

# ENVIRONMENTAL IMPACT ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PLAN



**FOR THE PROPOSED AGGREGATE STONE QUARRY BY  
PEACE GARDEN GAME FARM CC OVER MINING CLAIMS ,  
71806, 71807, 71808, 71809, 71810, 71811, 71812, 71813,  
71814 AND 71815 IN THE OMAHEKE REGION.**

## **ABSTRACT**

Peace Garden Game farm cc holds rights over Mining Claims , 71806, 71807, 71808, 71809, 71810, 71811, 71812, 71813, 71814 and 71815 in the Omaheke region. Peace Garden Game farm cc is a Namibian owned company interested in quarrying aggregate stone in particular the sandstone at farm Magariental 81/Peace Garden Game farm.

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## PROJECT INFORMATION

**PROJECT TITLE:** ENVIRONMENTAL IMPACT ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PLAN FOR THE PROPOSED AGGREGATE STONE QUARRY BY PEACE GARDEN GAME FARM CC OVER MINING CLAIMS , 71806, 71807, 71808, 71809, 71810, 71811, 71812, 71813, 71814 AND 71815 IN THE OMAHEKE REGION.

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# 1. PROJECT BACKGROUND AND INTRODUCTION

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## 1.1 General Overview

The accelerated development in Namibia in the last 30 years has led to more pressure on the natural resources which are mainly limited. This pressure has become more and more in recent years to meet the demands for infrastructure projects such as the creation of mass housing, buildings, paving roads, building bridges and others. In order to cope with the rapid development in the Namibia, many companies have invested in stone aggregate mining and quarries which abundantly exist in the mountainous areas.

Several serious environmental impacts related to quarrying activities has previously been recorded, such as vibrations, land degradation, land subsidence and landslides, water pollution, occupational noise pollution, and air pollution, will lead to health-related problems and loss of biodiversity.

Quarrying operations can adversely alter pre-existing ecosystems, and change hydrogeological and hydrological regimes. This adverse influence of stone and sand quarrying induces damage in property, depletion of ground water, loss of fertile topsoil, degradation of forests, deterioration in aquatic biodiversity and public health.

Quarrying basically destroys landscape. This can lead to downstream movement, scouring, or accumulation of sediment.

In spite of the economic benefit of aggregate mining, there are environmental impacts which should be controlled in order to preserve the environment resources and human welfare. The stone quarry industry is an important industry to the national economy due to its role in supplying essential raw materials for the construction and manufacturing industries. However, it is recognized that stone quarry activities can have a significant impact on the environment. All development have potential negative environmental consequences, but identifying the most important flora species including high risk habitats before hand, coupled with environmentally acceptable mitigation factors lessens the

overall impacts of such development. It is suggested that a stone quarry be constructed according to the HSE (Health, Safety and Environment) requirements from the Ministry of Mines and Energy and the Ministry of Environment and Tourism. In order to minimize any negative impacts, the stone quarry design has incorporated all health and safety and environmental standards .Hence this document provides guidelines for avoiding, or minimising those impacts.

## 1.2 Introduction

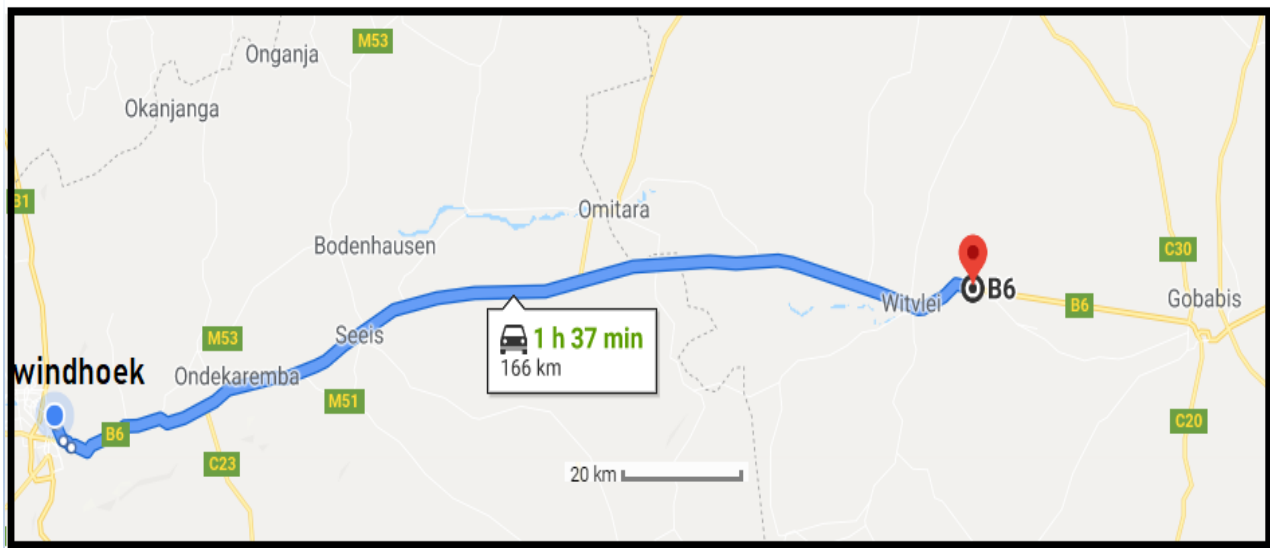
Centre for Geosciences Research cc was appointed to undertake the EIA on the proposed establishment of a stone quarry. See Figure 1 (for location map).

Peace Garden Game farm cc holds rights over Mining Claims , 71806, 71807, 71808, 71809, 71810, 71811, 71812, 71813, 71814 and 71815 in the Omaheke region. Peace Garden Game farm cc is a Namibian owned company interested in quarrying aggregate stone in particular the sandstone at farm Magariental 81/Peace Garden Game farm. This rationale for the quarry is based upon the increasing demand for construction aggregate stone in Namibia, particularly in Omaheke region. Within the Omaheke region in Namibia, construction aggregate stone quarrying stone mining is not well appreciated due lack of adequate quarries that exist there to meet the demand supply for the construction and road industry. The aggregate quarry within the rural Omaheke has potential to sustain the farmers' income with recent past persistent periodic drought events, hence the opportunity presents as an alternative to farming land use practice to sustainable income generation. Therefore Peace Garden Game farm cc sees this as an opportunity to unveil the potential that the aggregate stone industry in Namibia has to offer.

With this short background, it further reiterated that Peace Garden Game farm cc propose to carry out small scale stone quarry mining at farm Magariental 81/Peace Garden Game farm. As stipulated in the Government gazette announcing the commencement of the Environmental Management Act 2007 that an Environmental Impact Assessment be conducted for every prospecting and mining undertaking. **Peace Garden Game farm cc** appointed **CENTRE FOR GEOSCIENCES RESEARCH** to carry out the said assessment for Mining claims, 71806, 71807, 71808, 71809, 71810, 71811, 71812, 71813, 71814 and 71815.

### 1.3 Location of project

The Mining claims, 71806, 71807, 71808, 71809, 71810, 71811, 71812, 71813, 71814 and 71815 are located in the Omaheke region in East-central Namibia. The deposit is located in the Gobabis District of the Omaheke region (**Figure 2**). The license hosts industrial rocks such as consolidated hard sandstone for the use as aggregate stone. The mining claims are located on the farm land comprising mainly of farm Magariental 81/Peace Garden Game farm. The area is accessed by driving about 166km east of Windhoek along the B6 road.



**Figure 1:** Project Location (Maps of Namibia, 2012)

## 2. SCOPE

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The scope of the EIA is to determine the potential environmental impacts emanating from commissioning and operation of the stone aggregate quarry. Relevant environmental data have been compiled by making use of secondary data and that from reconnaissance site visits. Potential environmental impacts and associated social impacts are identified and addressed in this report.

The aims and objective of this EIA report is to:

- Provide sufficient information to determine the significant adverse impacts of the proposed project;
- Identify a range of management actions that could mitigate the potential adverse impacts to acceptable levels;
- Comply with Namibia's Environmental Assessment Policy and Environmental Management and Assessment Act, and
- Provide sufficient information to the Ministry of Environment and Tourism and the Ministry of Mines and Energy, to make an informed decision regarding the proposed development.

### 3 METHODOLOGY

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The following methods were used to assess the potential impacts on the social and natural environment that will result from the commissioning and operation of the stone aggregate quarry.

- Baseline information about the site and its surrounding was obtained from existing secondary information as well as field observation.
- As part of the scoping process to determine potential environmental impacts, Interested and Affected Parties (I & APs) an advert to call for Public inputs and comments was placed in two (2) Local newspapers “The New Era, and The Confidante” (Appendix B). The I&AP specifically the adjacent immediate farm was informed through the registered mail for comments (Appendix C).. There was no public meeting held due the COVID-19 pandemic emergency restrictions.

## **4 ADMINISTRATIVE, LEGAL AND POLICY REQUIREMENTS**

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To protect the environment and achieve sustainable development, all projects, plans, programs and policies (PPPPs) deemed to have adverse impacts on the environment require an EIA, as per the Namibian legislation. The proposed development of the stone quarry mine is listed as a project requiring an environmental assessment. The clearance certificate will mean that the Ministry of Environment and Tourism are satisfied that the proposed development will have minimum impact on the environment.

The following legislation governs the EIA process in Namibia, pertaining to the proposed development.

### **4.1 The Namibian Constitution**

The statutory governing environmental regulatory framework in Namibia is based on Article 95 of the Constitution of the Republic of Namibia (1990), which states that; “the state shall actively promote and maintain the welfare of the people by adopting, inter alia, policies aimed at maintenance of ecosystems, essential ecological processes and biological diversity of Namibia and utilization of natural resources on a sustainable basis for the benefit of all Namibians both present and future.” Article 101 further states that; “the principles embodied within the constitution shall not of and by themselves be legally enforceable by any court, but shall nevertheless guide the Government in making and applying laws.” The courts are entitled to have regard to the said principles in interpreting any laws based on them.

## **4.2 Minerals (Prospecting and Mining) Act (No 33 of 1992)**

The national regulations governing prospecting and mining for mining and prospecting of minerals and rocks 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 quarry of aggregate 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.

### **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 1**).



**Table 1: Types of license regulated by the Mineral Act of 1992, activities and environmental requirements**

Types of license	Activities	Environmental Requirements
Exclusive Reconnaissance License (ERL)	1. Project Identification, 2. Reconnaissance	None Complete Environmental Questionnaire
Exclusive Prospecting License (EPL)	Exploration based on the following steps: Desktop study, Detailed Mapping, Geophysical Methods, Drilling and Bulk Sampling, Test a quarrying	Scoping Report, Environmental Impact Assessment (EIA)
Mining License	Preconstruction and Construction, Operation and, Ongoing Monitoring, Decommissioning, Closure, Restoration and Aftercare	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

## **4.3 Environmental Legislation**

### **4.3.1 Environmental Management Act No. 7 of 2007**

The Environmental Management Act No. 7 of 2007 is an important tool in terms of environmental protection. The Act requires adherence to the principle of optimal sustainable yield in the exploitation of all natural resources. The Act gives effect to Article 95 (l) of the Namibian Constitution by establishing general principles for the management of the environment and natural resources. It promotes the coordinated and integrated management of the environment. The Act promotes inter-generational equity in the utilization of all natural resources. Environmental impact assessments and consultations with communities and relevant regional and local authorities are provided for, to monitor the development of projects that potentially have an impact on the environment. According to the Act, Namibia's cultural and natural heritage is required to be protected and respected for the benefit of present and future generations. In order to promote the sustainable management of the environment and the use of natural resources, the Act has established a bundle of principles for decision-making on matters affecting the environment. The objective of the Act is laid down in its Section 2, which is to prevent and mitigate, on the basis of the principles set out in section 3, the significant effects of activities on the environment.

### **4.3.2 Environmental Impact Assessment Regulations No. 30 of 2012 of the Environmental Management of 2007**

Environmental Impact Assessment Regulations No. 30 of 2012 of the Environmental Management Act No. 7 of 2007 lists activities which may not be undertaken without environmental clearance certificate and hence are subject to an environmental assessment process. It is for these reasons that an environmental assessment should be undertaken to identify the fatal flaws associated with the various activities to be undertaken.

### **4.3.3 Environmental Assessment Policy for Sustainable Development and Environmental Conservation of 1995**

Currently, the Environmental Assessment process in Namibia is governed by the cabinet approved Environmental Assessment Policy published by the Ministry of Environment and Tourism in 1995. The Environmental Assessment policy for Sustainable Development and Environmental Conservation (1995) provides that all policies, projects and programs should be subjected to an Environmental Assessment, regardless of where these originate. The assessment must aim for a high degree of public participation, and consider the environmental costs and benefits of projects proposed. In order to allow for identification and avoidance of adverse impacts in line with best practice, Environmental Assessments should be conducted at an early phase of project development. The Directorate of Environmental Affairs (DEA) provides guidelines for environmental assessments for all construction related issues. The guidelines address obvious environmental aspects such as pollution and waste management as well as operational procedures and rehabilitation measures.

Environmental Assessment procedures as outlined in the Environmental Policy for sustainable Development and Environmental Conservation (2008) is shown in (Figure 2) below.

