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HEALTHY EARTH ENVIRONMENTAL CONSULTANTS CC

MEFT REF: 221124000425

## PROJECT DETAILS

| | | | |
|---|---|---|---|
| **Title** | ENVIRONMENTAL MANAGEMENT PLAN (EMP) FOR THE MINING LICENCE 244 APPLICATION FOR DIMENSION STONES TARGETING DOLERITE SITUATED AT FARM SUKSES NO. 90, EAST OF ARANDIS, ERONGO REGION. | | |
| **HEEC Reference** | HEEC202022 | | |
| **Proponent** | **Rockstar Explore Mining CC**<br>**Reg No: CC/2020/01972**<br>16 Nelson Mandela Avenue,<br>P.O Box 81018<br>Olympia<br>Windhoek,<br>Namibia<br>Contact Person: Mr. Betuel Iileka<br>Contact Number: +26481 252 3636<br>Email: betueliileka@gmail.com | | |
| **Report date** | February 2022 | | |
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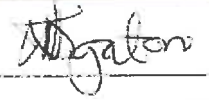
| **Author** | Tanaka D. Nyatoro |  | 28/02/2022 |

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**ABBREVIATIONS**

| | |
|---|---|
| AIDS | Acquired Immuno-Deficiency Syndrome |
| dB | Decibels |
| PR | Proponent's Representative |
| EA | Environmental Assessment |
| ECC | Environmental Clearance Certificate |
| ECO | Environmental Control Officer |
| EIA | Environmental Impact Assessment |
| EMA | Environmental Management Act |
| EMP | Environmental Management Plan |
| EPL | Exclusive Prospecting Licence |
| GG | Government Gazette |
| GIS | Geographic Information System |
| GN | Government Notice |
| GPS | Global Positioning System |
| HEEC | Healthy Earth Environmental Consultants CC |
| HIV | Human Immuno-deficiency Virus |
| I&APs | Interested and Affected Parties |
| NHC | National Heritage Council |
| Reg. | Regulation |
| S | Section |
| TB | Tuberculosis |

## 1 INTRODUCTION

Rockstar Explore Mining CC (Reg No: CC/2020/01972) hold mineral rights for the mining claims 71816, 71817, 71818, 71819, 71820 & 71821 covering a total area of 96.8029 hectares for the commodity, dimension stones and they intend to apply for a mining licence to carry out mining activities for the next 20 years after exploration activities proved the area feasible and financially viable. The mining licence under application is referenced 14/2/5/1/244 (ML244) by the Ministry of Mines and Energy (MME) and therefore an Environmental Clearance Certificate (ECC) is needed to allow this listed activity to be undertaken in a sustainable manner.

Dimension stone is a collective term for various natural stones used for structural or decorative purposes in construction and monumental applications. The defining feature of dimension stone is that unlike other mineral commodities which have value mainly as a result of their physical properties, the physical properties of a rock are merely the minimum qualification in determining whether it is fit for use in dimension stone applications. The ultimate success in marketing a natural stone as a dimension stone lies firstly in its appearance, and secondly in the possibility of producing rectangular blocks of suitable dimensions (hence the term dimension stone - some authors prefer the term "ornamental stone", emphasising the decorative aspect of its use) to allow for successful production of the final product in the required sizes. A dimension stone block thus has value as a result of its dimensions and appearance, underlain by a set of minimum physical properties (among these are various strength parameters, workability, ability to take a polish, and resistance to physical and chemical weathering). A dimension stone block thus has value because of its dimensions and appearance, underlain by a set of minimum physical properties (among these are various strength parameters, workability, ability to take a polish, and resistance to physical and chemical weathering). The 6 mining claims (71816-71821) were granted on 02/11/2021 and expire on 01/11/2024. The ECC is a required document to apply for the Mining Licence 244 at the Ministry of Mines & Energy (MME).

It is with this background that after exploration was completed and deemed viable, the mined dimension stones will be for commercial purposes, and some will be exported to China where there is a ready market and other upcoming markets.

However uncontrolled natural resource mining/ excavation has resulted in negative environmental effects in the respective areas. This has been largely attributed to the fact that people were under no obligation to rehabilitate the affected areas and thus left behind large open pits/quarries that pose a danger to both humans and animals.

**Rockstar Explore Mining CC**, hereinafter referred to as the proponent intends to carry out the following activity:

- **Environmental Assessment (EA) for the Mining Licence 244 (ML244) application for dimension stones targeting dolerite at the allocated portion of Farm Sukses No. 90, east of Arandis, Erongo Region.**

The objective of the intended Environmental Assessment is thus needed to assess the potential social and environmental impacts associated with the Mining Licence 244 (ML244) application for dimension stones targeting dolerite at the allocated portion of Farm Sukses No. 90, east of Arandis, Erongo Region and to formulate methods of rehabilitation of the quarries once the dimension stones have been excavated.

In terms of the Environmental Management Act (No. 7 of 2007) and Environmental Impact Assessment Regulations (Government Notice No. 30 of 2012), the following listed activities in **Table 1** were triggered by the proposed project:

**Table 1:** List of triggered activities identified in the EIA Regulations which apply to the proposed project

| **Activity description and No(s):** | **Description of relevant Activity** | **The portion of the development as per the project description that relates to the applicable listed activity** |
|---|---|---|
| Activity 3.1 (Mining and Quarrying Activities) | The construction of facilities for any process or activities which requires a licence, right or other form of authorisation, and the renewal of a licence, right or other form of authorisation, in terms of the Minerals (Prospecting and Mining Act), 1992. | The proposed project includes the mining for dimension stones for commercial purposes. |
| Activity 3.2 (Mining and Quarrying Activities) | Other forms of mining or extraction of any natural resources whether regulated by law or not. | The proposed project includes the mining for dimension stones for commercial purposes. |

| Activity description and No(s): | Description of relevant Activity | The portion of the development as per the project description that relates to the applicable listed activity |
|---|---|---|
| Activity 3.3 (Mining and Quarrying Activities) | Resource extraction, manipulation, conservation and related activities. | The proposed project includes the mining for dimension stones for commercial purposes. |

An Environmental Management Plan (EMP) is one of the most important outputs of the EA process as it synthesises all the proposed mitigation and monitoring actions, set to a timeline and with specific assigned responsibilities. This updated EMP details the mitigation and monitoring actions to be implemented during the following phases of these developments:

- Dimension stone mining Phase – the period during which the proponent, having dealt with the necessary legislative and administrative arrangements, appoints a contractor to engage in the mining of dimension stones from the project site to be transported to the Walvis Bay Port for export purposes for quality testing;
- Transportation Phase- the period during which the proponent transports the dimension stone samples from the quarry to Walvis Bay port for export.
- Tile Cutting/Polishing Phase- the period during which the proponent processes the excavated dimension stones, by polishing and cutting them into smaller dimensions so that they can be used in the construction and decorative industry by the customers. This will be done in China and therefore is not in the scope of this EMP.

The rehabilitation of the quarries at the dimension stone mining sites once activities have ceased is highly recommended to ensure that the subject EPL area assumes economically viable alternative land uses and not pose a drowning threat/injury to the livestock and locals making use of these Reserve lands; when the event occurs then some recommendations have been outlined in **Table 4.**

## 2 ROLES AND RESPONSIBILITIES

The proponent (Rockstar Explore Mining CC) is ultimately responsible for the implementation of the EMP, at the dimension stone mining phase to the quarry rehabilitation phase of the Mining Licence 244 (ML244) application for dimension stones targeting dolerite at the allocated portion of Farm Sukses No. 90, east of Arandis, Erongo Region. The proponent will delegate this responsibility as the project progresses through its life cycle. The delegated responsibility for the effective implementation of this EMP will rest on the following key individuals:

- Proponent's Representative;
- Environmental Control Officer; and
- Contractor (Rockstar Explore Mining CC).

