, A. (2001). *Amphibians of Central and Southern Africa*. Protea Bookhouse, Pretoria, RSA.
- Coats Palgrave, K. (1983). *Trees of Southern Africa*. Struik Publishers, Cape Town, RSA.



- Curtis, B. & Barnard, P. (1998). Sites and species of biological, economic or archaeological importance. In: Barnard, P. (ed.). Biological diversity in Namibia: a country study. Windhoek: Namibian National Biodiversity Task Force.
- Curtis, B. & Mannheimer, C. (2005). Tree Atlas of Namibia. National Botanical Research Institute, Windhoek, Namibia.
- De Graaff, G. (1981). The rodents of southern Africa. Buterworths, RSA.
- De Lukas, M, Janss, G.F.E., Whitfield, D.P. & Ferrer, M. (2008). Collision fatality of raptors in wind farms does not depend on raptor abundance. *Journal of Applied Ecology* 45(6): 1695-1703.
- Department of Water Affairs (DWA). (2002). The hydrogeological map of Namibia
- Du Preez, L. & Carruthers, V. (2009). A complete guide to the frogs of southern Africa. Struik Publishers, Cape Town, RSA.
- Electricity Control Board (ECB).(2009), Annual Report, Windhoek, Namibia.
- IUCN,(1996). IUCN red list of threatened animals, IUCN, Gland, Switzerland.
- IUCN. (2004). IUCN, Gland, Switzerland. In: Griffin, M. 2005. Annotated checklist and provisional national conservation status of Namibian mammals. Ministry of Environment and Tourism, Windhoek.
- Joubert, E. & Mostert, P.M.K. 1975. Distribution patterns and status of some mammals in South West Africa. *Madoqua* 9(1): 5-44.
- Kisting, J., 2008. Opportunities in the renewable energy sector in Namibia, Baobab Equity Management (Pty) Ltd, Windhoek, Namibia
- Mendelson, J., Jarvis, A., Roberts, C., and Robertson, T. (2002). Atlas of Namibia: A portrait of the land and its people. Windhoek, Namibia: Ministry of Environment and Tourism.
- Miller ,R. (2008).The geology of Namibia, neoproterozoic to lower palaeozoic
- Miller, R. McG., (1983a). The Pan – African Damara Orogen od S.W.A. / Namibia, Special Publication of the Geological Society of South Africa, 11, 431 - 515.
- Miller, R. McG., (1983b). Economic implications of plate tectonic models of the Damara Orogen, Special Publication of the Geological Society of South Africa, 11, 115 -138.
- Miller, R. McG., (1992). Stratigraphy. The mineral resource of Namibia, Geological Survey of Namibia, Ministry of Mines and Energy, Windhoek, 1.2 .1 -1.2.13.
- Ministry of Environment and Tourism. Republic of Namibia. (2008). Guide to the Environmental Management Act No. 7 of 2007. 56 pp
- Ministry of Environment and Tourism. Republic of Namibia. (2012). Environmental Impact Assessment Regulation: Envirommental Management Act, 2007. Government Gazette No.4878.
- NamPower, 2010. Network Map ([www. nampower.com.na](http://www.nampower.com.na)) – Retrieved on 06th February 2014.

- NamWater.(1998).The hydrogeological conceptual model of the Omaruru Delta (OMDEL).
- Ransom, A. H., (1981). Interim Report on Prospecting Grant No. M46/3/758 – Tumas Project No. 53 - Namib Desert Park – Namibia, Period April 1978 - April 1981, Falconbridge of S.W.A. (PTY) LTD, Bulletin No. 2267 (Annex 4).
- Republic of Namibia. (2005). Namibia’s Environmental Assessment Policy for Sustainable Development and Environmental Conservation.
- Republic of Namibia. (2007). Environmental Management Act No. 7 of 2007. Government Gazette No. 3966.
- Richards, J.P. (2009).Mining society and a sustainable world. Springer, New York.
- Risk Based Solution. (2011). Final EIA and EMP for the proposed exploration and possible testing a mine for the MINING LICENCE No-4458, Karas Region. Swedish Exploration.
- SARDB, 2004. CBSG Southern Africa. In: Griffin, M.( 2005). Annotated checklist and provisional national conservation status of Namibian mammals. Ministry of Environment and Tourism, Windhoek.
- Shadmon, A., (1993). “Dimension Stone - its Impact on environment and constructional applications the role of engineering geology”, Bulletin of the International Association of Engineering Geology, No 48, pp 119-122.
- Simmons R.E. & Brown C.J. (2009). Birds to watch in Namibia: red, rare and endemic species. National Biodiversity Programme, Windhoek.
- Simmons, R.E. (1998a). Important Bird Areas (IBA’s) in Namibia. In: Barnard, P. (ed.).
- Simmons, R.E. (1998b). Areas of high species endemism. In: Barnard, P. (ed.). Biological diversity in Namibia: a country study. Windhoek: Namibian National Biodiversity Task Force.
- Simmons, R.E. (1998c). Flamingos: declining in southern Africa. In: Barnard, P. (ed.). Biological diversity in Namibia: a country study. Windhoek: Namibian National Biodiversity Task Force.
- Skinner, J.D. & Smithers, R.H.N. (1990). The mammals of the southern African subregion. University of Pretoria, RSA.
- Steven, N. M., (1993). A study of epigenetic mineralization in the Central Zone of the Damara Orogen, Namibia, with special reference to gold, tungsten, tin, and rare earth element. Geological Survey of Namibia, Memoir 16,166 pp.
- Tapscott, C., (1999). An overview of the socio-economics of some key maritime industries in the Benguela Current region. A Report Prepared on Behalf of the Benguela Current Large Marine Ecosystem Project, Windhoek, October 1999

## **PART 2: ENVIRONMENTAL MANAGEMENT PLAN (EMP)**

# ENVIRONMENTAL MANAGEMENT PLAN

## MINING LICENCE 222-KARIBIB ERONGO REGION NAMIBIA



**Proponent:**

Erongo Marble and Granite (pty) Ltd  
P O Box 2326  
Swakopmund  
Namibia

**Prepared by:**

Centre for Geosciences Research cc



128 A Bach street Windhoek  
Windhoek  
Cell:0856419511

## ***Appendix***

---

- ***Newspaper advert***
- ***Letter from Ministry of Mines and Energy***
- ***Company Registration Documents***
- ***Mine Geotechnical Report***
- ***Reserve estimation***
- ***mine planning***
- ***Geology of the EPL 5625 area***
- ***Financial feasibility studies***
- ***CV of consultant***