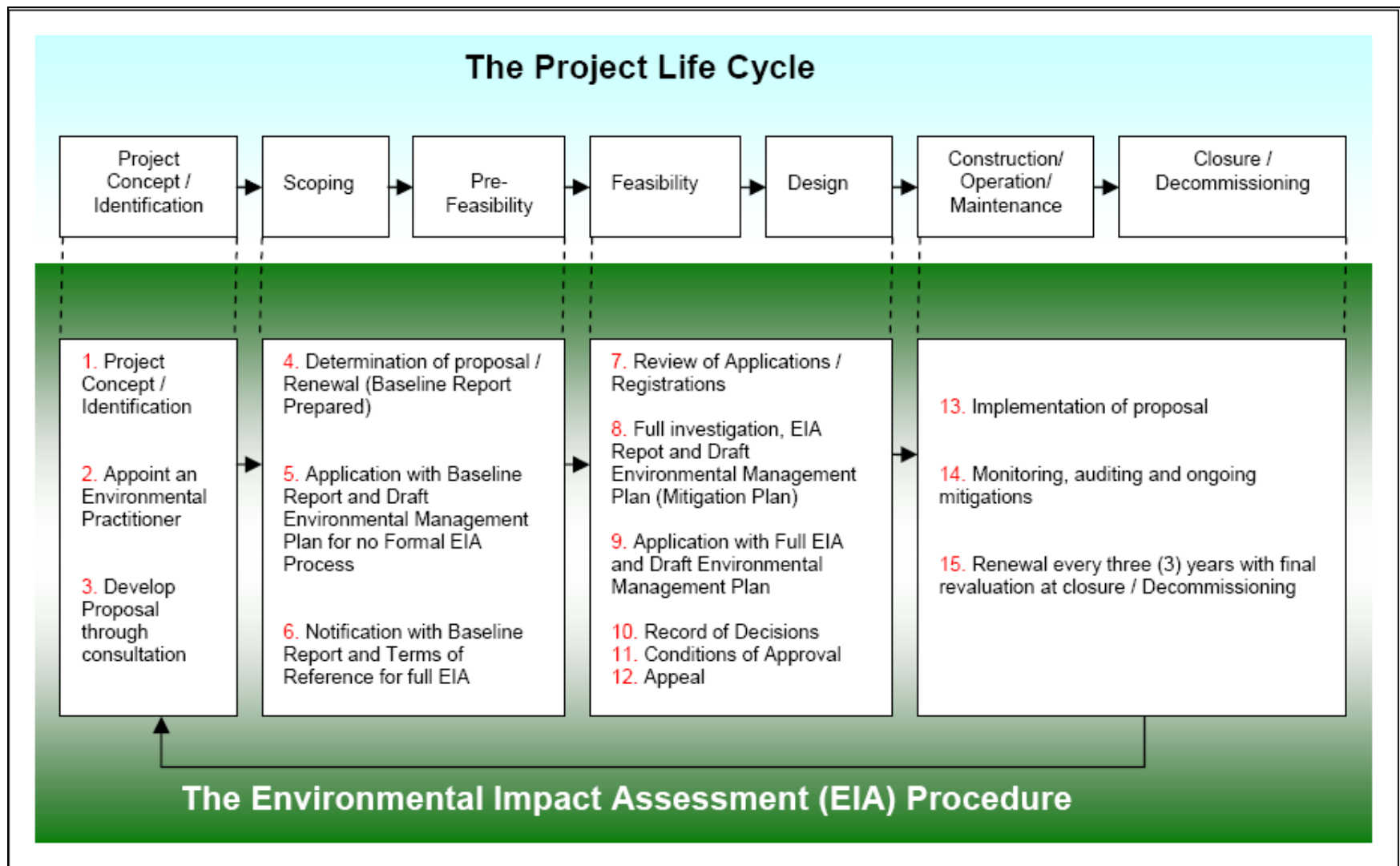


Figure 2: Environmental Assessment process in Namibia (Directorate of Environmental affairs DEA, 2008).

#### **4.3.4 The National Environmental Health Policy**

The construction of the fully fledged truck port must be guided by the aim of this Policy, which includes the following:

- Facilitate the improvement of the living and working environments of all Namibians, through pro-active preventative means, health education and promotion and control of environmental health standards and risks that could result in ill-health; and
- Ensure provision of a pro-active and accessible integrated and co-ordinated environmental health services at national, regional, district and local levels.

### **4.4 Water Resources Legislation**

#### **4.4.1 Water Resources Management Act, (No. 24 of 2004)**

The Water Resources Management Act, (No. 24 of 2004) which came into operation on 8 December 2004, makes provision for a number of functions pertaining to the management, control and use of water resources, water supply and protection of water resources. This Act repeals the Water Act No. 54 of 1956 referred to as the old Act. The Department of Water Affairs and Forestry (DWAF) in the Ministry of Agriculture, Water and Forestry (MAWF) has the mandate over the conservation and utilization of the water resources in Namibia. A distinction is made between private and public water in terms of ownership, control and use. In accordance with the Water Resources Management Act, 2004, (Act No. 24 of 2004) and in view of the arid nature of the Namibian environment, the disposal of waste-water as well as all other type of waste is strictly controlled. In most cases and in particular wastewater is disposed off in evaporation ponds because no effluent may be discharged into the ephemeral, dry riverbeds in the interior of Namibia. The reclamation, re-use and recycling of waste is encouraged whenever an industry applies for a waste water disposal permit. The objective of the Act is to ensure that Namibia's water resources are managed, developed, protected, conserved and used in ways which are consistent with or conducive to fundamental principles set out in section 3 of the Act.

## 4.5 Health and safety legislation

### 4.5.1 Regulations for the Health and Safety of Employees at Work of the Labour Act of 2007 (amended 2011)

The Regulations relating to Health and Safety at the Workplace in terms of the Labour Act No. 11 of 2007 came into force on 31 July 1997. These regulations prescribe conditions at the workplace, and *inter alia* deal with the following:

- ❖ Welfare and facilities at work-places, including lighting, floor space, ventilation, sanitary and washing facilities, usage and storage of volatile flammable substances, fire precautions, etc.
- ❖ Safety of machinery.
- ❖ Hazardous Substances including precautionary measures related to their transport, labeling, storage, and handling. Exposure limits, monitoring requirements, and record keeping are also covered.
- ❖ Physical hazards including noise, vibration, ionizing radiation, non-ionizing radiation, thermal requirements, illumination, windows and ventilation.
- ❖ Requirements for protective equipment.
- ❖ Emergency arrangements.
- ❖ Electrical safety.

Article 95 of Namibia's constitution provides that:

"The State shall actively promote and maintain the welfare of the people by adopting, *inter alia*, policies aimed at the following:

*(l) management of ecosystems, essential ecological processes and biological diversity of Namibia and utilization of living natural resources on a sustainable basis for the benefit of all Namibians, both present and future; in particular the Government shall provide measures against the dumping or recycling of foreign nuclear and toxic waste on Namibian territory."*

This article recommends that a relatively high level of environmental protection is called for in respect of pollution control and waste management.

## **4.6 National Heritage Act No. 27 of 2004**

The Heritage Act of 2004 makes provision for the developer to identify and assess any archaeological and historical sites of significance. The existence of any such sites should be reported to the Monuments Council as soon as possible. The Council may serve notice that prohibits any activities as prescribed within a specified distance of an identified heritage/archaeology site.

### **4.6.1 Cradle to Grave Responsibility**

This principle provides that those who manufacture potentially harmful products should be liable for their safe production, use and disposal and that those who initiate potentially polluting activities should be liable for their commissioning, operation and decommissioning.

### **4.6.2 Precautionary Principle**

There are numerous versions of the precautionary principle. At its simplest it provides that if there is any doubt about the effects of a potentially polluting activity, a cautious approach should be adopted.

### **4.6.3 The Polluter Pays Principle**

A person who generates waste or causes pollution should, in theory, pay the full costs of its treatment or of the harm, which it causes to the environment.

### **4.6.4 Public Participation and Access to Information**

In the context of environmental management, citizens should have access to information and the right to participate in decisions making.

## **4.7 Pollution Control and Waste Management Bill (guideline only)**

The proposed stone quarry aggregate at Peace Garden Game Farm is in reference to the above, only applies to Parts 2, 7 and 8 respectively.

Part 2 states that no person shall discharge or cause to be discharged any pollutant to the air from a process except under and in accordance with the provisions of an air

pollution licence issued under section 23. And also further provides for procedures to be followed in licence application, fees to be paid and required terms of conditions for air pollution licences.

Part 7 stipulate that any person who sells, stores, transports or uses any hazardous substances or products containing hazardous substances shall notify the competent authority, in accordance with sub-section (2), of the presence and quantity of those substances.

The competent authority for the purposes of section 74 shall maintain a register of substances notified in accordance with that section and the register shall be maintained in accordance with the provisions.

Part 8 provides for emergency preparedness by the person handling hazardous substances, through emergency response strategies.

#### **4.8 Atmospheric Pollution Prevention Ordinance of Namibia (No. 11 of 1976)**

Part 2 of the Ordinance governs the control of noxious or offensive gases. The Ordinance prohibits anyone from carrying on a scheduled process without a registration certificate in a controlled area. The registration certificate must be issued if it can be demonstrated that the best practical means are being adopted for preventing or reducing the escape into the atmosphere of noxious or offensive gases produced by the scheduled process.

Regulated by the Ministry of Health and Social Services

#### **4.9 Hazardous Substances Ordinance (No. 14 of 1974)**

The Ordinance applies to the manufacture, sale, use, disposal and dumping of hazardous substances, as well as their import and export and is administered by the Minister of Health and Social Welfare. Its primary purpose is to prevent hazardous substances from causing injury, ill-health or the death of human beings.



#### **4.10 Gobabis Municipality: Waste Management Regulations, Local Authority Act (No. 16 of 1993)**

The Gobabis Municipality developed a Solid Waste Management Policy and Regulations with the main objective of providing framework in which waste shall be governed in Gobabis, irrespective of the nature, toxicity and quantity. The policy with its regulations is also set to ensure that the management of waste is done in such a manner that the risk of impacts of waste on the residents and the environment are minimized. The policy focuses mainly on waste minimization in terms of prevention and increase re-use and recycling.

During construction, the waste produced is classified as builder's waste and will be mitigated in accordance to part 3 of chapter 3 in the regulation.

Business, recyclable and hazardous waste are some of the waste that will/can be produced during operation and/or decommissioning phase. This waste will be mitigated in accordance to part 4 and 5 of chapter 3 in the waste management regulations respectively.

#### **4.11 Water supply and sanitation policy (2008).**

The first Water Supply and Sanitation Policy (WASP) was adopted in 1993. Several developments then necessitated a review since. This Water Supply and Sanitation Policy (WSASP) of 2008 replaces the policy of 1993. The policy has principles that are in line with Integrated Water Resources Management including a strong focus on Water Demand Management (WDM). The policy aims on improving the provision of water supply in order to:

- Contribute to improved public health ;
- Reduce the burden of collecting water;
- Promote community based social development taking the role of women into account;
- Support basic water needs;
- Stimulate economic development; and
- Promote water conservation.

The policy also has operative strategies which would be to guarantee safe and affordable sanitation, encouraging decentralized sanitation systems where appropriate. The policy aims on improving the provision of sanitation services in order to:

- Contribute towards improved health and quality of life;
- Ensure an hygienic environment;
- Protect water sources from pollution;
- Protect conservations of water; and
- Stimulate economic development.

The Policy is regulated by the Ministry of Agriculture, Water and Forestry.

#### 4.12 Legal instrument relevant to this project

There are various legal instruments that advocates for the effects of small scale mining on the environment. Table 2 below shows the summaries of the legislation that are relevant to this project:

**Table 2: 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: Mining and Quarrying. Activities such as exploration 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 Henties 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
<p>Hazardous Substance such as used oil which (e.g. diesel)</p>	<p>Hazardous Substance Ordinance 14 of 1974</p>	<p>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”</p>	<p>Ministry of Health and Social Services</p>
<p>Fauna and flora</p>	<p>The Nature Conservation Ordinance, Ordinance of 1975,</p>	<p>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.</p>	<p>Ministry of Environment and Tourism (MET)</p>

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 be 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 construction, mining 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

#### 4.13 Regulatory authorities and permitting

The environmental regulatory authorities responsible for environmental protection and management in relation to the proposed small scale stone aggregate quarry project including their role in regulating environmental protection are listed in Table 3. Table 3 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 mining project.

**Table 3: 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 Mining	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).	

### 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.

## **5.0 Affected environment**

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

The proposed project aggregate stone quarry in 10 Mining Claims involves undertaking a small scale surface mining for sandstone. The overall aim of the project is to evaluate for possible development of a viable quarry for aggregate stone that may affect the environment. The mineral groups that are targeted in this 10 Mining claims is sandstones.

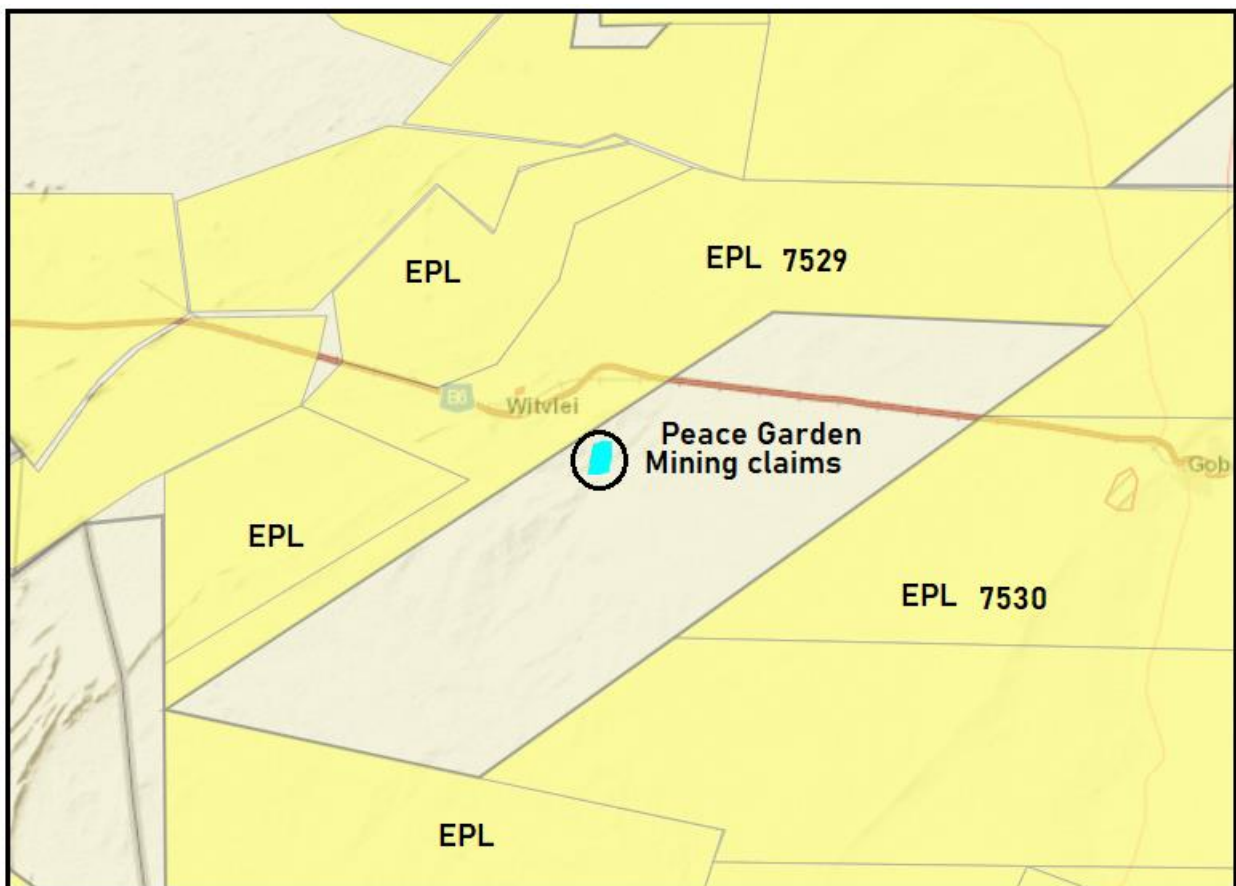
**5.1.1 Aggregate Stone:** In accordance with the provisions of Schedule 1, Groups of Minerals, Elements and Rock (Section 1), Part 2 of the Minerals (Prospecting and Mining) Act, 1992, (Act No. 33, 1992), aggregates Stone fall under the category of industrial minerals. Aggregates includes all rock material occurring naturally in, on or under the earth which is capable of being crushed down to the desired size using crushers, for the construction or road surfacing.