### 2.1 PROPONENT'S REPRESENTATIVE

Rockstar Explore Mining CC, the proponent, should assign the responsibility of managing all aspects of this development for all mining phases (including all contracts for work outsourced) to a designated member of staff, referred to in this EMP as the Proponent's Representative (PR). The proponent may decide to assign this role to one person for the full duration of these developments or may assign a different PR to each of the development phases – i.e., one for the dimension stone mining & one for the quarry rehabilitation phase. The PR's responsibilities are as follows:

| Responsibility | Project Phase |
|---|---|
| Making sure that the necessary approvals and permissions laid out in **Table 2** are obtained/adhered to | Throughout the lifecycle of this project |
| Suspending/evicting individuals and/or equipment not complying with the EMP | • Dimension stone mining<br>• Quarry rehabilitation |
| Issuing fines for contravening EMP provisions | • Dimension stone mining<br>• Quarry rehabilitation |

## 2.2 ENVIRONMENTAL CONTROL OFFICER

The PR should assign the responsibility of overseeing the implementation of the whole EMP on the ground during the dimension stone mining & quarry rehabilitation phases to a designated member of staff, referred to in this EMP as the Environmental Control Officer (ECO). The PR/ Rockstar Explore Mining CC may decide to assign this role to one person for all mining activities or may assign a different ECO for each activity. The ECO will have the following responsibilities during the mining and operation and maintenance phases of this project:

- Management and facilitation of communication between the Proponent, PR, the contractors, and Interested and Affected Parties (I&APs) with regard to this EMP;
- Conducting regular inspections (recommended minimum frequency is once every six months) with respect to the implementation of this EMP (monitor and audit the implementation of the EMP);
- Assisting the Contractor in finding solutions with respect to matters pertaining to the implementation of this EMP;
- Advising the PR on the removal of person(s) and/or equipment not complying with the provisions of this EMP;
- Making recommendations to the PR with respect to the issuing of fines for contraventions of the EMP; and
- Undertaking a bi-annual review of the EMP and recommending additions and/or changes to this document.

## 2.3 DIMENSION STONE MINING & QUARRY REHABILITATION CONTRACTOR

A contractor, in this case being the proponent, conducts the dimension stone mining & quarry rehabilitation activities at the Mining Licence 244 (ML244) application for dimension stones targeting dolerite at the allocated portion of Farm Sukses No. 90, east of Arandis, Erongo Region, and is therefore automatically responsible for implementing all provisions contained within the relevant chapters of this EMP. The dimension stone mining & quarry rehabilitation contractor will be responsible for the implementation of this EMP applicable to any work outsourced to subcontractors. **Table 3** applies to contractors appointed during the dimension stone mining phase and **Table 4** to those appointed during the continuous quarry rehabilitation phase. To ensure effective environmental management, the aforementioned chapters should be included in the applicable contracts for outsourced work relating to the intended activities.

The tables in the following chapter (**Chapter 3**) detail the management measures associated with the roles and responsibilities that have been laid out in this chapter.

## 3 MANAGEMENT ACTIONS

The aim of the management actions in this chapter of the EMP is to avoid potential impacts where possible. Where impacts cannot be avoided, measures are provided to reduce the significance of these impacts.

The following tables provide the management actions recommended to manage the potential impacts rated in the scoping-level EA conducted for these activities. These management actions have been organised temporally according to project phase:

- Applicable legislation (**Table 2**);
- Dimension stone mining Actions (**Table 3**);
- Quarry rehabilitation Management Actions (**Table 4**); and
- Decommissioning phase management actions (**Table 5**).

***NB: The responsible persons from the proponents' team have assessed these commitments in detail and have committed to the specific management actions were indicated in the tables below.***

### 3.1 ASSUMPTIONS AND LIMITATIONS

This EMP has been formulated based on the scoping-level Environmental Assessment (EA) conducted for the operation and management of the dimension stone mining & quarry rehabilitation activities as represented in **Figure 2**. HEEC will not be held responsible for the potential consequences that may result from any alterations to the agreed course of action in terms of the intended activities in the areas surrounding Farm Sukses No. 90.

It is assumed that labourers will be sourced mostly from the Arandis area and that migrant labourers (if applicable) will be housed within established accommodation facilities at the worker's residents in Arandis during the mining phase.

### 3.2 APPLICABLE LEGISLATION

There are multiple legal instruments that regulate and have a bearing on good environmental management in Namibia. **Table 2** below provides a summary of the legal instruments considered to be relevant to the dimension stone mining & quarry rehabilitation activities and the environmental assessment process.

**Table 2: Legal provisions relevant to these activities**

| LEGISLATION/POLICIES | RELEVANT PROVISIONS | RELEVANCE TO PROJECT |
|---|---|---|
| The Constitution of the Republic of Namibia as Amended | Article 91 (c) provides for duty to guard against "the degradation and destruction of ecosystems and failure to protect the beauty and character of Namibia."<br><br>Article 95(l) deals with the "maintenance of ecosystems, essential ecological processes and biological diversity" and sustainable use of the country's natural resources. | Sustainable development should be at the forefront of management of the mining activities. |
| Environmental Management Act No. 7 of 2007 (EMA) | Section 2 outlines the objective of the Act and the means to achieve that.<br>Section 3 details the principles of Environmental Management | The management of this project must be informed by the EMA. |
| EIA Regulations GN 28, 29, and 30 of EMA (2012) | GN 29 Identifies and lists certain activities that cannot be undertaken without an environmental clearance certificate.<br>GN 30 provides the regulations governing the environmental assessment (EA) process. | **Activity 3.1 (Mining and Quarrying Activities)** The construction of facilities for any process or activities which requires a licence, right or other form of authorisation, and the renewal of a licence, right or other form of authorisation, in terms of the Minerals (Prospecting and Mining Act), 1992.<br>**Activity 3.2 (Mining and Quarrying Activities)** Other forms of mining or extraction of any natural resources whether regulated by law or not.<br>**Activity 3.3 (Mining and Quarrying Activities)** Resource extraction, |

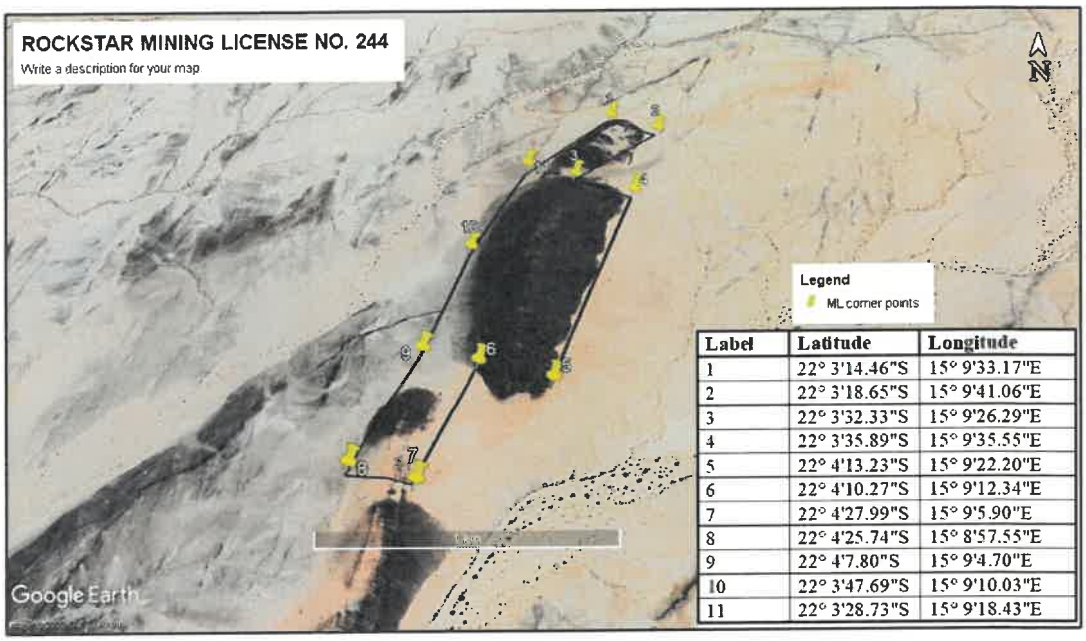
| LEGISLATION/POLICIES | RELEVANT PROVISIONS | RELEVANCE TO PROJECT |
|---|---|---|
| | | manipulation, conservation and related activities. |
| Convention on Biological Diversity (1992) | Article 1 lists the conservation of biological diversity amongst the objectives of the convention. | The dimension stone mining & quarry rehabilitation activities should consider the impact it will have on the biodiversity of the area. |
| Draft Procedures and Guidelines for conducting EIAs and compiling EMPs (2008) | Part 1, Stage 8 of the guidelines states that if a proposal is likely to affect people, certain guidelines should be considered by the proponent in the scoping process. | The EA process should incorporate the aspects outlined in the guidelines. |
| Namibia Vision 2030 | Vision 2030 states that the solitude, silence and natural beauty that many areas in Namibia provide are becoming sought after commodities and must be regarded as valuable natural assets. | Care should be taken that the proposed dimension stone mining & quarry rehabilitation activities do not lead to the degradation of the natural beauty of the Farm Sukses No. 90 and surrounding areas. |
| Water Act No. 54 of 1956 | Section 23(1) deals with the prohibition of pollution of underground and surface water bodies. | The pollution of water resources should be avoided during dimension stone mining & quarry rehabilitation activities. |
| The Ministry of Environment and Tourism (MET) Policy on HIV & AIDS | MEFT has recently developed a policy on HIV and AIDS. In addition it has also initiated a programme aimed at mainstreaming HIV and gender issues into environmental impact assessments. | The proponent and its contractor have to adhere to the guidelines provided to manage the aspects of HIV/AIDS. Experience with similar projects has shown that a significant health risk is created when migrant construction workers/labourers interact with local communities. |
| Local Authorities Act No. 23 of 1992 | The Local Authorities Act prescribes the manner in which a town or municipality should be managed by the Town or Municipal Council. Sections 34-47 make provision for the aspects of water and sewerage. | Dimension stone mining & quarry rehabilitation activities have to comply with provisions of the Local Authorities Act. |
| Labour Act No. 11 of 2007 | Chapter 2 details the fundamental rights and protections.<br>Chapter 3 deals with the basic conditions of employment. | Given the employment opportunities presented by the dimension stone mining & quarry rehabilitation activities, compliance with the law is essential. |