## 5.2 Social environment and archaeology

### Social environment

According to Namibia Statistic agency, (2011), majority of the people in the area of Gobabis area are heavily depended on livestock farming industry for their livelihood. However the area (Gobabis Town) has many various Exclusive Prospecting Licences ( Fig 3) activities specifically of base metals such as copper, adjacent to the proposed stone quarry at farm Magariental 81/Peace Garden Game farm .



**Fig 3,** Locality of Peace Garden mining claims in relation to current active exploration licenses.

The locality of the Mining Claims for stone aggregate Mining comprise of private farms. And majority of the farm owners are previous disadvantage people.

### **5.3 Archaeology**

There are no archaeological sites within and outside the boundary of the all the ten (10) Mining Claims. In Namibia, the archaeological sites are protected by laws 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 any existing archaeological sites located in and outside 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.

### **6.0 Biophysical Environment**

#### **Geology**

Regionally the Mining Claims are stratigraphically situated within the east central trending intracontinental arm of the Damara Orogen. The area geologically forms part of the Witvlei Group that is preserved in two regional synclinoria in the Gobabis-Witvlei area of east-central Namibia. It consists of mixed, coarse- to fine-grained siliciclastic and carbonate strata deposited in deep- to shallow-marine, and locally non-marine, settings along the post-rift continental margin of the Kalahari Craton prior to the onset of foreland basin sedimentation recorded by the overlying terminal Neoproterozoic–Cambrian Nama Group. No direct age constrains exist for the Witvlei Group, but it post-dates c. 800 Ma rift-related rocks and pre-dates the c. 548 Ma base of the Nama Group, thereby placing it as Cryogenian to Ediacaran in age. The Witvlei Group consists of three main units, from oldest to youngest, the Blaubeker, Court and Buschmannsklippe Formations. The Blaubeker Formation is highly variable in thickness and can be as much as 1000 m thick. It consists mostly of massive, polymict diamictite and, in the area of the type locality, contains conglomerate and pebbly sandstone beds. The diamictic strata combined with the presence of numerous faceted and striated clasts provide the evidence for glaciogenic influences on sedimentation. The highly variable thickness pattern likely reflects the infill of palaeo-valleys formed by the deep erosion and scouring of bedrock by ice, and the conglomerates and pebbly sandstones record glacial outwash processes. The Tahiti Formation is a locally developed, fine-grained sandstone above the Blaubeker Formation.

## 6.1 Biodiversity (fauna and flora)

The larger within the Ten Claim at Peace Garden Game Farm area accommodates both the mixed tree and savanna (Mendelsohn et al. 2002), the later occurring along the low-lying undulating hills that expand to Witvlei. The exact proposed site lies within the mixed tree and savanna (refer to figure 4).

As part of the baseline study, a desktop study (i.e. literature review) was conducted to the vertebrate fauna (e.g. reptiles, amphibians, mammals & birds) expected to occur in and around the Witvlei-Gobabis area.

This literature review was to determine the actual as well as potential vertebrate fauna associated with the general area commonly referred to as the Highland Savannah, which covers certain parts of the Witvlei-Gobabis area (Giess 1971, Mendelsohn *et al.* 2002, Van der Merwe 1983). Only 7% of the Savannah biome is formally protected.

East- Central Namibia in general, is regarded as “relatively moderate to high” in overall (all terrestrial species) diversity (Mendelsohn *et al.* 2002). Overall terrestrial endemism in the area is classified as “moderate to high” (Mendelsohn *et al.* 2002).

Literature review was also done to determine the actual as well as potential flora associated with the general area commonly referred to as the mixed tree and savanna (Giess 1971, Mendelsohn *et al.* 2002, Van der Merwe 1983). According to Maggs (1998) there are approximately 4 344 higher plant species with the most species being within the grasses (422), composites (Asteraceae) (385), legumes (Fabaceae) (377) and figies (Mesembryanthemaceae) (177), recorded from Namibia. Total species richness depends on further collecting and taxonomic revisions. High species richness is found in the Okavango, Otavi/Karsveld, Kaokoveld, southern Namib and Central Highland areas. Endemic species – approximately 687 species in total – are manly associated with the Kaokoveld (northwestern) and the succulent Karoo (southwestern) Namibia. The major threats to the floral diversity in Namibia are:

- (i). Conversion of the land to agriculture (with associated problems) and,
- (ii). poorly considered development (Maggs 1998, Mendelsohn *et al.* 2002).

The greatest variants affecting the diversity of plants are habitat and climate with the highest plant diversity generally associated with high rainfall areas. Sheep and goat farming is the dominant farming activity in the Witvlei=Gobabis area with between 90-100% of stock farmed with being sheep and 10% being goats (van der Merwe 1983).

The risk of farming is viewed as extremely high with the carrying capacity viewed as 0-10kg/ha (Mendelsohn *et al.* 2002) or >24ha/LAU (van der Merwe 1983).

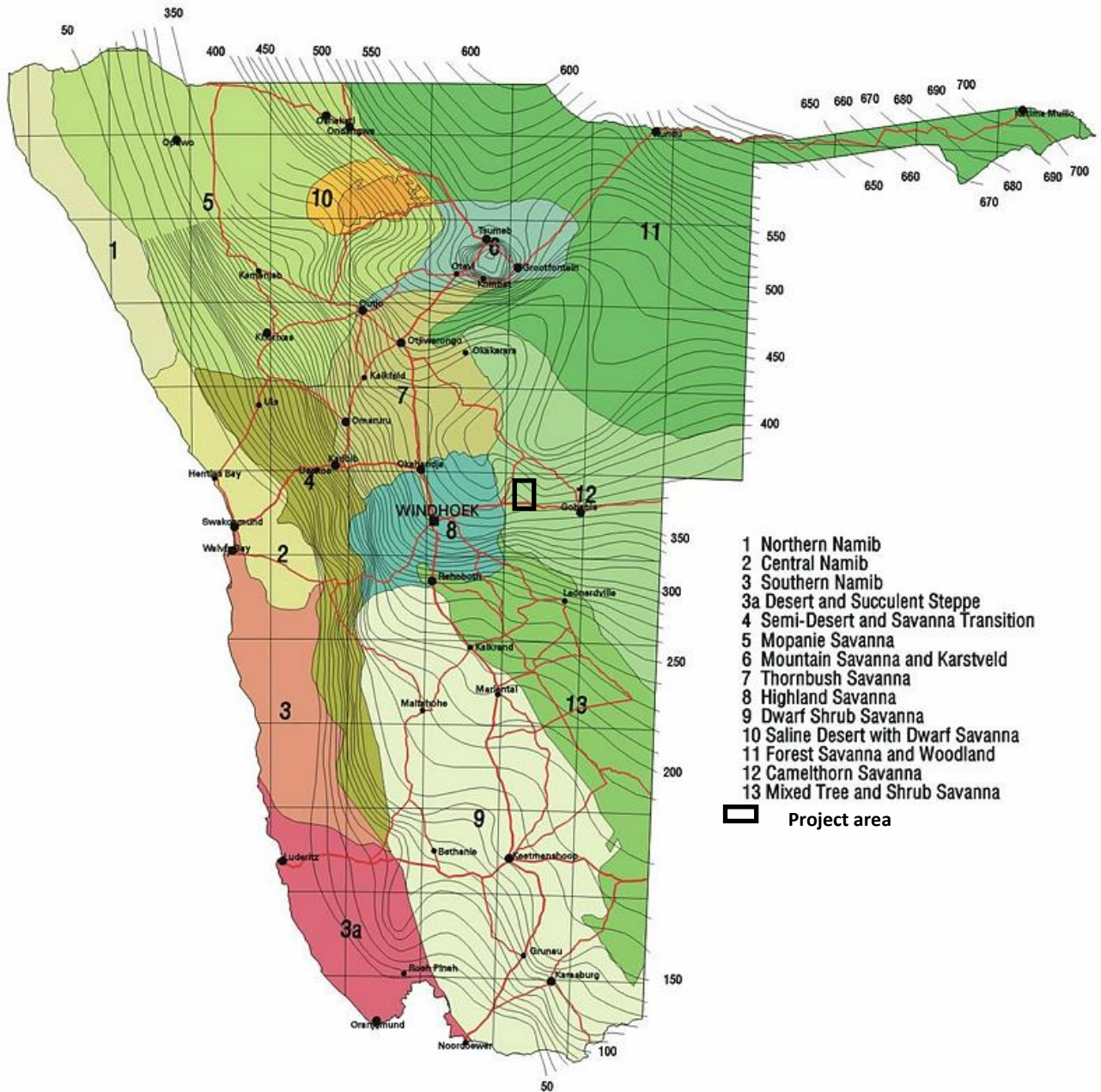


Figure 4: The vegetation zones of Namibia (Directorate of Environmental Affairs, 2002).

## Reptile Diversity

Table 4 indicates the reptile diversity expected to occur in the general Witvlei-Gobabis area.

Table 4: Reptile diversity expected to occur in the Witvlei-Gobabis area

Species: Scientific name	Species: Common name	Expected	Status
<b>TORTOISES &amp; TERRAPINS</b>			
<i>Geochelone pardalis</i>	Leopard Tortoise	√	
<i>Psammobates tentorius verroxii</i>	Bushmanland Tent Tortoise	√	Endemic
<i>Psammobates tentorius trimeni</i>	Namaqualand Tent Tortoise	√	Endemic
<i>Homopus solus</i>	Nama Padloper	√	Endemic
<b>SNAKES</b>			
<b>Blind Snakes</b>			
<i>Rhinotyphlops schinzi</i>	Schinz's Beaked Blind Snake	√	Endemic
<b>Thread Snakes</b>			
<i>Leptotyphlops gracilior</i>	Slender Thread Snake	√	Endemic
<i>Leptotyphlops scutifrons</i>	Peter's Thread Snake	√	
<i>Leptotyphlops occidentalis</i>	Western Thread Snake	√	Endemic
<b>Typical Snakes</b>			
<i>Lamprophis fuliginosus</i>	Brown House Snake	√	
<i>Lamprophis guttatus</i>	Spotted House Snake	√	Endemic
<i>Pseudaspis cana</i>	Mole Snake	√	
<i>Prosymna bivittata</i>	Two-striped Shovel-snout	√	Endemic
<i>Prosymna frontalis</i>	South-western Shovel-snout	√	
<i>Dipsina multimaculata</i>	Dwarf Beaked Snake	√	Endemic
<i>Psammophis trigrammus</i>	Western Sand Snake	√	
<i>Psammophis notostictus</i>	Karoo Sand Snake	√	
<i>Psammophis leightoni trinasalis</i>	Namib Sand Snake	√	
<i>Dasypeltis scabra</i>	Common/Rhombic Egg Eater	√	



<i>Telescopus semiannulatus polystrictus</i>	Eastern Tiger Snake	√	
<i>Telescopus beetzii</i>	Beetz's Tiger Snake	√	Endemic
<i>Aspidelaps lubricus lubricus</i>	Coral Snake	√	
<i>Naja nivea</i>	Cape Cobra	√	Endemic
<i>Naya nigricollis nigricincta</i>	Black-necked Spitting Cobra	√	Endemic
<i>Dendroaspis polylepis</i>	Black Mamba	√	
<i>Bitis arietans</i>	Puff Adder	√	
<i>Bitis caudalis</i>	Horned Adder	√	
<i>Bitis cornuta</i>	Many-horned Adder	√	Endemic
<i>Bitis xeropaga</i>	Desert mountain Adder	√	Endemic
<b>WORM LIZARDS</b>			
<i>Zygaspis quadrifrons</i>	Kalahari Round-headed Worm Lizard	√	
<i>Monopeltis infuscata</i>	Dusky Spade-snouted Worm Lizard	√	
<b>LIZARDS</b>			
<b>Skinks</b>			
<i>Acontias lineatus lineatus</i>	Striped Legless Skink	√	Endemic
<i>Typhlosaurus meyeri</i>	Meyer's Blind Legless Skink	√	Endemic
<i>Scelotes capensis</i>	Western Dwarf Burrowing Skink	√	Endemic
<i>Mabuya capensis</i>	Cape Skink	√	
<i>Mabuya occidentalis</i>	Western Three-striped Skink	√	
<i>Mabuya spilogaster</i>	Kalahari Tree Skink	√	
<i>Mabuya striata sparsa</i>	Striped Skink	√	
<i>Mabuya sulcata</i>	Western Rock Skink	√	
<i>Mabuya variegata variegata</i>	Variegated Skink	√	
<b>Old World Lizards</b>			
<i>Heliobolus lugubris</i>	Bushveld Lizard	√	
<i>Meroles ctenodactylus</i>	Smith's Desert Lizard	√	Endemic
<i>Meroles knoxii</i>	Knox's Desert Lizard	√	Endemic
<i>Pedioplanis lineocellata lineocellata</i>	Spotted Sand Lizard	√	Endemic
<i>Nucras tessellate</i>	Western Sandveld Lizard	√	Endemic