| LEGISLATION/POLICIES | RELEVANT PROVISIONS | RELEVANCE TO PROJECT |
|---|---|---|
| Public and Environmental Health Act of 2015 | This Act (GG 5740) provides a framework for a structured uniform public and environmental health system in Namibia. It covers notification, prevention and control of diseases and sexually transmitted infections; maternal, ante-natal and neo-natal care; water and food supplies; infant nutrition; waste management; health nuisances; public and environmental health planning and reporting. It repeals the Public Health Act 36 of 1919 (SA GG 979). | Dimension stone mining & quarry rehabilitation activities are to comply with these legal requirements. |
| Nature Conservation Ordinance No. 4 of 1975 | Chapter 6 provides for legislation regarding the protection of indigenous plants. | Indigenous and protected plants have to be managed within the legal confines. |
| Environmental Assessment Policy of Namibia (1995) | The Policy seeks to ensure that the environmental consequences of development projects and policies are considered, understood, and incorporated into the planning process, and that the term ENVIRONMENT is broadly interpreted to include biophysical, social, economic, cultural, historical and political components. | This EIA considers this term of Environment. |
| Minerals (Prospecting and Mining) Act, 1992 (Act 33 1 of 1992) | To provide for the reconnaissance, prospecting and mining for, and disposal of, and the exercise of control over, minerals in Namibia; and to provide for matters incidental thereto. "mineral" means any substance, whether in solid, liquid or gaseous form, occurring naturally in, on or under any land and having been formed by, or subjected to, a | The intended activity involves the mining of dimension stones for export purposes. |

| LEGISLATION/POLICIES | RELEVANT PROVISIONS | RELEVANCE TO PROJECT |
|---|---|---|
| | geological process, excluding -(c) subject to the provisions of subsection (2), soil, sand, clay, gravel or stone (other than rock material specified in Part 2 of Schedule 1) if they are bona fide required for purposes of –<br>(i) agriculture, building works, fencing or road making;<br>(ii) the manufacture of bricks and tiles; | |
| Soil Conservation Act 6 of 1969 Ministry of Agriculture, Water and Forestry | This Act covers the prevention and combating of soil erosion; the conservation, improvement and manner of use of the soil and vegetation; and the protection of water sources | Soils should not be polluted or left un-rehabilitated. |

### 3.3 PROJECT LOCATION

The proponent intends to undertake mining activities under the Mining Licence 244 for dimension stones targeting dolerite at the allocated portion of Farm Sukses No. 90, east of Arandis, Erongo Region, located about 45 km south of Arandis and 13 km north of the main B2 road as shown Figure 1 and Figure 2 for the locality of the Mining Licence 244 for the dimension stone mining (GPS Coordinates: - 22.05401667; 15.15921389).




| Label | Latitude | Longitude |
|---|---|---|
| 1 | 22° 3'14.46"S | 15° 9'33.17"E |
| 2 | 22° 3'18.65"S | 15° 9'41.06"E |
| 3 | 22° 3'32.33"S | 15° 9'26.29"E |
| 4 | 22° 3'35.89"S | 15° 9'35.55"E |
| 5 | 22° 4'13.23"S | 15° 9'22.20"E |
| 6 | 22° 4'10.27"S | 15° 9'12.34"E |
| 7 | 22° 4'27.99"S | 15° 9'5.90"E |
| 8 | 22° 4'25.74"S | 15° 8'57.55"E |
| 9 | 22° 4'7.80"S | 15° 9'4.70"E |
| 10 | 22° 3'47.69"S | 15° 9'10.03"E |
| 11 | 22° 3'28.73"S | 15° 9'18.43"E |

**Figure 1: Locality map showing the area under application for mining licence 244, Farm Sukses No. 90, Erongo Region (HEEC, 2022).**

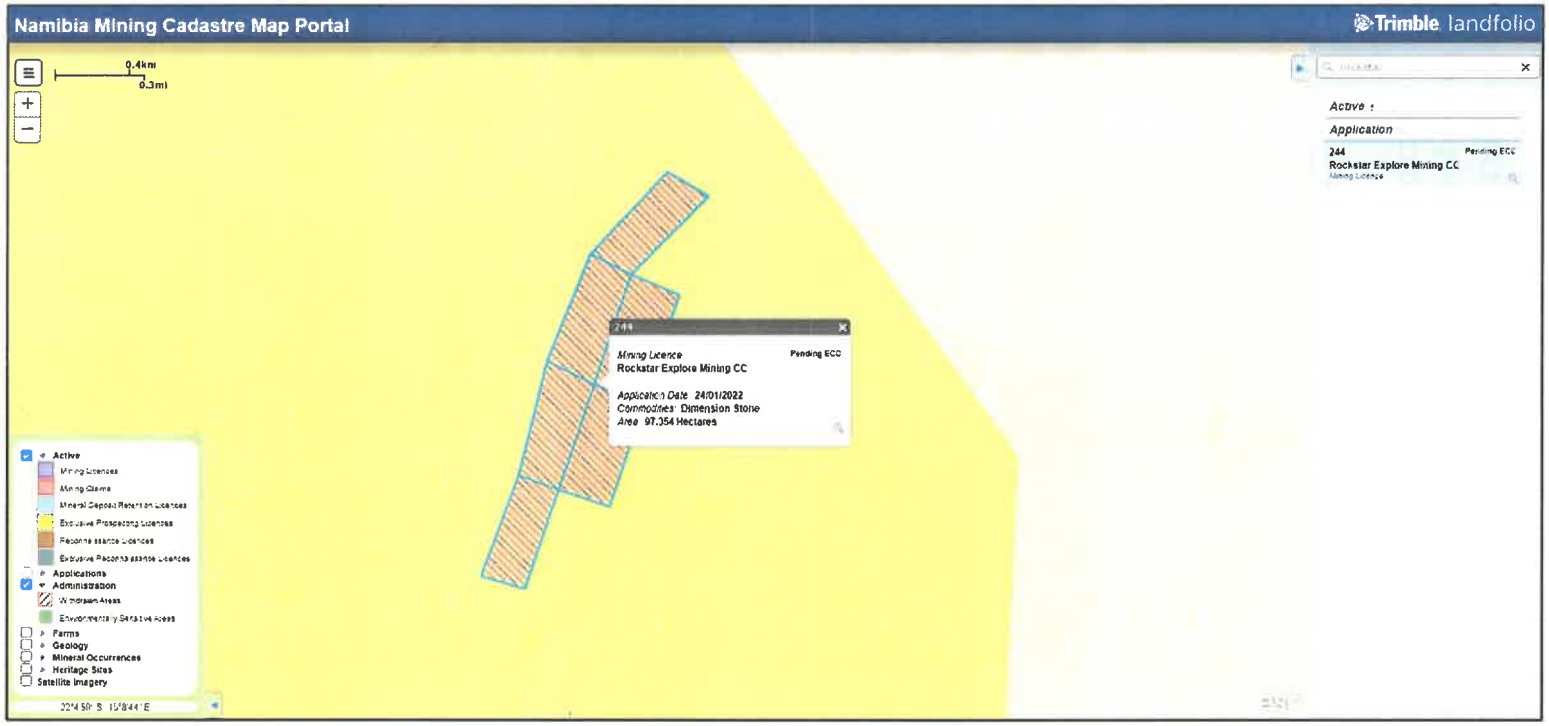



**Figure 2:** Mining licence 244 area under application on Farm Sukses No. 90 (MME Portal, 2022).

### 3.4 DIMENSION STONE MINING PHASE

The PR should ensure that the management actions detailed in **Table 3** below should be adhered to during the operation of the dimension stone mining activities and should be undertaken together with the mitigation measures in **Table 8** of the FESR.

**Table 3: Dimension stone mining Phase Management Actions**

| Aspect | Management Actions |
|---|---|
| Environmental Incidents | • The ECO on site shall maintain a register of all environmental incidents occurring because of the activities associated with the project. Environmental incidents that shall be recorded include (but are not limited to):<br>➢ Fires;<br>➢ Drowning;<br>➢ Accidents (e.g. traffic);<br>➢ Spills of hazardous materials, contaminating soil or water resources;<br>➢ Non-compliances with applicable legislation; and<br>➢ Non-compliances with this EMP.<br>• Environmental incident reports shall include (as a minimum) a description of the incident, the actions taken to contain any damage to the environment, personnel, or the public, and the actions taken to repair / remediate any such damage.<br>• Additional measures shall be prescribed that may be required to remediate damage resulting from the incident and / or to prevent similar incidents occurring in the future. |
| Traffic | • Ensure that road junctions have good sightlines.<br>• Limit the type of vehicle (heavy trucks) allowed on site.<br>• Adhere to the speed limit. If permissible, caution signs and 40 km/hr signs shall be placed at regulation distance from heavy vehicle crossing signs at the intersections of the access tracks and the main B2 road.<br>• Designate no-drive zones. |

| Aspect | Management Actions |
|---|---|
| | • Implement traffic control measures where necessary by keeping a number plate register of all vehicles transporting personnel & dimension stones at the site and restricting access to authorised contractors. |
| Quarries/Dimension stone on the 6 mining claims (71816-71821) sites | • Dimension stone samples should be sourced from quarries with a valid ECC.<br>• The dimension stone mining site must be clearly demarcated by means of a perimeter stock-proof fence with a lockable gated entrance.<br>• Dimension stone mining and resultant operations shall only take place within this demarcated 6 mining claims (71816-71821) area.<br>• A detailed photographic record of the demarcated 6 mining claims (71816-71821) areas under mining licence 244 application, prior to any mining activities, shall be taken. These records are to be kept by the Proponent and PR for reference purposes during the rehabilitation of the site.<br>• There will be **'No unauthorised access'** signs at the 6 mining claims (71816-71821) gates until to restrict entry and/or harm to people not involved in the dimension stone mining operations. |
| EMP training | All workers at the site are to undergo EMP training that should include as a minimum the following:<br>• Explanation of the importance of complying with the EMP.<br>• Discussion of the potential environmental impacts of the intended dimension stone mining and quarry rehabilitation activities.<br>• Employees' roles and responsibilities, including emergency preparedness and response requirements.<br>• Explanation of the mitigation measures that must be implemented when particular work groups carry out their respective activities. |

| Aspect | Management Actions |
|---|---|
| | • The potential consequences of departure from specified operating procedures; and rewards for enhancing mitigation measures or avoiding negative environmental effects. |
| Fauna and Flora | • Prevent the destruction of protected tree species.<br>• Encourage the regrowth and regeneration of trees with exposed roots at the site.<br>• The excavation of the dimension stones should incorporate existing trees[1].<br>• The Contractor should compile a Tree Management Plan which should include the following as a minimum:<br>o Trees if not already accounted for in an existing Geographic Information System (GIS), should be surveyed, co-ordinates/location incorporated into the Contractor's GIS, marked with paint (or other means so as to be readily visible) and protected;<br>o Trees, which are impossible to conserve, need to be identified and their location recorded on a map;<br>o The Contractor should apply to the relevant authority (Ministry of Environment, Forestry & Tourism) for a permit to remove these trees.<br>o A list should be compiled of all trees to be removed detailing the location of the tree, the species as well as which trees will be planted to replace these. The nursery where these trees will be sourced from should also be included;<br>o Each tree that is removed needs to be replaced with an indigenous tree species;<br>o Some of these trees can be obtained at the nearest forestry office or at a commercial nursery such as the Forestry office in Karibib/ Windhoek. Assistance can be sought from the nearest forestry office regarding nearby nurseries where additional trees may be bought and advice sought. |

[1]a "tree" is defined as an indigenous woody perennial plant with a trunk diameter ≥150 mm

| Aspect | Management Actions |
|---|---|
| | • Only a limited width +/- 5 m on the side of the access roads may be partially cleared of vegetation.<br>• Workers are prohibited from collecting wood or other plant products on or near the site.<br>• No alien species may be planted on or within the existing site.<br>• Prevent contractors from collecting wood and veld food such as amphibians, migrating birds, etc. during the dimension stone mining phase.<br>• Prevent contractors from fishing in the nearby ephemeral rivers or catching aquatic species. |
| Lay-down areas and materials camp | Suitable locations for the contractors lay-down areas and materials camp should be identified with the assistance of the PR and the following should be considered in selecting these sites:<br>• The areas designated for the services infrastructure should be used as far as possible.<br>• Second option should be degraded land.<br>• Avoid sensitive areas (e.g., wetlands/rivers/drainage lines) |
| Hazardous waste | • All heavy-duty vehicles and equipment on site should be provided with a drip tray.<br>• All heavy-duty delivery vehicles should be maintained regularly to prevent oil leakages.<br>• Maintenance and washing of vehicles should take place only at a designated workshop area.<br>• Spilled cement and/or concrete (wet or dry) should be treated as hazardous waste and disposed of by the end of each day in the appropriate hazardous waste containers.<br>• All hazardous substances (e.g., fuel etc.) or chemicals should be stored in a specific location on an impermeable surface that is bunded - with a volume of 120 % of the largest single storage container or 25 % of the total storage containers, whichever is greater. |
| Surface and Ground Water Impacts | • It is recommended that dimension stone mining takes place outside of the rainy season in order to limit erosion & flooding on site and surface water pollution. |

| Aspect | Management Actions |
|---|---|
| | • No dumping of waste products of any kind in or near surface water bodies.<br>• Heavy duty vehicles should be kept out of any surface water bodies and the movement of vehicles should be limited where possible to the existing access roads and tracks.<br>• Contaminated runoff from the sites should be prevented from entering the surface water bodies.<br>• Workers should be given ablution facilities at the sites that are located at least **30 m** away from any surface water and regularly serviced.<br>• Washing of personnel or any equipment should not be allowed on site. |
| Topsoil | • When excavations are carried out, topsoil[2] should be stockpiled in a demarcated area and used in profiling and rehabilitating of the depleted, open quarries at the 6 mining claims (71816-71821) at Farm Sukses No. 90.<br>• Stockpiled topsoil should be used to rehabilitate post-harvesting degraded areas and/or other nearby degraded areas within the Farm Sukses No. 90 in consultation with the Farm owner who is the surface rights holder. |
| Soil Erosion | • Clear the vegetation of the project area in phases during the dimension stone mining period in order to keep the soil more compacted as well as to limit overall disturbance to the area over time.<br>• It is recommended that most dimension stone mining takes place outside of the rainy season in order to limit potential flooding and the run off of loose soil causing further erosion.<br>• Appropriate erosion control structures must be put in place where soil may be prone to erosion. |

[2] Topsoil is defined here as the top 150mm of surface material, which accounts for the seedbank.

| Aspect | Management Actions |
|---|---|
| | • Checks must be carried out at regular intervals to identify areas within the 6 mining claims (71816-71821) sites under mining licence 244 application where erosion is occurring. Appropriate remedial actions are to be undertaken wherever erosion is evident. |
| Rehabilitation | • Upon completion of the dimension stone mining phase consultations should be held with the local community/property owner(s) regarding the post-dimension stone mining use of remaining excavated areas (if applicable) and to identify priority areas.<br>• Sand/rubble at the site should be levelled so it can be reclaimed for other purposes once the dimension stone mining has ceased and rather than leaving the quarries open which will pose a threat to people and animals in the area.<br>• In the event that no post-operation uses are requested, all excavated/degraded areas need to be rehabilitated as follows:<br>o Excavated areas may only be backfilled with clean or inert fill. No material of hazardous nature (e.g., sand removed with an oil spill) may be dumped as backfill.<br>o Rehabilitated excavated areas need to match the contours of the existing landscape.<br>o The rehabilitated area should not be higher (or lower) than nearby drainage channels. This ensures the efficiency of re-vegetation and reduces the chances of potential erosion.<br>o Topsoil is to be spread across excavated areas evenly.<br>o Deep ripping of areas to be rehabilitated is required, not just simple scarification, to enable rip lines to hold water after heavy rainfall.<br>o Ripping should be done along slopes, not up and down a slope, which could lead to enhanced erosion. |

| Aspect | Management Actions |
|---|---|
| HIV/AIDS, Covid19 and TB awareness | • The Contractor should approach the Ministry of Health and Social Services to co-opt a health officer to facilitate HIV/AIDS, Covid19 and TB education programmes periodically on site during the project operation.<br>• A wellness program should be initiated to raise awareness on health issues, especially the impact of sexually transmitted diseases.<br>• Provide free condoms in the workplace and to local community throughout project operation.<br>• Facilitate access to Antiretroviral medication<br>• Personnel should not overnight at the active dimension stone mining sites, but only the security personnel. |
| Road safety | • Demarcate roads clearly.<br>• Off-road driving should not be allowed.<br>• All vehicles that transport materials to and from the site must be roadworthy.<br>• Drivers that transport materials should have a valid driver's license and should adhere to all traffic rules.<br>• Loads upon vehicles should be properly secured to avoid items falling off the vehicle.<br>• Limit and control the number of access points to the mining sites.<br>• The road leading to the 6 mining claims (71816-71821) site under mining licence 244 should be properly maintained so as to reduce dust emissions when heavy vehicles travel on them. |
| Safety around work sites | • Excavations/quarries should be left open for the shortest time possible.<br>• Excavate short lengths of trenches and box areas for services or foundations in a manner that will not leave the trench unattended for more than 24 hours.<br>• Demarcate excavated areas and topsoil stockpiles with danger tape.<br>• Provide additional warning signage in areas of movement and in "no personnel" areas where workers are not active. |