<i>Pedioplanis lineocellata</i>	Spotted Sand Lizard	√	Endemic
<i>Pedioplanis namaquensis</i>	Namaqua Sand Lizard	√	
<i>Pedioplanis inornata</i>	Plain Sand Lizard	√	Endemic
<b>Plated Lizards</b>			
<i>Cordylosaurus subtessellatus</i>	Dwarf Plated Lizard	√	
<b>Girdled Lizards</b>			
<i>Cordylus polyzonus</i>	Karoo Girdled Lizard	√	Endemic
<b>Flat Lizards</b>			
<i>Platysaurus capensis</i>	Cape Flat Lizard	√	Endemic
<b>Monitors</b>			
<i>Varanus albigularis</i>	Rock Monitor	√	
<b>Agamas</b>			
<i>Agama aculeate aculeata</i>	Ground Agama	√	
<i>Agama anchietae</i>	Anchieta's Agama	√	
<i>Agama atra</i>	Southern Rock Agama	√	Endemic
<i>Agama hispida</i>	Southern Spiny Agama	√	Endemic
<b>Chameleons</b>			
<i>Chamaeleo namaquensis</i>	Namaqua Chameleon	√	
<b>Geckos</b>			
<i>Chondrodactylus angulifer angulifer</i>	Giant Ground Gecko	√	Endemic
<i>Goggia gemmula</i>	Richtersveld Dwarf Leaf-toed Gecko	√	Endemic
<i>Goggia lineata</i>	Striped Dwarf Leaf-toed Gecko	√	Endemic
<i>Lygodactylus bradfieldi</i>	Bradfield's Dwarf Gecko	√	Endemic
<i>Narudasia festiva</i>	Festive Gecko	√	Endemic
<i>Pachydactylus bibronii</i>	Bibron's Thick-toed Gecko	√	Endemic
<i>Pachydactylus turneri</i>	Turner's Thick-toed Gecko	√	Endemic
<i>Pachydactylus mariquensis latirostris</i>	Marico Thick-toed Gecko	√	Endemic
<i>Pachydactylus namaquensis</i>	Namaqua Thick-toed Gecko	√	Endemic
<i>Pachydactylus haackei</i>	Haacke's Thick-toed Gecko	√	Endemic
<i>Pachydactylus punctatus</i>	Speckled Thick-toed Gecko	√	



<i>Pachydactylus rugosus rugosus</i>	Rough Thick-toed Gecko	√	Endemic
<i>Pachydactylus serval purcelli</i>	Western Spotted Thick-toed Gecko	√	Endemic
<i>Pachydactylus weberi</i>	Weber's Thick-toed Gecko	√	Endemic
<i>Phelsuma ocellata</i>	Namaqua Day Gecko	√	Endemic
<i>Ptenopus garrulus maculatus</i>	Common Barking Gecko	√	Endemic

Source for literature review: Branch (1998), Boycott & Bourquin 2000, Broadley (1983), Cunningham (2006), Griffin (2003), Hebbard (n.d.), Marais (1992)

Approximately 261 species of reptiles are known or expected to occur in Namibia thus supporting approximately 30% of the continents species diversity (Griffin 1998a). At least 22% or 55 species of Namibian lizards are classified as endemic. The occurrence of reptiles of “conservation concern” includes about 67% of Namibian reptiles (Griffin 1998a). Emergency grazing and large scale mineral extraction in critical habitats are some of the biggest problems facing reptiles in Namibia (Griffin 1998a). The overall reptile diversity and endemism in the Witvlei- Gobabis areas is estimated at between 51-60 species and 13-16 species, respectively (Mendelsohn *et al.* 2002). Griffin (1998a) presents figures of between 21-30 and 7-8 for endemic lizards and snakes, respectively, from the general south-western part of Namibia.

At least 72 species of reptiles are expected to occur in the Witvlei- Gobabis area with 42 species being endemic – i.e. 58% endemic. These consist of at least 24 snakes (1 blind snake, 3 thread snakes & 20 typical snakes), 11 of which are endemic (46%) to Namibia, 4 tortoises, 44 lizards, 28 (64%) of which are endemic to Namibia. The Nama Padloper (*Homopus solus*) tortoise, Namibia’s only true endemic (i.e. occurs only in Namibia), occurs in the area. Gecko’s (16 species) and Skink’s (9 species) are the most numerous lizards expected from the Witvlei- Gobabis areas. Namibia with approximately 129 species of lizards (Lacertilia) has one of the continents richest lizard fauna (Griffin 1998a). Due to the fact that reptiles are an understudied group of animals, especially in Namibia, it is expected that more species may be located in the Windhoek and Rehoboth areas than presented above.

## 6.2 Amphibian Diversity

Table 5 below indicates the amphibian diversity expected to occur in the general Witvlei-Gobabis.

Table 5. Amphibian diversity expected to occur in the Witvlei- Gobabis area.

Species: Scientific name	Species: Common name	Expected	Status
<b>Platannas</b>			
<i>Xenopus laevis</i>	Common Platanna	√	
<b>Kassinias</b>			
<i>Kassina senegalensis</i>	Bubbling Kasina	√	
<b>Rubber Frog</b>			
<i>Phrynomantis annectens</i>	Marbled Rubber Frog	√	Endemic
<b>Common Frogs</b>			
<i>Afrana fuscigula</i>	Cape River Frog	√	
<i>Cacosternum namaquense</i>	Namaqua Dainty Frog	√	
<b>Bull &amp; Sand Frogs</b>			
<i>Tomopterna cryptotus</i>	Tremolo Sand Frog	√	

Source for literature review: Carruthers (2001), Channing (2001), Channing & Griffin (1993), Passmore & Carruthers (1995)

Amphibians are declining throughout the world due to various factors of which much has been ascribed to habitat destruction. Basic species lists for various habitats are not always available with Namibia being no exception in this regard while the basic ecology of most species is also unknown. Approximately 4 000 species of amphibians are known worldwide with just over 200 species known from southern Africa and at least 57 species expected to occur in Namibia. Griffin (1998b) puts this figure at 50 recorded species and a final species richness of approximately 65 species, 6 of which are endemic to Namibia. This “low” number of amphibians from Namibia is not only as a result of the generally marginal desert habitat, but also due to Namibia being under studied and under collected. Most amphibians require water to breed and are therefore associated with the permanent water bodies, mainly in northeast Namibia.

## 6.3 Mammal Diversity

**Table 6** below indicates the mammal diversity known expected to occur in the general Witvlei- Gobabis area.

**Table 6. Mammal diversity known and/or expected to occur in the Witvlei-Gobabis areas.**

<b>Species: Scientific name</b>	<b>Species: Common name</b>	<b>Expected</b>	<b>Status</b>
<b>Shrews</b>			
<i>Crosidura cyanea</i>	Reddish-grey Musk Shrew	√	
<b>Elephant Shrews</b>			
<i>Macroscelides proboscideus</i>	Round-eared Elephant-shrew	√	Endemic <sup>2</sup> Vulnerable
<i>Elephantulus rupestris</i>	Smith's Rock Elephant-shrew	√	<sup>2</sup> Vulnerable
<i>Elephantulus intufi</i>	Bushveld Elephant-shrew	√	
<b>Bats</b>			
<i>Tadarida aegyptiaca</i>	Egyptian Free-tailed Bat	√	
<i>Myotis seabrai</i>	Angola Hairy Bat	√	
<i>Cistugo seabrai</i>	Namibian Wing-gland Bat	√	Endemic <sup>1</sup> Vulnerable
<i>Laephotis namibensis</i>	Namib Long-eared Bat	√	Endemic <sup>2</sup> Endangered
<i>Eptesicus hottentotus</i>	Long-tailed Serotine Bat	√	
<i>Pipistrellus capensis</i>	Cape Serotine Bat	√	
<i>Nycteris thebaica</i>	Common Slit-faced Bat	√	
<i>Rhinolophus fumigatus</i>	Rüppell's Horseshoe Bat	√	<sup>1</sup> Near Threatened
<i>Rhinolophus clivosus</i>	Geoffroy's Horseshoe Bat	√	<sup>1</sup> Near Threatened
<i>Rhinolophus darlingi</i>	Darling's Horseshoe Bat	√	<sup>1</sup> Near Threatened
<i>Rhinolophus denti</i>	Dent's Horseshoe Bat	√	<sup>1</sup> Near Threatened
<b>Monkeys &amp; Baboons</b>			
<i>Papio ursinus</i>	Chacma Baboon	√	
<b>Hares &amp; Rabbits</b>			
<i>Lepus capensis</i>	Cape Hare	√	
<i>Lepus saxatilis</i>	Scrub Hare	√	
<i>Pronolagus rupestris</i>	Smith's Red Rock Rabbit	√	
<b>Rodents</b>			
<b>Molerat</b>			

<i>Cryptomys damarensis</i>	Damara Molerat	√	
<b>Squirrels</b>			
<i>Xerus inauris</i>	Cape Ground Squirrel	√	
<i>Xerus princeps</i>	Mountain Ground Squirrel	√	Endemic <sup>1</sup> Near Threatened
<b>Porcupine, Springhare &amp; Dassie Rat</b>			
<i>Hystrix africaeaustralis</i>	Cape Porcupine	√	
<i>Pedetes capensis</i>	Springhare	√	
<i>Petromus typicus</i>	Dassie Rat	√	Endemic <sup>1</sup> Near Threatened
<b>Rats &amp; Mice</b>			
<i>Parotomys brantsii</i>	Brant's Whistling Rat	√	
<i>Parotomys littledalei</i>	Littledale's Whistling Rat	√	Endemic <sup>1</sup> Near Threatened
<i>Rhabdomys pumilio</i>	Striped Mouse	√	
<i>Mus musculus</i>	House Mouse	√	Invasive alien
<i>Aethomys namaquensis</i>	Namaqua Rock Mouse	√	
<i>Desmodillus auricularis</i>	Short-tailed Gerbil	√	
<i>Gerbillurus paeaba infernus</i>	Hairy-footed Gerbil	√	Endemic
<i>Gerbillurus vallinus</i>	Brush-tailed Hairy-footed Gerbil	√	Endemic
<i>Malacothrix typical</i>	Large-eared Mouse	√	
<i>Petromyscus collinus</i>	Pygmy Rock Mouse	√	Endemic
<b>Carnivores</b>			
<i>Proteles cristatus</i>	Aardwolf	√	
<i>Hyaena brunnea</i>	Brown Hyena	√	<sup>1</sup> Near Threatened <sup>2</sup> Endangered
<i>Acinonyx jubatus</i>	Cheetah	√	Vulnerable; CITES Appendix 1
<i>Panthera pardus</i>	Leopard	√	
<i>Felis caracal</i>	Caracal	√	
<i>Felis lybica</i>	African Wild Cat	√	
<i>Felis nigripes</i>	Small Spotted Cat	√	Rare; <sup>2</sup> Vulnerable; CITES Appendix 1
<i>Otocyon megalotis</i>	Bat-eared Fox	√	
<i>Vulpes chama</i>	Cape Fox	√	

<i>Canis mesomelas</i>	Black-backed Jackal	√	
<i>Mellivora capensis</i>	Ratel or Honey Badger	√	<sup>1</sup> Near Threatened
<i>Ictonyx striatus</i>	Striped Polecat	√	
<i>Genetta genetta</i>	Small-spotted Genet	√	
<i>Suricata suricatta</i>	Suricate	√	
<i>Cynictis penicillata</i>	Yellow Mongoose	√	
<i>Galerella sanguinea</i>	Slender Mongoose	√	
<i>Galerella pulverulenta</i>	Small Grey Mongoose	√	Rare
<b>Aardvark</b>			
<i>Orycteropus afer</i>	Aardvark	√	
<b>Dassie</b>			
<i>Procavia capensis</i>	Rock Dassie	√	
<b>Zebra</b>			
<i>Equus zebra hartmannae</i>	Hartmann's Mountain Zebra	√	Endemic
<b>Antelopes</b>			
<i>Alcelaphus buselaphus</i>	Red Hartebeest	√	
<i>Sylvicapra grimmia</i>	Common Duiker	√	
<i>Antidorcas marsupialis</i>	Springbok	√	
<i>Oreotragus oreotragus</i>	Klipspringer	√	
<i>Raphicerus campestris</i>	Steenbok	√	
<i>Oryx gazella</i>	Gemsbok	√	
<i>Tragelaphus strepsiceros</i>	Kudu	√	

<sup>1</sup>SARDB (2004)

<sup>2</sup>IUCN (2004)

Source for literature review: De Graaff (1981), Griffin (2005), Estes (1995), Joubert & Mostert (1975), Skinner & Smithers (1990) & Taylor (2000)

Namibia is well endowed with mammal diversity with at least 250 species occurring in the country. These include the well-known big and hairy as well as a legion of smaller and lesser-known species. Currently 14 mammal species are considered endemic to Namibia of which 11 species are rodents and small carnivores of which very little is known. Most endemic mammals are associated with the Namib and escarpment with 60% of these rock-dwelling (Griffin 1998c). According to Griffin (1998c) the endemic mammal fauna is best characterized by the endemic rodent family *Petromuridae* (Dassie rat) and the rodent genera *Gerbillurus* and *Petromyscus*. The overall mammal diversity in the general Witvlei-

Gobabis area is estimated at between 61-75 species with 9-10 species being endemic to the area (Mendelsohn *et al.* 2002).

According to the literature at least 62 species of mammals are expected to occur in the general Witvlei- Gobabis area of which 10 species (16%) are classified as endemic, 6 species as near threatened, 2 species as vulnerable and 2 species as rare (this excludes other categories - i.e. only take the highest category and not all a species might be classified as). The House Mouse (*Mus musculus*) is potentially viewed as an invasive alien species to the area. Mammal species probably underrepresented in the above mentioned table for the general area are bats and rodents, as these groups have not been well documented from the arid rocky southern parts of Namibia. Other species such as Cheetah and Red Hartebeest may not necessarily occur in the area throughout the year, but may venture into the area from time-to-time depending on rainfall, prey and disturbance elsewhere.

The general Witvlei-Gobabis area are understudied and under collected especially regarding the bat and rodent fauna. Overall terrestrial diversity – all species – is classified as “low” in the central-southern parts of Namibia (Mendelsohn *et al.* 2002). The overall diversity (3-4 species) and abundance of large herbivorous mammals is medium in the Witvlei-Gobabis areas with Springbok, Kudu and Oryx having the highest density of the larger species (Mendelsohn *et al.* 2002). The overall abundance and diversity of large carnivorous mammals is moderate (2-3 species) in the Witvlei-Gobabis areas with Leopard and Cheetah, followed by Brown Hyena having the highest density of the larger species (Mendelsohn *et al.* 2002). At least 30.7%, 27.4% and 17.73% of the mammalian fauna that occur or are expected to occur in the Witvlei-Gobabis area are represented by rodents (19 species), carnivores (17 species) and bats (11 species). Important habitats often not realised and/or neglected include mountains and hills as well as ephemeral rivers and drainage lines and associated vegetation. Habitat alteration and overutilization are the two primary processes threatening most mammals (Griffin 1998c).