| Aspect | Management Actions |
|---|---|
| | • Quarries are to be fenced-off with stock-proof perimeter fencing.<br>• Work areas must be set out and isolated with danger tape on a daily basis.<br>• All materials and equipment are to be stored only within set out and demarcated work areas.<br>• Only dimension stone mining personnel will be allowed within these work areas.<br>• 2 fire extinguishers should be available at fuel storage areas.<br>• Comply with all waste related management actions stated above in this table. |
| Ablutions | • Separate toilets should be available for men and women and should clearly be indicated as such.<br>• Portable toilets (i.e., easily transportable) should be available at every construction site:<br>➢ 1 toilet for every 15 females.<br>➢ 1 toilet for every 30 males.<br>➢ Sewage needs to be removed on a regular basis to an approved (municipal) sewage disposal site. Alternatively, sewage may be pumped into sealable containers and stored until it can be removed.<br>➢ Workers responsible for cleaning the toilets should be provided with latex gloves and masks. |
| Open fires | No open fires may be made anywhere on the active mining site where there is stored/used flammable substances in close proximity. |
| General health and safety | • A fully stocked first aid kit should permanently be available on-site as well as an adequately trained member of staff capable of administering first aid.<br>• All workers should have access to the relevant personal protective equipment (overalls, hard toe boots, goggles, dust masks, sun hats heavy duty gloves etc.).<br>• Sufficient potable water reserves should be always available to workers. |

| Aspect | Management Actions |
|---|---|
| | • No person should be allowed to smoke close to fuel storage facilities or portable toilets (if toilets are chemical toilets – the chemicals are flammable).<br>• No workers should be allowed to drink alcohol during work hours.<br>• No workers should be allowed on the mining site/quarries if under the influence of alcohol. |
| Dust | • A watering truck should be used on gravel roads with the heaviest vehicle movement especially during dry and windy conditions. However, due consideration should be given to water restrictions during times of drought.<br>• The use of waterless dust suppression means (e.g., lignosulphonate products such as Dustex) should be considered.<br>• Cover any stockpiles with plastic to minimise windblown dust.<br>• Dust protection masks should be provided to workers if they complain about dust.<br>• During high wind conditions the contractor must make the decision to cease works until the wind has calmed down. |
| Noise | Work hours should be restricted to between **08h00 and 17h00** where excavation involving the use of heavy equipment, power tools and the movement of heavy vehicles is less than 500 m from residential areas on the Farm Sukses No. 90. If an exception to this provision is required, all residents at the farm within the **500 m** radius should be given 1 week's written notice.<br>➢ If workers are to be exposed to noise levels above 85dB for continuous extended periods of more than two hours, they are to be provided with earmuffs and allowed to take 10-15 minute breaks away from the noise source. |
| Recruitment of labourers | The Contractor should compile a formal recruitment process including the following provisions as a minimum: |

| Aspect | Management Actions |
|---|---|
| | • Adhere to the legal provisions in the Labour Act No. 11 of 2007 for the recruitment of labour (target percentages for gender balance, optimal use of local labour and SME's, etc.).<br>• Recruitment should not take place at the dimension stone mining site.<br>• Ensure that all sub-contractors are aware of recommended recruitment procedures and discourage any recruitment of labour outside these agreed upon procedures.<br>• All contractors should give preference in terms of recruitment of sub-contractors and individual labourers to those who are qualified and from the project area and only then look to surrounding towns.<br>• Clearly explain to all jobseekers the terms and conditions of their respective employment contracts (e.g., period of employment etc.) – make use of interpreters where necessary. |
| Communication plan | The Contractor or PR should draft a Communication Plan, which should outline as a minimum the following:<br>• How Interested and Affected Parties (I&APs), who require on-going communication for the duration of the operation period, will be identified and recorded and who will manage and update these records;<br>• How these I&APs will be consulted on an on-going basis;<br>• Make provision for grievance mechanisms – i.e. how concerns can be lodged/ recorded and how feedback will be delivered as well as further steps of arbitration in the event that feedback is deemed unsatisfactory. |
| General communication | • The PR must appoint an ECO to liaise between the Contractor, I&APs, and Rockstar Explore Mining CC's management.<br>• The Contractor shall at every bi-monthly site meeting report on the status of the implementation of all provisions of the EMP. |

| Aspect | Management Actions |
|---|---|
| | • The Contractor should implement the EMP awareness training as stipulated above in this table.<br>• The Contractor must list the I&APs of the project and their contact details with whom on-going communication would be required for the duration of the contract. This list, together with the Communication Plan must be agreed upon and given to the PR before operation commences/resumes.<br>• The Communication Plan, once agreed upon by the Developer, shall be legally binding.<br>• A copy of the EMP must be available at the site office and should be accessible to all I&APs.<br>• Key representatives from the above-mentioned list need to be invited to attend monthly site meetings to raise any concerns and issues regarding progress to rehabilitate the excavated areas and surrounding quarries.<br>• The Contractor should liaise with the proponent regarding all issues related to community consultation and negotiation before operation commences/resumes.<br>• A procedure should be put in place to ensure that concerns raised have been followed-up and addressed.<br>• All people on the I&APs list should be informed about the availability of the complaints register and associated grievance mechanisms in writing by the PR prior to the commencement of site activities. |
| Archaeology | • Should a heritage site or archaeological site be uncovered or discovered during the dimension stone mining phase of the project, a "chance find" procedure should be applied in the order they appear below:<br>o If operating machinery or equipment stop work;<br>o Demarcate the site with danger tape;<br>o Determine GPS position if possible;<br>o Report findings to the site foreman;<br>o Report findings, site location and actions taken to superintendent. |

| Aspect | Management Actions |
|---|---|
| | ○ Cease any works in immediate vicinity;<br>○ Visit find site and determine whether work can proceed without damage to findings;<br>○ Determine and demarcate exclusion boundary;<br>○ Site location and details to be added to a Geographic Information System (GIS) for field confirmation by archaeologist;<br>○ Inspect site and confirm addition to dimension stone mining site GIS;<br>○ Advise the National Heritage Council (NHC) and request written permission to remove findings from work area; and<br>○ Recovery, packaging and labelling of findings for transfer to National Museum.<br>• Should human remains be found, the following actions will be required:<br>○ Apply the chance find procedure as described above;<br>○ Schedule a field inspection with an archaeologist to confirm that remains are human;<br>○ Advise and liaise with the NHC and Police; and<br>○ Remains will be recovered and removed either to the National Museum or the National Forensic Laboratory. |

### 3.5 QUARRY REHABILITATION PHASE (Continuous)

The management actions included in **Table 4** below applies during the continuous quarry rehabilitation phase of the mining operations and should be undertaken together with the mitigation measures in **Table 9** of the FESR.

**Table 4: Quarry Rehabilitation Phase Management actions**

| Environmental Feature | Management Actions |
|---|---|
| EMP training | All contractors appointed for the transportation/ translocation of the dimension stones on 6 mining claims (71816-71821) must ensure that all personnel are aware of necessary health, safety and environmental considerations applicable to their respective work. |
| Monitoring | The ECO should monitor the implementation of the EMP: |

| Environmental Feature | Management Actions |
|---|---|
| | • The ECO should regularly inspect the conditions around the dimension stone mining site before work starts; and<br>• The ECO should inspect the active mining site at the end of each prospecting period. |
| Water and waste management | • Ensure that the infrastructure at the dimension stone mining site has a drainage and wastewater reticulation system designed so as not to allow open standing water bodies on site.<br>• Regular preventative maintenance should be carried out on the infrastructure to ensure that risks of overspills are minimised.<br>• A no-go buffer area of at least **30 m** should be allocated to any water bodies in the area.<br>• No dumping of waste products of any kind in or in close proximity to any surface water bodies.<br>• Sufficient weather and scavenger-proof bins (with lids, to prevent the escape of litter) shall be provided and be easily accessible at all points where wastes are generated.<br>• The site shall be kept clean and free of litter and no litter from the site shall be allowed to disperse to surrounding areas.<br>• All personnel shall be instructed to dispose of all waste in the proper manner.<br>• The Contractor shall identify and separate materials that can be reused or recycled to minimise waste e.g., metals, packaging, and plastics, and provide separate marked bins for these items.<br>• All materials (e.g., oil drums) must be suitably stored and protected, so that they do not become damaged and unusable. |

| Environmental Feature | Management Actions |
|---|---|
| | • The Contractor shall be responsible for the regular disposal (at suitable and licensed municipal waste disposal facilities in Karibib) of all waste generated as a result of the dimension stone mining.<br>• Contaminated runoff from the various operational activities should be prevented from entering any surface water bodies.<br>• Ensure that surface water accumulating on-site are channelled and captured through a proper storm water management system to be treated in an appropriate manner before disposal into the environment.<br>• Disposal of waste from the properties should be properly managed.<br>• No waste may be burned on site.<br>• General waste is to be collected either by the local Municipality or removed by the proponent.<br>• The frequency of collections will be such that waste containment receptacles do not unduly accumulate or overflow. |
| Energy efficiency | • The use of solar energy should be encouraged to provide for general lighting and heating of water and buildings.<br>• The use of water saving initiatives should be incorporated within the workers' housing/office design in order to reduce water demand. |