## 6.4 Avian Diversity

Table 5 indicates the combined avian diversity expected to occur in the general Witvlei-Gobabis area

Table 7. Avian diversity known and/or expected to occur in the general Witvlei-Gobabis area

Species: Scientific name	Species: Common name	Expected	Status
<i>Struthio camelus</i>	Ostrich	√	
<i>Podiceps nigricollis</i>	Blacknecked Grebe	√	
<i>Tachybaptus ruficollis</i>	Dabchick	√	
<i>Puffinus griseus</i>	Sooty Shearwater	√	
<i>Pelecanus onocrotalus</i>	White Pelican	√	
<i>Phalacrocorax carbo</i>	Whitebreasted Cormorant	√	
<i>Phalacrocorax africanus</i>	Reed Cormorant	√	
<i>Anhinga melanogaster</i>	Darter	√	
<i>Ardea cinerea</i>	Grey Heron	√	
<i>Ardea melanocephala</i>	Blackheaded Heron	√	
<i>Ardea goliath</i>	Goliath Heron	√	
<i>Ardea purpurea</i>	Purple Heron	√	
<i>Egretta alba</i>	Great White Egret	√	
<i>Egretta garzetta</i>	Little Egret	√	
<i>Egretta intermedia</i>	Yellowbilled Egret	√	
<i>Bubulcus ibis</i>	Cattle Egret	√	
<i>Ardeola ralloides</i>	Squacco Heron	√	
<i>Butorides striatus</i>	Greenbacked Heron	√	
<i>Nycticorax nycticorax</i>	Blackcrowned Night Heron	√	
<i>Ixobrychus minutus</i>	Little Bittern	√	
<i>Scopus umbretta</i>	Hamerkop	√	
<i>Ciconia ciconia</i>	White Stork	√	
<i>Ciconia nigra</i>	Black Stork	√	
<i>Ciconia abdimii</i>	Abdim's Stork	√	
<i>Ciconia episcopus</i>	Woollynecked Stork	√	
<i>Leptoptilos crumeniferus</i>	Marabou Stork	√	
<i>Mycteria ibis</i>	Yellowbilled Stork	√	
<i>Threskiornis aethiopicus</i>	Sacred Ibis	√	
<i>Plegadis falcinellus</i>	Glossy Ibis	√	
<i>Platalea alba</i>	African Spoonbill	√	
<i>Phoenicopterus ruber</i>	Greater Flamingo	√	
<i>Phoenicopterus minor</i>	Lesser Flamingo	√	
<i>Dendrocygna viduata</i>	Whitefaced Duck	√	

<i>Dendrocygna bicolor</i>	Fulvous Duck	√	
<i>Thalassornis leuconotus</i>	Whitebacked Duck	√	
<i>Alopochen aegyptiacus</i>	Egyptian Goose	√	
<i>Tadorna cana</i>	South African Shelduck	√	
<i>Anas undulata</i>	Yellowbilled Duck	√	
<i>Anas sparsa</i>	African Black Duck	√	
<i>Anas capensis</i>	Cape Teal	√	
<i>Anas hottentota</i>	Hottentot Teal	√	
<i>Anas erythrorhyncha</i>	Redbilled Teal	√	
<i>Anas smithii</i>	Cape Shoveller	√	
<i>Netta erythrophthalma</i>	Southern Pochard	√	
<i>Sarkidiornis melanotos</i>	Knobbilled Duck	√	
<i>Plectropterus gambensis</i>	Spurwinged Goose	√	
<i>Oxyura maccoa</i>	Maccoa Duck	√	
<i>Sagittarius serpentarius</i>	Secretarybird	√	
<i>Gyps africanus</i>	Whitebacked Vulture	√	
<i>Torgos tracheliotus</i>	Lappetfaced Vulture	√	
<i>Milvus migrans</i>	Black Kite	√	
<i>Elanus caeruleus</i>	Blackshouldered Kite	√	
<i>Aquila verreauxii</i>	Black Eagle	√	
<i>Aquila rapax</i>	Tawny Eagle	√	
<i>Aquila wahlbergi</i>	Wahlberg's Eagle	√	
<i>Hieraaetus pennatus</i>	Booted Eagle	√	
<i>Hieraaetus spilogaster</i>	African Hawk Eagle	√	
<i>Polemaetus bellicosus</i>	Martial Eagle	√	
<i>Circaetus cinereus</i>	Brown Snake Eagle	√	
<i>Circaetus pectoralis</i>	Blackbreasted Snake Eagle	√	
<i>Haliaeetus vocifer</i>	African Fish Eagle	√	
<i>Buteo buteo</i>	Steppe Buzzard	√	
<i>Buteo rufofuscus</i>	Jackal Buzzard	√	
<i>Buteo augur</i>	Augur Buzzard	√	
<i>Kaupifalco monogrammicus</i>	Lizard Buzzard	√	
<i>Accipiter ovampensis</i>	Ovambo Sparrowhawk	√	
<i>Accipiter minullus</i>	Little Sparrowhawk	√	
<i>Accipiter badius</i>	Little Banded Goshawk	√	
<i>Micronisus gabar</i>	Gabar Goshawk	√	
<i>Melierax canorus</i>	Pale Chanting Goshawk	√	
<i>Circus macrourus</i>	Pallid Harrier	√	
<i>Polyboroides typus</i>	Gymnogone	√	
<i>Pandion haliaetus</i>	Osprey	√	
<i>Falco peregrinus</i>	Peregrine Falcon	√	
<i>Falco biarmicus</i>	Lanner Falcon	√	
<i>Falco subbuteo</i>	Hobby Falcon	√	
<i>Falco concolor</i>	Sooty Falcon	√	
<i>Falco vespertinus</i>	Western Redfooted Kestrel	√	
<i>Falco tinnunculus</i>	Rock Kestrel	√	
<i>Falco rupicoloides</i>	Greater Kestrel	√	



<i>Falco naumanni</i>	Lesser Kestrel	√	
<i>Polihierax semitorquatus</i>	Pygmy Falcon	√	
<i>Francolinus levaillantoides</i>	Orange River Francolin	√	
<i>Francolinus adspersus</i>	Redbilled Francolin	√	
<i>Francolinus hartlaubi</i>	Hartlaub's Francolin	√	
<i>Francolinus swainsonii</i>	Swainson's Francolin	√	
<i>Coturnix coturnix</i>	Common Quail	√	
<i>Numida meleagris</i>	Helmeted Guineafowl	√	
<i>Turnix sylvatica</i>	Kurrichane Buttonquail	√	
<i>Crex egregia</i>	African Crake	√	
<i>Amaurornis flavirostris</i>	Black Crake	√	
<i>Porzana porzana</i>	Spotted Crake	√	
<i>Porzana pusilla</i>	Baillon's Crake	√	
<i>Porphyrio porphyrio</i>	Purple Gallinule	√	
<i>Porphyryula alleni</i>	Lesser Gallinule	√	
<i>Gallinula chloropus</i>	Moorhen	√	
<i>Gallinula angulata</i>	Lesser Moorhen	√	
<i>Fulica cristata</i>	Redknobbed Coot	√	
<i>Ardeotis kori</i>	Kori Bustard	√	
<i>Eupodotis ruficrista</i>	Redcrested Korhaan	√	
<i>Eupodotis afrooides</i>	Whitequilled Korhaan	√	
<i>Actophilornis africanus</i>	African Jacana	√	
<i>Rostratula benghalensis</i>	Painted Snipe	√	
<i>Charadrius hiaticula</i>	Ringed Plover	√	
<i>Charadrius marginatus</i>	Whitefronted Plover	√	
<i>Charadrius pecuarius</i>	Kittlitz's Plover	√	
<i>Charadrius tricollaris</i>	Threebanded Plover	√	
<i>Charadrius asiaticus</i>	Caspian Plover	√	
<i>Pluvialis squatarola</i>	Grey Plover	√	
<i>Vanellus coronatus</i>	Crowned Plover	√	
<i>Vanellus armatus</i>	Blacksmith Plover	√	
<i>Arenaria interpres</i>	Turnstone	√	
<i>Actitis hypoleucos</i>	Common Sandpiper	√	
<i>Tringa glareola</i>	Wood Sandpiper	√	
<i>Tringa totanus</i>	Redshank	√	
<i>Tringa stagnatilis</i>	Marsh Sandpiper	√	
<i>Tringa nebularia</i>	Greenshank	√	
<i>Calidris ferruginea</i>	Curlew Sandpiper	√	
<i>Calidris minuta</i>	Little Stint	√	
<i>Calidris alba</i>	Sanderling	√	
<i>Philomachus pugnax</i>	Ruff	√	
<i>Limosa limosa</i>	Blacktailed Godwit	√	
<i>Limosa lapponica</i>	Bartailed Godwit	√	
<i>Numenius arquata</i>	Curlew	√	
<i>Numenius phaeopus</i>	Whimbrel	√	
<i>Recurvirostra avosetta</i>	Avocet	√	
<i>Himantopus himantopus</i>	Blackwinged Stilt	√	

<i>Burhinus capensis</i>	Spotted Dikkop	√	
<i>Rhinoptilus africanus</i>	Doublebanded Courser	√	
<i>Rhinoptilus chalcopterus</i>	Bronzewinged Courser	√	
<i>Larus fuscus</i>	Lesser Blackbacked Gull	√	
<i>Larus cirrocephalus</i>	Greyheaded Gull	√	
<i>Chlidonias leucopterus</i>	Whitewinged Tern	√	
<i>Pterocles namaqua</i>	Namaqua Sandgrouse	√	
<i>Pterocles burchelli</i>	Burchell's Sandgrouse	√	
<i>Pterocles bicinctus</i>	Doublebanded Sandgrouse	√	
<i>Columba livia</i>	Feral Pigeon	√	
<i>Columba guinea</i>	Rock Pigeon	√	
<i>Streptopelia capicola</i>	Cape Turtle Dove	√	
<i>Streptopelia senegalensis</i>	Laughing Dove	√	
<i>Oena capensis</i>	Namaqua Dove	√	
<i>Turtur chalcospilos</i>	Greenspotted Dove	√	
<i>Poicephalus rueppellii</i>	Rueppell's Parrot	√	
<i>Agapornis roseicollis</i>	Rosy faced Lovebird	√	
<i>Corythaixoides concolor</i>	Grey Lourie	√	
<i>Cuculus canorus</i>	European Cuckoo	√	
<i>Cuculus gularis</i>	African Cuckoo	√	
<i>Cuculus solitarius</i>	Red chested Cuckoo	√	
<i>Cuculus clamosus</i>	Black Cuckoo	√	
<i>Clamator glandarius</i>	Great Spotted Cuckoo	√	
<i>Clamator levaillantii</i>	Striped Cuckoo	√	
<i>Clamator jacobinus</i>	Jacobin Cuckoo	√	
<i>Chrysococcyx klaas</i>	Klaas's Cuckoo	√	
<i>Chrysococcyx caprius</i>	Diederik Cuckoo	√	
<i>Tyto alba</i>	Barn Owl	√	
<i>Otus senegalensis</i>	Scops Owl	√	
<i>Otus leucotis</i>	Whitefaced Owl	√	
<i>Glaucidium perlatum</i>	Pearlspotted Owl	√	
<i>Glaucidium capense</i>	Barred Owl	√	
<i>Bubo africanus</i>	Spotted Eagle Owl	√	
<i>Bubo lacteus</i>	Giant Eagle Owl	√	
<i>Caprimulgus europaeus</i>	European Nightjar	√	
<i>Caprimulgus pectoralis</i>	Fierynecked Nightjar	√	
<i>Caprimulgus rufigena</i>	Rufouscheeked Nightjar	√	
<i>Caprimulgus tristigma</i>	Freckled Nightjar	√	
<i>Apus apus</i>	European Swift	√	
<i>Apus bradfieldi</i>	Bradfield's Swift	√	
<i>Apus caffer</i>	Whiterumped Swift	√	
<i>Apus affinis</i>	Little Swift	√	
<i>Apus melba</i>	Alpine Swift	√	
<i>Cypsiurus parvus</i>	Palm Swift	√	
<i>Colius colius</i>	Whitebacked Mousebird	√	
<i>Urocolius indicus</i>	Redfaced Mousebird	√	
<i>Ceryle rudis</i>	Pied Kingfisher	√	

<i>Halcyon senegalensis</i>	Woodland Kingfisher	√	
<i>Halcyon leucocephala</i>	Greyhooded Kingfisher	√	
<i>Merops apiaster</i>	European Bee-Eater	√	
<i>Merops hirundineus</i>	Swallowtailed Bee-Eater	√	
<i>Coracias garrulus</i>	European Roller	√	
<i>Coracias caudata</i>	Lilacbreasted Roller	√	
<i>Coracias naevia</i>	Purple Roller	√	
<i>Upupa epops</i>	Hoopoe	√	
<i>Phoeniculus purpureus</i>	Redbilled Woodhoopoe	√	
<i>Phoeniculus damarensis</i>	Violet Woodhoopoe	√	
<i>Rhinopomastus cyanomelas</i>	Scimitar billed Woodhoopoe	√	
<i>Tockus nasutus</i>	Grey Hornbill	√	
<i>Tockus erythrorhynchus</i>	Redbilled Hornbill	√	
<i>Tockus leucomelas</i>	Southern Yellowbilled Hornbill	√	
<i>Tockus monteiri</i>	Monteiro's Hornbill	√	
<i>Tricholaema leucomelas</i>	Pied Barbet	√	
<i>Indicator minor</i>	Lesser Honeyguide	√	
<i>Campethera bennettii</i>	Bennett's Woodpecker	√	
<i>Campethera abingoni</i>	Goldentailed Woodpecker	√	
<i>Dendropicos fuscescens</i>	Cardinal Woodpecker	√	
<i>Thripias namaquus</i>	Bearded Woodpecker	√	
<i>Mirafra passerina</i>	Monotonous Lark	√	
<i>Mirafra africana</i>	Rufousnaped Lark	√	
<i>Mirafra apiata</i>	Clapper Lark	√	
<i>Mirafra africanoides</i>	Fawn coloured Lark	√	
<i>Calendulauda sabota</i>	Sabota Lark	√	
<i>Certhilauda curvirostris</i>	Longbilled Lark	√	
<i>Pinarocorys nigricans</i>	Dusky Lark	√	
<i>Chersomanes albofasciata</i>	Spikeheeled Lark	√	
<i>Calandrella cinerea</i>	Redcapped Lark	√	
<i>Spizocorys starki</i>	Stark's Lark	√	
<i>Eremopterix leucotis</i>	Chestnutbacked Finchlark	√	
<i>Eremopterix verticalis</i>	Greybacked Finchlark	√	
<i>Hirundo rustica</i>	European Swallow	√	
<i>Hirundo albigularis</i>	Whitethroated Swallow	√	
<i>Hirundo dimidiata</i>	Pearlbreasted Swallow	√	
<i>Hirundo semirufa</i>	Redbreasted Swallow	√	
<i>Hirundo cucullata</i>	Greater Striped Swallow	√	
<i>Hirundo spilodera</i>	South African Cliff Swallow	√	
<i>Hirundo fuligula</i>	Rock Martin	√	
<i>Delichon urbica</i>	House Martin	√	
<i>Riparia riparia</i>	Sand Martin	√	
<i>Riparia paludicola</i>	Brownthroated Martin	√	
<i>Riparia cincta</i>	Banded Martin	√	
<i>Dicrurus adsimilis</i>	Forktailed Drongo	√	
<i>Oriolus oriolus</i>	European Golden Oriole	√	
<i>Corvus albus</i>	Pied Crow	√	

<i>Parus cinerascens</i>	Ashy Tit	√	
<i>Parus carpi</i>	Carp's Black Tit	√	
<i>Anthoscopus minutus</i>	Cape Penduline Tit	√	
<i>Turdoides bicolor</i>	Pied Babbler	√	
<i>Pycnonotus nigricans</i>	Redeyed Bulbul	√	
<i>Turdus litsitsirupa</i>	Groundscraper Thrush	√	
<i>Monticola brevipes</i>	Shorttoed Rock Thrush	√	
<i>Oenanthe monticola</i>	Mountain Chat	√	
<i>Oenanthe pileata</i>	Capped Wheatear	√	
<i>Cercomela familiaris</i>	Familiar Chat	√	
<i>Cercomela schlegelii</i>	Karoo Chat	√	
<i>Myrmecocichla formicivora</i>	Anteating Chat	√	
<i>Erythropygia leucophrys</i>	Whitebrowed Robin	√	
<i>Erythropygia paena</i>	Kalahari Robin	√	
<i>Sylvia borin</i>	Garden Warbler	√	
<i>Parisoma subcaeruleum</i>	Titbabbler	√	
<i>Hippolais icterina</i>	Icterine Warbler	√	
<i>Acrocephalus arundinaceus</i>	Great Reed Warbler	√	
<i>Acrocephalus baeticatus</i>	African Marsh Warbler	√	
<i>Acrocephalus palustris</i>	European Marsh Warbler	√	
<i>Acrocephalus schoenobaenus</i>	European Sedge Warbler	√	
<i>Acrocephalus gracilirostris</i>	Cape Reed Warbler	√	
<i>Phylloscopus trochilus</i>	Willow Warbler	√	
<i>Sylvietta rufescens</i>	Longbilled Crombec	√	
<i>Eremomela icteropygialis</i>	Yellowbellied Eremomela	√	
<i>Eremomela usticollis</i>	Burntnecked Eremomela	√	
<i>Camaroptera brevicaudata</i>	Grey-backed Bleating Warbler	√	
<i>Calamonastes fasciolatus</i>	Barred Warbler	√	
<i>Achaetops pycnopygius</i>	Rockrunner	√	
<i>Cisticola juncidis</i>	Fantailed Cisticola	√	
<i>Cisticola aridula</i>	Desert Cisticola	√	
<i>Cisticola subruficapilla</i>	Greybacked Cisticola	√	
<i>Cisticola rufilata</i>	Tinkling Cisticola	√	
<i>Cisticola chiniana</i>	Rattling Cisticola	√	
<i>Prinia flavicans</i>	Blackchedsted Prinia	√	
<i>Malcorus pectoralis</i>	Rufouseared Warbler	√	
<i>Muscicapa striata</i>	Spotted Flycatcher	√	
<i>Melaenornis mariquensis</i>	Marico Flycatcher	√	
<i>Melaenornis infuscatus</i>	Chat Flycatcher	√	
<i>Batis pririt</i>	Pirit Batis	√	
<i>Terpsiphone viridis</i>	Paradise Flycatcher	√	
<i>Motacilla capensis</i>	Cape Wagtail	√	

<i>Motacilla flava</i>	Yellow Wagtail	√	
<i>Anthus cinnamomeus</i>	Richard's Pipit	√	
<i>Anthus similis</i>	Longbilled Pipit	√	
<i>Anthus vaalensis</i>	Buffy Pipit	√	
<i>Lanius minor</i>	Lesser Grey Shrike	√	
<i>Lanius collaris</i>	Fiscal Shrike	√	
<i>Lanius collurio</i>	Redbacked Shrike	√	
<i>Laniarius atrococcineus</i>	Crimsonbreasted Shrike	√	
<i>Nilaus afer</i>	Brubru	√	
<i>Tchagra australis</i>	Threestreaked Tchagra	√	
<i>Telophorus zeylonus</i>	Bokmakierie	√	
<i>Lanioturdus torquatus</i>	Whitetailed Shrike	√	
<i>Eurocephalus anguimans</i>	Whitecrowned Shrike	√	
<i>Creatophora cinerea</i>	Wattled Starling	√	
<i>Cinnyricinclus leucogaster</i>	Plumcoloured Starling	√	
<i>Lamprotornis australis</i>	Burchell's Starling	√	
<i>Lamprotornis nitens</i>	Glossy Starling	√	
<i>Onychognathus nabouroup</i>	Palewinged Starling	√	
<i>Nectarinia mariquensis</i>	Marico Sunbird	√	
<i>Cinnyris fuscus</i>	Dusky Sunbird	√	
<i>Nectarinia senegalensis</i>	Scarletched Sunbird	√	
<i>Nectarinia amethystina</i>	Black Sunbird	√	
<i>Zosterops pallidus</i>	Cape White-Eye	√	
<i>Bubalornis niger</i>	Redbilled Buffalo Weaver	√	
<i>Plocepasser mahali</i>	Whitebrowed Sparrowweaver	√	
<i>Philetairus socius</i>	Sociable Weaver	√	
<i>Passer domesticus</i>	House Sparrow	√	
<i>Passer motitensis</i>	Great Sparrow	√	
<i>Passer melanurus</i>	Cape Sparrow	√	
<i>Passer diffusus</i>	Greyheaded Sparrow	√	
<i>Sporopipes squamifrons</i>	Scalyfeathered Finch	√	
<i>Ploceus rubiginosus</i>	Chestnut Weaver	√	
<i>Ploceus velatus</i>	Masked Weaver	√	
<i>Ploceus intermedius</i>	Lesser Masked Weaver	√	
<i>Quelea quelea</i>	Redbilled Quelea	√	
<i>Euplectes orix</i>	Red Bishop	√	
<i>Euplectes afer</i>	Golden Bishop	√	
<i>Pytilia melba</i>	Melba Finch	√	
<i>Uraeginthus angolensis</i>	Blue Waxbill	√	
<i>Uraeginthus granatinus</i>	Violeteared Waxbill	√	
<i>Estrilda astrild</i>	Common Waxbill	√	
<i>Estrilda erythronotos</i>	Blackcheeked Waxbill	√	
<i>Ortygospiza atricollis</i>	Quail Finch	√	
<i>Amadina erythrocephala</i>	Redheaded Finch	√	
<i>Vidua macroura</i>	Pintailed Whydah	√	
<i>Vidua regia</i>	Shafttailed Whydah	√	

<i>Vidua paradisaea</i>	Paradise Whydah	√	
<i>Serinus atrogularis</i>	Blackthroated Canary	√	
<i>Serinus alario</i>	Blackheaded Canary	√	
<i>Serinus flaviventris</i>	Yellow Canary	√	
<i>Serinus albogularis</i>	Whitethroated Canary	√	
<i>Emberiza flaviventris</i>	Goldenbreasted Bunting	√	
<i>Emberiza capensis</i>	Cape Bunting	√	
<i>Emberiza tahapisi</i>	Rock Bunting	√	
<i>Emberiza impetuani</i>	Larklike Bunting	√	

Source for literature review: Brown *et al.* (1998), Komen (*n.d.*), Maclean (1985) & Tarboton (2001)

\* Names of birds follow the old Roberts (1985) classification system.

Although Namibia's avifauna is comparatively sparse compared to the high rainfall equatorial areas elsewhere in Africa, approximately 658 species have already been recorded with a diverse and unique group of arid endemics (Brown *et al.* 1998, Maclean 1985). Fourteen species of birds are endemic or near endemic to Namibia with the majority of Namibian endemics occurring in the savannas (30%) of which ten species occur in a north-south belt of dry savannah in central Namibia (Brown *et al.* 1998). Bird diversity is viewed as medium to high in the Witvlei-Gobabis area (Mendelsohn *et al.* 2000).

At least 134 species of terrestrial ["breeding residents"] birds occur and/or could occur in the general Windhoek and Rehoboth area at any time (Maclean 1985, Tarboton 2001). Rainfall (or lack thereof) would affect bird species distribution and abundance. This however excludes all aquatic species (freshwater & marine) and migrant species that could also be found in the area depending on rainfall and temporary pools, season, etc. in the area. Two of the 14 Namibian endemic bird species (14% of all Namibian endemic species or 1.5% of the species expected to occur in the area) can or are likely to occur in the general Witvlei-Gobabis area.

## 6.5 Important Species

The high percentage of endemic reptile species associated with the rocky escarpment region of east-central Namibia underscores the importance of this area without formal state protection. Reptile species of concern are the various endemic geckos (e.g. *Pachydactylus* species), desert lizards (e.g. *Meroles* species), adders (e.g. *Bites* species)



and tortoises (especially *Homopus solus*) associated with rocky substrates and of which very little is known about their ecological role and actual status in Namibia. Snakes are often killed outright due to the “fear factor” associated with all snakes as well as local beliefs and negative folklore. The most problematic snake species are probably the endemic *Telescopus beetzii* and the endemic, but poisonous *Bitis xeropaga*. Indiscriminate killing of snakes does not bode well for rare and endemic snake species. Tortoises consumed as food has resulted in them often becoming locally extinct. Tortoises are viewed as the reptile family of greatest concern (Griffin 1998a) and the collection and eating of tortoises are of grave concern. The endemic *Homopus solus* is known from the area and collection for whatever reason of this species is worrisome.

Endemic mammals expected to occur in the general Witvlei-Gobabis area as make up a relatively large percentage (16%) of the mammals expected from the area. Mammal species of concern are most often predators such as the Cheetah (*Acinonyx jubatus*) – classified internationally as Vulnerable (CITES Appendix 1) and Small Spotted Cat (*Felis nigripes*) – classified as Rare and Vulnerable (CITES Appendix 1) as well the Dassie Rat and Mountain Ground Squirrel, both of which are endemic and classified as near threatened (SARDB 2004). Other species of concern include various endemic bats of which very little are known. Bats are unfortunately often viewed with undeserved revulsion and exterminated for such reasons.

Although there are only 2 endemics (14% of endemics in Namibia or 1.5% of all the birds expected to occur in the area) expected from the general Witvlei-Gobabis area, they still remain important and should be taken into consideration regarding development in the area. The overall decline of raptors in general (declines not always understood, although humans are often the cause thereof e.g. killed as perceived predators of poultry and lambs or as collateral damage during poisoning episodes against problem animals) is disconcerting throughout Namibia, including the Witvlei-Gobabis area.

## 6.6 Tree & Shrub Diversity

The general area is classified as the mixed tree and savanna (Giess 1971). The dominant vegetation structure is viewed as “low shrubs” or “sparse shrubland” (Mendelsohn *et al.* 2002). Trees such as *Acacia erioloba*, *A. karoo* and *Tamarix usneoides* are confined along the drainage lines while shrubs such as *Catophractes alexandri*, *Eriocephalus* (Karoo bushes) species and *Rhigozum trichotomum* characterise the area. Other tree species often common in the area include *A. nebrownii*, *Boscia albitrunca*, *B. foetida* and *Parkinsonia Africana* (Giess 1971). Although *Rhigozum trichotomum* occurs in the area it is not viewed as such a “problem” species with regards to bush thickening (encroachment) as elsewhere in Central Namibia.

It is estimated that at least 37-59 species of larger trees and shrubs (>1m) (Coats Palgrave 1983 [45sp.], Curtis & Mannheimer 2005 [59sp.], Van Wyk & Van Wyk 1997 [37sp.]) occur in the general central Namibia, area.

**Table 8** indicates the trees & shrubs known and/or expected to occur in the general Witvlei-Gobabis area and are derived from Curtis & Mannheimer (2005). Some species indicated to possibly occur in the area according to Coats Palgrave (1983) and Van Wyk & Van Wyk (1997) are excluded here.