### 3.6 DECOMMISSIONING PHASE

Mine closures can be planned for and should form part of an integrated land use strategy that involves the community. The decommissioning of the dimension stone mining activities at 6 mining claims (71816-71821) is envisaged in the future. Planned closure, in consultation with the farm owner, provides the opportunity to develop alternative land uses through rehabilitation, and to use the remaining infrastructure for other economic purposes such as small stock farming. When the event occurs, some recommendations have been outlined in **Table 5 & 6**.

**Table 5** is a guideline to the decommissioning plan, whereby an active care mine closure is going to be implemented.

**Table 5: Decommissioning plan**

| Decommissioning Phase | | | |
|---|---|---|---|
| **Possible Impact** | **Mitigation** | **Responsibility** | **Monitoring Agent** |
| **Physical/Biological**<br>-Land degradation& loss of aesthetic value | -Establish a vegetation cover as soon as possible (stabilization)<br>-Vegetate cleared area with indigenous trees<br>-Fencing of the dangerous areas | CONTRACTOR | -ECO<br>-MEFT,<br>-MAW&LR |
| -Injury to people and livestock | -Complete filling up of the trenches<br>-Barricade the old workings with concrete<br>-Fencing of the dangerous areas | CONTRACTOR | -ECO<br>-MEFT,<br>-MAW&LR |
| -Contaminated surface and underground water.<br>-Soil pollution.<br>-Acid water drainage | -clean up spills (chemicals, diesel and oil)<br>-Water quality analysis.<br>-Monitor soil and water quality for a specified time after closure. | CONTRACTOR | -ECO<br>-MEFT,<br>-MAW&LR |
| Resurgence of hazardous chemicals | -Treatment of hazardous chemicals (if any)<br>-Neutralization<br>-Precipitation, oxidation, reduction and acid/alkali hydrolysis | CONTRACTOR | -ECO<br>-MEFT,<br>-MAW&LR<br>-MHSS |
| Accumulated solid waste | -Disposal of solid waste through source sorting, recycling, aerobic decomposition (composition), incineration or depositing in land fill and covering of land fill | CONTRACTOR | -ECO<br>-MEFT,<br>-MAW&LR<br>-MHSS |
| Loss of biodiversity | -Eliminate environmental damage through reclamation.<br>-Site restoration through regeneration of woodland.<br>-Restore chemical, biological and physical stability of site.<br>-Allow productive land use. | CONTRACTOR | -ECO<br>-MEFT,<br>-MAW&LR |
| Compacted soil | -Rehabilitate areas affected by excessive soil compaction and oil spillage | CONTRACTOR | -ECO<br>-MEFT,<br>-MAW&LR<br>-MME |
| **Social/Economic**<br>-Laying off workers<br>-Loss of income<br>-Drop in the standard of living | -Catering of welfare of laid off workers<br>-Pension schemes<br>-Creation of income generating projects for laid off workers<br>-Secure alternative employment for workers | CONTRACTOR | -ECO<br>-SSC |

| | | | |
|---|---|---|---|
| -Infrastructure may become derelict<br>-Derelict building may detract from the value of surrounding properties | -Return of community access to infrastructure<br>-Educate locals on the utilization of the infrastructure<br>-Considering promoting water reservoir for fishing | CONTRACTOR | Ministry of Works and Transport |
| -Possible outbreaks of diseases | Educate communities on dangers of STIs and waterborne diseases | CONTRACTOR | Ministry of Health & Social Services(MHSS) |
| Damaged roads | Repair damaged roads | CONTRACTOR | -Roads Authority |

In addition to the plan above, decommissioning should also be carried out as per the following guidelines:

- The Proponent/Owners and Managers of the mines should be capable of implementing responsible environmental management practices. The preparation of environmental management plans will facilitate this process and is strongly encouraged.
- All mined sites should be rehabilitated either progressively or at the end of mining. Each mining site should be left in a safe well drained and maintenance-free state, blending in as much as possible with the surrounding landscape.
- Mine operators should ensure that funds are available for progressive and final site (closure) rehabilitation.
- Unless otherwise approved (by an Inspector of mines) at mining closure, all machinery structures and buildings should be removed from the site and concentrate slabs broken up and buried. The site should be ripped; top soiled (if available), fertilized and re-vegetated using indigenous plant species. Alternatively, if approved, certain structures can remain for the benefit of the next land user.
- Surface and ground waters should be effectively managed to prevent contamination of mining operations.
- Effluent from mining and milling operations should be effectively contained and only released into river systems if the water quality satisfies the standards of the **Water Quality Guidelines (Annexure A)**.
- Measures to be taken to control noise and dust from mining/milling/hauling operations to ensure a comfortable and health working environment as specified in the **Labour Act No. 11 of 2007**.
- Measures should be taken to minimise excessive ground vibrations and air-blasts over pressure due to blasting. Peak particle velocities of 5 mm/sec and air-blasts over pressures of 120 dB (peak) should not be exceeded at the boundaries of the mining area.
- Mine operators should ensure that refuse is deposited in proper containers and disposed of responsibly. Fuel and oil spills should be effectively contained.
- Where practical, buildings, processing plant, stockpiles and waste dumps should be designed and located to reduce visual impact. Advantage should be taken of natural topography and exciting vegetation and if this not a practical option, a screen of trees should be established.

- Measures should be taken to prevent or minimise soil erosion.
- As far as is practical, topsoil should be stripped from all areas to be distributed by mining operations/milling and used immediately if possible or preserved for later rehabilitation.
- Areas disturbed by mining should be re-vegetated as far as is practical using indigenous grass or tree species. However, on sites such as tailings/waste dumps, where it is important to establish a vegetative cover as soon as possible on difficult growing mediums, the use of fast-growing exotic species is acceptable. Care should be taken to prevent the entry and spread of noxious plants.
- Explosives, hydrocarbon fuels and other toxic materials should be transported stored and handled in a safe and acceptable manner. They should be stored in safe place, fenced to prevent entry of unauthorised persons. The owner /manager should ensure that toxic materials do not escape into the surrounding rivers/ground waters.
- Mine operators should strive to conserve local flora and fauna species and avoid unnecessary destruction of both.
- Unique archaeological, historical, geological, and scenic features should be protected at all mining sites.
- Residents in the vicinity of a mine should not be subjected to excessive airborne emissions (including dust, gases, and smokes), liquid effluent, noise, ground vibrations and air blast from mining /haulage operations.
- Mine tailings and slimes should be disposed of/stored in impoundments constructed in accordance with sound engineering principles. The dams should be sited to avoid the encountering of permeable sub-soil and/or fracture systems and an adequate drainage system should be incorporated in the design. They should be sited so that their catchments are minimal and should be designed to withstand significant rainfall events.
- Unless otherwise approved, at the cessation of mining, or earlier if practical, waste rock dumps should be stabilized by reducing the slope angle and re-vegetated. Topsoil should be used if practicable.
- All shafts not being used should be securely capped/otherwise made safe to prevent the entry of persons/livestock.
- The final land use of open cast mine /quarry should be determined prior to the cessation of mining. For example, if the site is to be used for water storage, then at the end of the mine life, drainage could be directed into the pit. If the pit/quarry is to be used for any other purpose then drainage should not be diverted around the site.
- The final land use will dictate the amount of reshaping required on the pit faces. Where practical the slope of the steep faces should be reduced and benches top soiled (if available) to facilitate re-vegetation and blending with the surrounding landscape.
- If practical quarry faces should be oriented to minimise their visual impact from public areas.
- Dangerous excavations should be made safe to prevent entry of persons/livestock.
- In strip mining operations, overburden material, which is adverse to plant growth, should be buried and every effort should be made to recover and store topsoil from mining path for later rehabilitation.