**Table 8. Trees and shrubs known and/or expected to occur in the Witvlei-Gobabis areas.**

Species: Scientific name	Expected	Status
<i>Acacia erioloba</i>	√	Protected (F)
<i>Acacia hebeclada</i>	√	
<i>Acacia hereroensis</i>	√	
<i>Acacia karroo</i>	√	
<i>Acacia mellifera</i> subsp. <i>mellifera</i>	√	
<i>Acacia nebrownii</i>	√	
<i>Adenolobus garipensis</i>	√	
<i>Aloe dichotoma</i>	√	NC, C2
<i>Boscia albitrunca</i>	√	Protected (F)
<i>Boscia foetida</i>	√	



<i>Cadaba aphylla</i>	√	
<i>Catophractes alexandri</i>	√	
<i>Ceraria fruticulosa</i>	√	
<i>Ceraria namaquensis</i>	√	
<i>Commiphora capensis</i>	√	Near-endemic
<i>Commiphora cervifolia</i>	√	Endemic Near Threatened
<i>Commiphora namaensis</i>	√	Near-endemic
<i>Diospyros lycioides</i>	√	
<i>Ehretia alba</i>	√	
<i>Euclea pseudebenus</i>	√	Protected (F)
<i>Euclea undulata</i>	√	
<i>Euphorbia avasmontana</i>	√	C2
<i>Euphorbia gregaria</i>	√	C2
<i>Euphorbia guerichiana</i>	√	C2
<i>Euphorbia virosa</i>	√	C2
<i>Ficus cordata</i>	√	Protected (F)
<i>Ficus ilicina</i>	√	
<i>Grewia tenax</i>	√	
<i>Gymnosporia linearis</i>	√	
<i>Gymnosporia senegalensis</i>	√	
<i>Gymnosporia sp. A</i>	√	
<i>Haematoxylum dinteri</i>	√	Endemic
<i>Lycium bosciifolium</i>	√	
<i>Lycium eenii</i>	√	
<i>Lycium cinereum</i>	√	
<i>Lycium hirsutum</i>	√	
<i>Maerua schinzii</i>	√	Protected (F)
<i>Montinia caryophyllacea</i>	√	
<i>Neoluederitzia sericeocarpa</i>	√	Endemic
<i>Nymanina capensis</i>	√	
<i>Ozoroa concolor</i>	√	Near-endemic
<i>Ozoroa crassinervia</i>	√	Protected (F)
<i>Ozoroa dispar</i>	√	
<i>Ozoroa namaensis</i>	√	
<i>Pappea capensis</i>	√	Protected (F)
<i>Parkinsonia africana</i>	√	Protected (F)
<i>Phaeoptilum spinosum</i>	√	
<i>Rhus burchelli</i>	√	

<i>Rhus lancea</i>	√	Protected (F)
<i>Rhus populifolia</i>	√	
<i>Rhus tenuinervis</i>	√	
<i>Rhigozum trichotomum</i>	√	
<i>Salsola nollothensis</i>	√	
<i>Salvadora persica</i>	√	
<i>Sisyndite spartea</i>	√	
<i>Tamarix usneoides</i>	√	Protected (F)
<i>Tetragonia schenckii</i>	√	
<i>Ziziphus mucronata</i>	√	Protected (F)
<i>Zygophyllum prismatocarpum</i>	√	

**Endemic** (Craven 1999)

**Near-endemic** (Curtis & Mannheimer 2005)

**Near Threatened** (Craven & Loots 2002)

**F** – Forestry Ordinance No. 37 of 1952 and/or Forest Act No. 72 of 1968 (Curtis & Mannheimer 2005)

**NC** – Nature Conservation Ordinance No. 4 of 1975 (Curtis & Mannheimer 2005)

**C2** – CITES Appendix 2 (Curtis & Mannheimer 2005)

Twenty seven species of Aloe (all protected) occur throughout Namibia with at least 8 species (30%) (*A. dichotoma*, *A. erinacea*, *A. gariepensis*, *A. hereroensis*, *A. meyeri*, *A. pachygaster*, *A. striata* subsp. *karasbergensis* & *A. variegata*) present in the general Witvlei-Gobabis area (Rothmann 2004). These plants are however just a selection of common plants from the general area and also mainly focus on the south-western winter rainfall area of the southern Namib.



Figure 4: Trees and shrub within the study area.

## 6.7 Grass Diversity

It is estimated that at least 31-43 grasses (Müller 2007 [43sp.], Van Oudshoorn 1999 [31sp.]) - approximate total of 49 species – occur in the general Witvlei-Gobabis area, central, Namibia area. Grass species in the Highland Savannah area depend mainly on the soil types associated with, with *Stipagrostis* species such as *S. anomala*, *S. brevifolia*, *S. obtusa* and *S. uniplumis* characteristic of the general area (Giess 1971). Other valuable – i.e. palatable – grasses in the general area include *Antheophora pubescens*, *A. ramosa*, *Digitaria eriantha*, *Panicum arbusculum* and *Setaria appendiculata* (Giess 1971).

**Table 9** indicates the grass known and/or expected to occur in the general Witvlei-Gobabis area and are derived from <sup>1</sup>Müller (2007) and <sup>2</sup>Van Oudtshoorn (1999).

**Table 9.** Grass known and/or expected to occur in the Witvlei-Gobabis.

Species: Scientific name	Expected	Ecological Status *	Grazing Value *
<sup>1,2</sup> <i>Antheophora pubescens</i>	√	Decreaser	High
<sup>1,2</sup> <i>Aristida adscensionis</i>	√	Increaser 2	Low
<sup>1,2</sup> <i>Aristida congesta</i>	√	Increaser 2	Low
<sup>1</sup> <i>Aristida engleri</i>	√	?	Low
<sup>1,2</sup> <i>Aristida meridionalis</i>	√	Increaser 2	Low
<sup>1</sup> <i>Brachiaria glomerata</i>	√	Decreaser	Average
<sup>1,2</sup> <i>Cenchrus ciliaris</i>	√	Decreaser	High
<sup>1,2</sup> <i>Centropodia glauca</i>	√	Decreaser	High
<sup>1,2</sup> <i>Chloris virgata</i>	√	Increaser 2	Average
<sup>2</sup> <i>Cladoraphis spinosa</i>	√	Increaser 1	?
<sup>1</sup> <i>Cymbopogon pospischilii</i>	√	?	Low
<sup>1,2</sup> <i>Cynodon dactylon</i>	√	Increaser 2	High
<sup>1,2</sup> <i>Dichanthium annulatum</i>	√	Decreaser	High
<sup>1,2</sup> <i>Digitaria eriantha</i>	√	Decreaser	High
<sup>1,2</sup> <i>Enneapogon cenchroides</i>	√	Increaser 2	Low
<sup>1,2</sup> <i>Enneapogon desvauxii</i>	√	Intermediate	Average
<sup>1,2</sup> <i>Enneapogon scaber</i>	√	?	Low
<sup>1</sup> <i>Entoplocamia aristulata</i>	√	Intermediate	Low
<sup>1,2</sup> <i>Eragrostis annulata</i>	√	Increaser 2	Low
<sup>1</sup> <i>Eragrostis brizantha</i>	√	Increaser 2	Average
<sup>1,2</sup> <i>Eragrostis nindensis</i>	√	Increaser 2	Average
<sup>1</sup> <i>Eragrostis porosa</i>	√	Intermediate	Low
<sup>1,2</sup> <i>Eragrostis rotifer</i>	√	Intermediate	Low
<sup>1</sup> <i>Eragrostis scopelophila</i>	√	?	High
<sup>1,2</sup> <i>Fingerhuthia africana</i>	√	Decreaser	Average
<sup>1,2</sup> <i>Heteropogon contortus</i>	√	Increaser 2	Average
<sup>2</sup> <i>Hyparrhenia hirta</i>	√	Increaser 1	Average
<sup>1</sup> <i>Leucophrys mesccoma</i>	√	?	Average
<sup>1,2</sup> <i>Melinis repens</i>	√	Increaser 2	Low
<sup>1</sup> <i>Oropetium capense</i>	√	Increaser 2	Low
<sup>1</sup> <i>Panicum arbusculum</i>	√	Decreaser	High
<sup>1</sup> <i>Panicum maximum</i>	√	Decreaser	High
<sup>2</sup> <i>Pentaschistis airoides</i>	√	Increaser 2	Low
<sup>2</sup> <i>Polypogon monspeliensis</i>	√	?	Average
<sup>1,2</sup> <i>Schmidtia kalahariensis</i>	√	Increaser 2	Low
<sup>1</sup> <i>Setaria appendiculata</i>	√	Decreaser	High
<sup>2</sup> <i>Setaria incrassata</i>	√	Decreaser	High
<sup>1</sup> <i>Setaria verticillata</i>	√	Increaser 2	Average
<sup>1</sup> <i>Stipagrostis anomala</i>	√	?	Low
<sup>1,2</sup> <i>Stipagrostis ciliata</i>	√	Decreaser	High
<sup>1</sup> <i>Stipagrostis fastigiata</i>	√	?	High

<sup>2</sup> <i>Stipagrostis hirtigluma</i>	√	Increaser 2	Low
<sup>1,2</sup> <i>Stipagrostis namaquensis</i>	√	?	Average
<sup>1,2</sup> <i>Stipagrostis obtusa</i>	√	Decreaser	High
<sup>1,2</sup> <i>Stipagrostis uniplumis</i>	√	Increaser 2	Average
<sup>1</sup> <i>Triraphis purpurea</i>	√	?	Low
<sup>1</sup> <i>Triraphis ramosissima</i>	√	?	Average
<sup>1,2</sup> <i>Tragus berteronianus</i>	√	Increaser 2	Low
<sup>1</sup> <i>Tragus racemosus</i>	√	Increaser 2	Low



Figure 5: Grass Diversity in the study area.

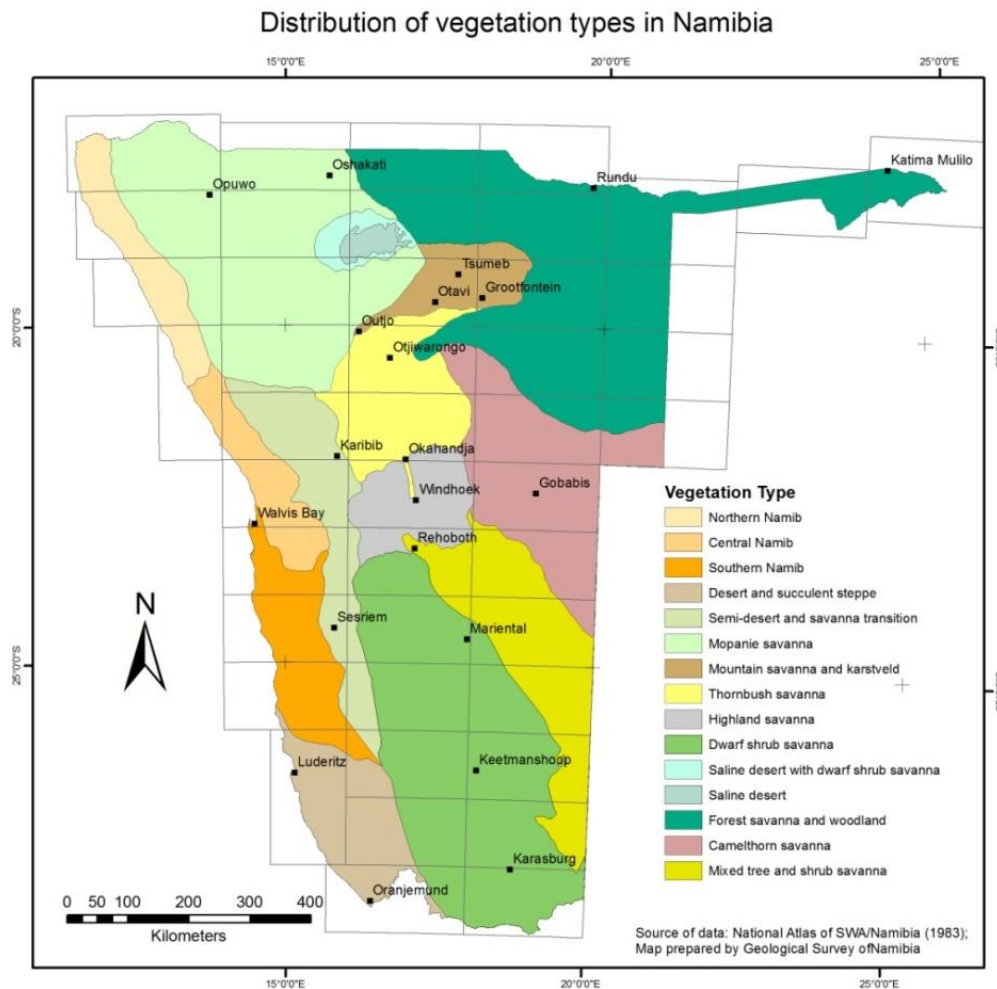
## 6.8 Important Species (Flora)

Important tree and shrub species in the general Witvlei-Gobabis area are the endemics (i.e. *Commiphora cervifolia*, *Haematoxylum dinteri* & *Neoluederitzia sericeocarpa*), near-endemics (i.e. *Commiphora capensis*, *Commiphora namaensis* & *Ozoroa concolor*) as well as the species protected under the Forestry Ordinance No. 37 of 1952, Forest Act No. 72 of 1968, Nature Conservation Ordinance No. 4 of 1975 and CITES Appendix 2. *Commiphora cervifolia* is also classified as near threatened and probably the most important species in the general area (Craven & Loots 2002).