- Heap leach operations should be designed to ensure that there is zero discharge of process fluid on surface waters or ground waters.
- Unless otherwise approved, heap leach pads should be rehabilitated after leaching by detoxification, re-contouring, re-top soiling, and re-vegetation so that they will be in stable maintenance free condition. Alternatively, the heaps could be used to backfill nearby pits.
- Mine rehabilitation should be carried out progressively to ensure that a minimum of ground is disturbed at any one time. A maximum of 2 hectares shall be un-rehabilitated at any one time unless otherwise approved.
- The mining and rehabilitation method should ensure each layer disturbed should be replaced to its original sequence at topsoil as its final layer. All disturbed areas should be progressively rehabilitated.
- Tailings and Slimes from wasting plants should be expounded in properly constructed dams unless otherwise approved.
- All drill holes should be capped, plugged/filled in, either progressively or at the end of the program.
- All drilling sites, trenches and pits should be rehabilitated (i.e., backfilled and re-vegetated) after the cessation of mining.
- Each site should be left in a clean and tidy condition with all refuse removed.

Mine closures can be planned for and should form part of an integrated land use strategy that involves the community and surrounding farm owners. The decommissioning of the granite mining at the sites is envisaged in the future. Planned closure, in consultation with the farm owner, Arandis Municipality and the community, provides the opportunity to develop alternative land uses through rehabilitation, and to use the remaining infrastructure for other economic purposes such as livestock farming or charcoal production. When the event occurs, some recommendations have been outlined in **Table 6**.

**Table 6: Decommissioning phase management actions**

| Environmental Feature | Management Actions |
|---|---|
| Deconstruction activity | Many of the mitigation measures prescribed for the dimension stone mining & quarry rehabilitation activities (**Table 3 & 4** above) would be applicable to some of the decommissioning activities. These should be adhered to where applicable. |
| Rehabilitation | In the event that decommissioning is deemed necessary, excavations need to be rehabilitated according to the management actions laid out in **Table 3 & 4** above. |

## 4 ANNEXURE A- WATER QUALITY GUIDELINES

THE WATER ACT, 1956 (ACT 54 OF 1956) AND ITS REQUIREMENTS IN TERMS OF WATER SUPPLIES FOR DRINKING WATER AND FOR WASTE WATER TREATMENT AND DISCHARGE INTO THE ENVIRONMENT

### 1. INTRODUCTION

The provisions of the Water Act are intended, amongst other things, to promote the maximum beneficial use of the country's water supplies and to safeguard water supplies from avoidable pollution.

The drinking water guidelines are not standards as no publication in the Government Gazette of Namibia exists to that effect. However the Cabinet of the Transitional Government for National Unity adopted the existing South African Guidelines (461/85) and the guidelines took effect from 1April 1988 under the signature of the then Secretary for Water Affairs.

The sections of the Water Act that relate to the discharge of industrial effluents are: - Section 21(1) which states that

-- The purification of waste water shall form an integral part of water usage and

-- that purified effluents shall comply with the General Standard Quality restrictions as laid out in Government Gazette R553 of 5 April 1962 and

- Section 21(2) which further stipulate that this purified effluent be returned as close as possible to the point of abstraction of the original water.

Where a local authority has undertaken the duty of disposing of all effluents from an industrial process the provisions of Section 21(1) and 21(2) apply to the local authority and not the producer of the effluents. If there is difficulty in complying with these provisions then the applicant may apply for an exemption from the conditions in terms of Section 21(5) and 22(2) of the Water Act. The Permanent Secretary after consultation with the Minister may grant the issuance of a Waste Water Discharge Permit under Sections 21(5) and 22(2) subject to such conditions as he may deem fit to impose.

After independence, the Government of the Republic of Namibia decided that for the interim the existing guidelines will continue to be valid and to remain in use until a proper study has been conducted and new standards have been formulated (Article 140 of Act 1 of 1990).

## 2. GUIDELINES FOR THE EVALUATION OF DRINKING-WATER QUALITY FOR HUMAN CONSUMPTION WITH REGARD TO CHEMICAL, PHYSICAL AND BACTERIOLOGICAL QUALITY

Water supplied for human consumption must comply with the officially approved guidelines for drinking-water quality. For practical reasons the approved guidelines have been divided into three basic groups of determinants, namely:

- Determinants with aesthetic / physical implications: TABLE 1.
- Inorganic determinants: TABLE 2.
- Bacteriological determinants: TABLE 3.

### 2.1 CLASSIFICATION OF WATER QUALITY

The concentration of and limits for the aesthetic, physical and inorganic determinants define the group into which water will be classified. See TABLES 1 and 2 for these limits. The water quality has been grouped into 4 quality classes:

2.1 Group A: Water with an excellent quality
2.2 Group B: Water with acceptable quality
2.3 Group C: Water with low health risk
Group D: Water with a high health risk, or water unsuitable for human consumption.

Water should ideally be of excellent quality (Group A) or acceptable quality (Group B), however in practice many of the determinants may fall outside the limits for these groups.

If water is classified as having a low health risk (Group C), attention should be given to this problem, although the situation is often not critical as yet.

If water is classified as having a higher health risk (Group D), urgent and immediate attention should be given to this matter.

Since the limits are defined on the basis of average lifelong consumption, short-term exposure to determinants exceeding their limits is not necessarily critical, but in the case of toxic substances, such as cyanide, remedial measures should immediately be taken.

The overall quality group, into which water is classified, is determined by the determinant that complies the least with the guidelines for the quality of drinking water.

TABLE 1: DETERMINANTS WITH AESTHETIC / PHYSICAL IMPLICATIONS

| DETERMINANTS | UNITS* | LIMITS FOR GROUPS | | | |
|---|---|---|---|---|---|
| | | A | B | C | D** |
| Colour | mg/l Pt*** | 20 | | | |
| Conductivity | mS/m !at 25 °C | 150 | 300 | 400 | 400 |
| Total hardness | mg/l $CaCO_3$ | 300 | 650 | 1300 | 1300 |
| Turbidity | N.T.U**** | 1 | 5 | 10 | 10 |
| Chloride | mg/l Cl | 250 | 600 | 1200 | 1200 |
| Chlorine (free) | mg/l Cl | 0,1- 5,0 | 0,1 – 5,0 | 0,1 – 5,0 | 5,0 |
| Fluoride | mg/l F | 1,5 | 2,0 | 3,0 | 3,0 |
| Sulphate | mg/l $SO_4$ | 200 | 600 | 1200 | 1200 |
| Copper | µg/l Cu | 500 | 1000 | 2000 | 2000 |
| Nitrate | mg/l N | 10 | 20 | 40 | 40 |
| Hydrogen Sulphide | µg/l $H_2S$ | 100 | 300 | 600 | 600 |
| Iron | µg/l Fe | 100 | 1000 | 2000 | 2000 |
| Manganese | µg/l Mn | 50 | 1000 | 2000 | 2000 |
| Zink | mg/l Zn | 1 | 5 | 10 | 10 |
| pH**** | pH-unit | 6,0 – 9,0 | 5,5 – 9,5 | 4,0 – 11,0 | 4,0 – 11,0 |

* In this and all following tables "l" (lower case L in ARIAL) is used to denote $dm^3$ or litre
2.3 All values greater than the figure indicated.
2.2 Pt = Platinum Units
3.0 Nephelometric Turbidity Units
***** The pH limits of each group exclude the limits of the previous group