Other important plant species in central Namibia is the Quiver Tree (*Aloe dichotoma* – protected under the Nature Conservation Ordinance No. 4 of 1975 and CITES Appendix 2) and the Tsamma Mellon (*Citrullus lanatus*) (Mendelsohn *et al.* 2002). *Aloe dichotoma*



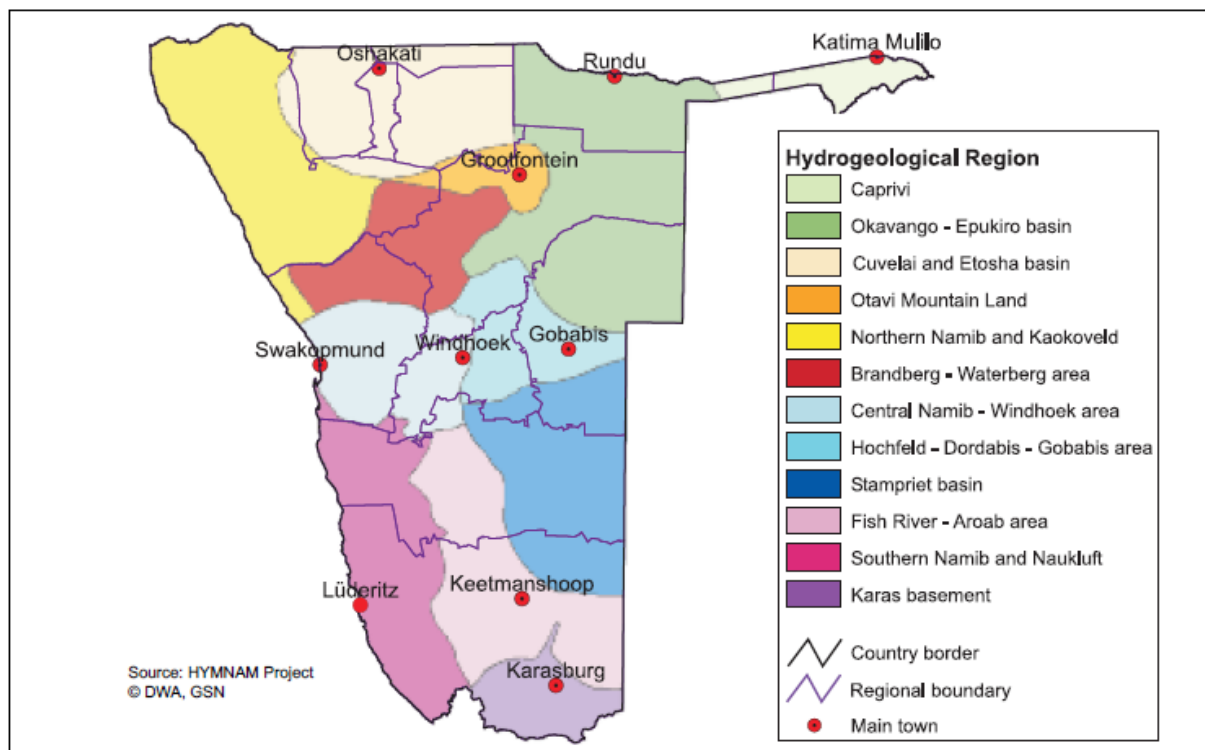
are associated with rocky outcrops in the general area and relatively abundant in the far south. Their flowers and associate nectar is an important source of food for insects and birds throughout their range. As the direct ancestor of the watermelon, *Citrullus lanatus* could prove important for developing drought and pest resistant commercial varieties. It is also used as a source of food throughout its range (Mendelsohn *et al.* 2002). All aloec species are protected in Namibia and thus viewed as important plants (Mendelsohn *et al.* 2002, Rothmann 2004). It is certain that many other plant species will be viewed as economically important in the future, especially if viewed as medicinally important (e.g. *Hoodia* sp. also found in the far south as well as a number of fygie species).



**Figure 6:** Distribution of vegetation types in Namibia indicating the project area in a carmelthorn savanna transition setting (Geological Survey of Namibia)

## 7.0 Groundwater and surface water hydrogeology

In terms of Hydrogeological setting, the Farm Magariental 81/Peace Garden Game farm falls within the demarcation of the Hochfeld-Dordabis aquifer system of the Gobabis area, as in fig 7.



**Figure 7:** Hydrogeology of the claims area, (Christelis and Struchmier, 2001).

The fact that most towns in the eastern Central Region in Namibia are situated on or near ephemeral rivers that is a reflection of ground water availability in the area. The ten claims at Farm Magariental 81/Peace Garden Game farm has sufficient water for small scale mining activities that can only be obtained by surface water storage in dams or from alluvial aquifers, while the potential of bedrock aquifers is very limited. This is partly due to the moderate rainfall and recharge (Christelis and Struchmier, 2001).

The ten claims at farm Magariental 81/Peace Garden Game farm are stratigraphically situated within the east central trending intracontinental arm of the Damara Orogen. The area geologically forms part of the Witvlei Group that is preserved in two regional synclinoria in the Gobabis-Witvlei area of east-central Namibia. It consists of mixed, coarse- to fine-grained siliciclastic and carbonate strata deposited in deep- to shallow-marine, and locally non-marine, settings along the post-rift continental margin of the Kalahari Craton prior to the onset of foreland basin sedimentation recorded by the overlying terminal Neoproterozoic–Cambrian Nama Group exclusive.

The main targets for geological site selection are steeply dipping north-south trending fractures and joint zones, if possible in competent rocks, although feldspathic quartzites should be avoided. Moderate yields are also encountered in the marble and schist aquifers of Hochfield -Dorbabis, Gobabis area.

#### **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.

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.

In recognition of these legal frameworks, the consultant recommends the principle method to be adopted as the **A**quifer confinement **O**verburden and **D**epth to water table (AOD) index scheme to evaluate the pollution vulnerability of the Hochfield-Dordabis aquifer system for monitoring.



### ***Potential impact identified***

#### **Positive impacts**

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

#### **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

#### ***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.

## **8.0 Public consultation process**

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### ***Legal and policy requirement***

#### **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.

28. 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.”

**8.1 Consultation process followed during the EIA process**

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

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

Table 14, 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 28 <sup>th</sup> May and 4 <sup>th</sup> of June 2020 in The New Era and the Confidante Newspapers.
<b>Written Notices:</b>	Written notices were provided to relevant the adjacent farmer was done by use of Registered mail. <b>Appendix D</b>	The letter was send to the farmer adjacent to the Mining Claims

Steps	Description of the process	Time allowed
<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 However due to <b>COVID-19 restrictions on public gatherings are regulated / not allowed.</b>	NO MEETING TOOK PLACE.

### ***8.2 Limitation of the public consultation process***

The following factors limited the public participation process:

- Delivery of letters and BID was by registered mail, that is timing consuming.
- Most people were not reachable during the stage 2 & 3 lock down due to the COVID 19 Pandemic.
- Some stakeholders don't have access to email.

### ***8.3 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.

### ***8.4 Concluding remark on this section***

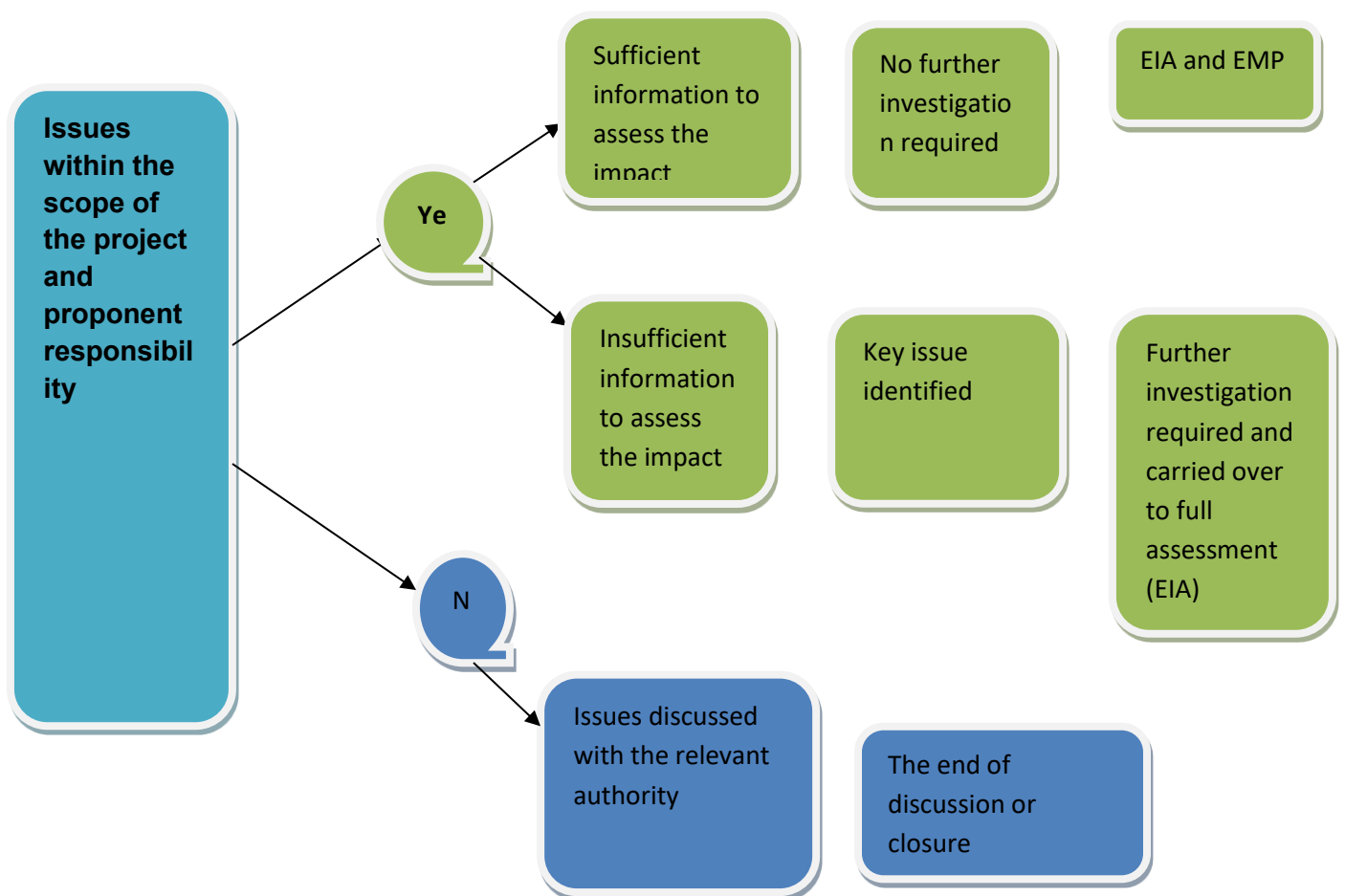
In this section, issues on public participation process such as steps or methods that were followed, process, the outcome of the public participation process, and key issues identified were presented. Moreover the legality patterning to public participation was also presented.

## 9.0 Impact assessment

### 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 mining for aggregate stone quarry**

<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 bushes.	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 Gobabis area economic growth and the nation at large	Low sensitivity	Addressed in sub-section:7.4.1. and EMP
	Potential spread of HIV/AIDS	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	Low sensitivity	Addressed in sub-section:7.4.3. and EMP
Solid waste	During mining 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	During mining 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





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

### 9.2 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 13 below:

**Table 12: Definition of criteria for assessing significant impact**

Criteria	Description
<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 13) 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 14:

### 9.3 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

**Table 13: 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.

## **9.4 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.

## **9.5 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.

## **10.0 Biophysical Environment**

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

#### Description

The aggregate 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 aggregate stone quarry in 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.

## 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>

### 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.

### Monitoring

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

## Loss of Fauna and Flora diversity

### Description

Biodiversity (i.e. fauna and flora) is likely to be affected by the project during the mining or quarrying 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 mining 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.

### Sensitivity of the affected environment

**Table 25: Expected significance of the project on Biodiversity: fauna and flora**

Criteria	Biodiversity: fauna and flora
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>

### Mitigation and enhancement measures

- Avoid damage to protected or high use value trees during mining 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.

### Monitoring

An ENC for Peace Garden Game Farm cc 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.

### **Dust generation on site**

#### 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, sandstone blocks will be crushed into smaller blocks in order to give them the desired size as aggregates. During the crushing process about 25% the original sandstone mass is lost in the form of dust. In addition, processing of aggregate results in the formation of sand 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 during mining 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.

### 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>



## 11.0 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.

### 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 mining process and the dry skin contact with gloves is prevented.

## **12.0 Conclusion and recommendations**

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### ***Conclusion***

The Ten Mining claims are inside the farm area close to the Town of Gobabis in Omaheke Region. The mining claims lies outside the National Park. The implementation of the proposed small scale surface mining project by Peace Garden Game Farm cc 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 mining project, a number of high positive and negative impacts have been identified. Overall, positive impacts of the proposed small scale surface mining 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.

### ***Recommendations***

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



## **Social Economic Environment**

### **Job creation**

#### Description

It is clear that unemployment is big challenge in the Town of Gobabis; hence the necessity of this project which will employ about 12 to 15 people during the mining phase. The employment will be conducted in the company's offices which will be opened in the Town of Gobabis once mining 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.

#### Sensitivity of the affected Environment

By implementing the mining or quarry project the socioeconomic significance of Peace Garden Game Farm cc 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>

### **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 Gobabis and Witvlei, should be employed as far as possible, especially where no specific skills are required.
- Both men and women should be granted the opportunity to be employed by this project.

### **Monitoring**

It is recommended that Peace Garden Game Farm cc Mining Manager should employ workers to be obtained from the potentially affected communities in particular Gobabis - Witvlei. Peace Garden Game Farm cc in consultation with the local authority Councilor will then be responsible to supervise the employment process when implementing this 'local's first' recommendation.

### **Potential spread of HIV/AIDS**

#### **Description**

In the proposed project area, it is estimated that one out of every four people are HIV positive. Previous experience has shown that construction workers or mining 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 both in the project area and beyond to other region.

### Sensitivity of the affected environment

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

Criteria	Contribution to the spread of HIV/AIDS
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>

### Mitigation and enhancement measures

Peace Garden Game Farm cc, 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.

### Monitoring

The ENC should report back to Peace Garden Game Farm cc as to when and how the workers received HIV training. Also, how workers were informed about the mitigation measures of the EMP.

## Disturbance or destruction of archaeological sites

### Descriptions

The mining activities may partially or completely destroy some small archaeological sites found within and outside the boundary of the mining area. There are no known archaeological sites in the area. .

## Sensitivity of the affected environment

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

Criteria	Contribution to the spread of HIV/AIDS
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>

## Mitigation and enhancement measures

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

## ***Solid waste: wires, drill bits, and human waste***

### Descriptions

Solid waste management is a problem in the mining industry or quarrying industry, and sometimes this problems extent beyond the mining industry. In the mining industry or exploration 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.

**Sensitivity of the affected environment**

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

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

<b>Criteria</b>	<b>Solid waste :</b>
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>

**Mitigation and enhancement measures**

Waste disposal sites should established on site were paper, plastic and wire should be kept. The collected solid waste should be dispose at the Town of Gobabis solid 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 Gobabis Town human waste disposal site. Prior to the disposal of the above mentioned wastes Peace Garden Game Farm cc must entered into agreement with the Gobabis Town for permission to use their facility.



## Monitoring

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

### ***Land or soil disturbance: on site and the proposed 23km stretch road***

## Descriptions

During the mining process, land or soil will be disturb both on site and along the proposed stretch road inside the farm linking to the B. 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 management will affect the growth of vegetation and the development biodiversity hiding or resting spots.

## Sensitivity of the affected environment

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

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

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

## 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.

**Monitoring**

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

***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.

## 1. References

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- 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: Enviromntal 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 EPL 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

## **2. Appendices: List of appendices**

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- Appendix A: Background Information Document (BID)
- Appendix B: Newspaper adverts
- Appendix C: Proof of stake holder consultation( receipt of registered mail).
- Appendix D: Copy of Non-Exclusive Prospecting Licence and Application for Mining Claims
- Appendix E: Copy of Peace Garden Game Farm company details
- Appendix F: CV of EAP Consultant