TABLE 2: INORGANIC DETERMINANTS

| DETERMINANTS | UNITS | LIMITS FOR GROUPS | | | |
|---|---|---|---|---|---|
| | | A | B | C | D* |
| Aluminium | µg/l Al | 150 | 500 | 1000 | 1000 |
| Ammonia | mg/l N | 1 | 2 | 4 | 4 |
| Antimonia | µg/l Sb | 50 | 100 | 200 | 200 |
| Arsenic | µg/l As | 100 | 300 | 600 | 600 |
| Barium | µg/l Ba | 500 | 1000 | 2000 | 2000 |
| Beryllium | µg/l Be | 2 | 5 | 10 | 10 |
| Bismuth | µg/l Bi | 250 | 500 | 1000 | 1000 |
| Boron | µg/l B | 500 | 2000 | 4000 | 4000 |
| Bromine | µg/l Br | 1000 | 3000 | 6000 | 6000 |
| Cadmium | µg/l Cd | 10 | 20 | 40 | 40 |
| Calcium | mg/l Ca | 150 | 200 | 400 | 400 |
| Calcium | mg/l $CaCO_3$ | 375 | 500 | 1000 | 1000 |
| Cerium | µg/l Ce | 1000 | 2000 | 4000 | 4000 |
| Chromium | µg/l Cr | 100 | 200 | 400 | 400 |
| Cobalt | µg/l Co | 250 | 500 | 1000 | 1000 |
| Cyanide (free) | µg/l CN | 200 | 300 | 600 | 600 |
| Gold | µg/l Au | 2 | 5 | 10 | 10 |
| Iodine | µg/l I | 500 | 1000 | 2000 | 2000 |
| Lead | µg/l Pb | 50 | 100 | 200 | 200 |
| Lithium | µg/l Li | 2500 | 5000 | 10000 | 10000 |
| Magnesium | mg/l Mg | 70 | 100 | 200 | 200 |
| Magnesium | mg/l $CaCO_3$ | 290 | 420 | 840 | 840 |
| Mercury | µg/l Hg | 5 | 10 | 20 | 20 |
| Molybdenum | µg/l Mo | 50 | 100 | 200 | 200 |
| Nickel | µg/l Ni | 250 | 500 | 1000 | 1000 |
| Phosphate | mg/l P | 1 | See note below | See note below | See note below |
| Potassium | mg/l K | 200 | 400 | 800 | 800 |
| Selenium | µg/l Se | 20 | 50 | 100 | 100 |
| Silver | µg/l Ag | 20 | 50 | 100 | 100 |
| Sodium | mg/l Na | 100 | 400 | 800 | 800 |
| Tellurium | µg/l Te | 2 | 5 | 10 | 10 |
| Thallium | µg/l Tl | 5 | 10 | 20 | 20 |
| Tin | µg/l Sn | 100 | 200 | 400 | 400 |
| Titanium | µg/l Ti | 100 | 500 | 1000 | 1000 |
| Tungsten | µg/l W | 100 | 500 | 1000 | 1000 |
| Uranium | µg/l U | 1000 | 4000 | 8000 | 8000 |
| Vanadium | µg/l V | 250 | 500 | 1000 | 1000 |

All values greater than the figure indicated.

Note FOR Table 2 on phosphate: Phosphates are not toxic and essential for all life-forms. Natural water will, however, seldom contain phosphate; it is generally seen as an indicator of pollution and is usually accompanied by other pollutants. Wherever drinking water is combined with or consists wholly of reclaimed or recycled water, it may be expected to contain phosphate. The general guideline for a concentration level to be aimed at is 1 mg/l as P. But in many cases this may be difficult to achieve technically. For this reason the Department will allow a phosphate concentration level of up to 5 mg/l as P in water intended for human consumption. Please refer also to the "Note on Phosphate" under Section 3: General Standards for Waste/Effluent.

## 2.2 BACTERIOLOGICAL DETERMINANTS

The bacteriological quality of drinking water is also divided into four groups, namely:

- Group A: Water which is bacteriological very safe;
- Group B: Water which is bacteriological still suitable for human consumption;
- Group C: Water which is bacteriological risk for human consumption, which requires immediate action for rectification;
- Group D: Water, which is bacteriological unsuitable for human consumption.

TABLE 3: BACTERIOLOGICAL DETERMINANTS

| DETERMINANTS | LIMITS FOR GROUPS | | | |
|---|---|---|---|---|
| | A** | B** | C | D* |
| Standard plate counts per 1 ml | 100 | 1000 | 10000 | 10000 |
| Total coliform counts per 100 ml | 0 | 10 | 100 | 100 |
| Faecal coliform counts per 100 ml | 0 | 5 | 50 | 50 |
| E. coli counts per 100 ml | 0 | 0 | 10 | 10 |

□ All values greater than the figure indicated.
** In 95% of the samples.

NB If the guidelines in group A are exceeded, a follow-up sample should be analysed as soon as possible.

## 2.3 FREQUENCY FOR BACTERIOLOGICAL ANALYSIS OF DRINKING-WATER SUPPLIES

The recommended frequency for bacteriological analysis of drinking water is given in Table 4.

TABLE 4: FREQUENCY FOR BACTERIOLOGICAL ANALYSIS

| POPULATION SERVED | MINIMUM FREQUENCY OF SAMPLING |
|---|---|
| More than 100 000 | Twice a week |
| 50 000 – 100 000 | Once a week |
| 10 000 – 50 000 | Once a month |
| Minimum analysis | Once every three months |

## 3 GENERAL STANDARDS FOR WASTE / EFFLUENT WATER DISCHARGE INTO THE ENVIRONMENT

All applications in terms of Section 21(5) and 22(2), for compliance with the requirements of Section 21(1) and 21(2) of the Water Act (Act 54 of 1956) that purified water shall comply with the General Standard as laid out in Government Gazette Regulation R553 of 5 April 1962.

TABLE 5 GENERAL STANDARDS FOR ARTICLE 21 PERMITS (EFFLUENTS)

| DETERMINANTS | MAXIMUM ALLOWABLE LEVELS |
|---|---|
| Arsenic | 0,5 mg/l as As |
| Biological Oxygen Demand (BOD) | no value given |
| Boron | 1,0 mg/l as B |
| Chemical Oxygen Demand (COD) | 75 mg / l as O |
| Chlorine, residual | 0,1 mg/l as $Cl_2$ |
| Chromium, hexavalent | 50 Ng/l as Cr(VI) |
| Chromium, total | 500 Ng/l as Cr |
| Copper | 1,0 mg/l as Cu |
| Cyanide | 500 Ng/l as CN |
| Oxygen, Dissolved (DO) | at least 75% saturation** |
| Detergents, Surfactants, Tensides | 0,5 mg/l as MBAS – See also Note 2 |
| Fats, Oil & Grease (FOG) | 2,5 mg/l (!gravimetric method) |
| Fluoride | 1,0 mg/l as F |
| Free & Saline Ammonia | 10 mg/l as N |
| Lead | 1,0 mg/l as Pb |
| Oxygen, Absorbed (OA) | 10 mg / l as O* |
| pH | 5,5 – 9,5 |
| Phenolic Compounds | 100 Ng/l as phenol |
| Phosphate | 1,0 mg/l as P - See also Note 1 |
| Sodium | not more than 90 mg/l Na more than influent |
| Sulphide | 1,0 mg/l as S |
| Temperature | 35°C |
| Total Dissolved Solids (TDS) | not more than 500 mg /l more than influent |
| Total Suspended Solids (TSS) | 25 mg/l |
| Typical faecal Coli. | no typical coli should be counted per 100 ml |
| Zinc | 5,0 mg/l as Zn |

* Also known as Permanganate Value (or PV).
** In Windhoek the saturation level is at approx. 9 mg/l $O_2$.

Note (1) on phosphate: Phospates are not toxic and essential for all life forms. Natural water will seldom contain phosphate; it is generally seen as an indicator of pollution and is usually accompanied by other pollutants. Wherever drinking water is combined with or consists wholly of reclaimed or recycled water, it may be expected to contain phosphate. There is no general guideline for phosphate contained in the Regulation 553. But generally it is assumed that eutrophication or algal bloom in dams is promoted by nutrient concentrations as low as 0,01 mg/l as P; generally a phosphate concentration limit for dams of 0,1 mg/l is recommended. All water that is consumed and subsequently discharged, will eventually end up in rivers, dams or

groundwater – that is why for potable water, a concentration level of 1 mg/l as P is aimed at.

But, again, in many cases of waste and effluent treatment, this may be difficult to achieve technically, or the required waste and effluent treatment infrastructure is not available; as the required infrastructure is sophisticated and expensive. The current situation calls for a compromise and for this reason, this Department will judge each application individually on its merits and allow, in certain cases, a phosphate concentration level of up to 15 mg/l as P in any effluent or waste stream to be discharged into the environment. This regulation is subject to be reviewed every two years, calculated from the date of approval of this document.

Note (2) on detergents, surfactants and ten sides: The MBAS (or methylene blue active substances) – test does not encompass all surface active compounds currently, commercially available. The limit given is therefore only a guideline. Many of the cleaning agents are toxic to biological life-forms in rivers and dams.

It should be taken into consideration that some commercial products interfere with the effective removal of oil, fat and grease by grease and fat traps, by breaking up such long-chain molecules into shorter ones. These cleaning agents thus effectively allow such components to pass through the traps and land into sections of a treatment plant further down the line and interfere with the process there.

Many cleaning agents contain very powerful disinfectants, and/or biocides. Such substances may interact with biological treatment processes. They may reduce the effectiveness of such treatment or 'kill' it completely, if they land in septic tanks, biofilters or even activate-sludge plants. Their activity may be attenuated by dilution.

## 4. AUTHORIZATION

Herewith, the Guidelines for the Evaluation of Drinking Water for Human Consumption with regard to Chemical, Physical and Bacteriological Quality, as well as the General Standards for Article 21* Permits, amended for detergents, surfactants, ten sides, as well as phosphates, are confirmed and remain in force until further notice.

Issued under my hand with the authority vested in my office, within the Ministry for Agriculture, Water and Rural Development,

PERMANENT SECRETARY
Dr V Shivute

WINDHOEK, DATE STAMP